NATIONAL COOPERATIVE SOIL SURVEY

Southern Soil Survey Conference Proceedings

Charleston, South Carolina
April 15-l 9, 1996

Sunday Afternoon, April 14

2:00-5:00 .... MEETING SETUP

Monday Morning, April 15

8:00-12:00 .... REGISTRATION
Hotel Lobby

Monday Afternoon, April 15

1:00-1:15 .... INTRODUCTIONS
Ben Stuckey
State Soil Scientist
NRCS, Columbia. SC

1:15-1:30 .... WELCOME
Mark Berkland
State Conservationist
NRCS, Columbia, SC

1:30-1:45 PURPOSE AND OBJECTIVE
Mary Collins, Professor
Environmental Pedology
University of Florida

1:45-2:45 .... OPENING REMARKS

Bill Simpson, Chairman
Charleston SWCD

Dr. James Timmerman
Department of Natural Resources
Columbia. SC

Dr. Allen Dunn
College of

Dave Wilson

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National Cooperative Soil Survey In The Natural Resources Conservation Service
Southern Regional Work Planning Conference
Charleston South Carolina
April 16, 1996
Judy Johnson

Partnerships and NRCS's Responsibilities In The Cooperative Soil Survey

The National Cooperative Soil Survey Program is a strong and dynamic relationship between The USDA -NRCS and other federal, state and local agencies, Land Grant Universities and private Partners that have pledged and committed to work together to provide quality soil data to their customers and to each other. This partnership must also interpret the data collected to insure the integrity of the data when used by landuse or resource decision makers.

Each partner have individual responsibilities for carrying out their role in the partnership, but as partners we must speak with a unified voice and act to realize a common vision.

The partners commitment must involve:
-listening and responding to our customers needs, internal and external
-being attentive to each others needs
-fostering economically viable and effective interpretations and recommendations to address resource needs and issues
- maintaining and advocating a strong relationship with traditional partners and developing and fostering new partnerships and
-advocating a big picture approach in studying the soil resources

As partners we cannot allow the changes occurring in our society, and organizations to distract us from our missions, visions and goals in the National Cooperative Soil Survey Program. We must continue to work as partners for the advancement of soil science and the contributions we can make to our society in the proper management and treatment of our natural resources.

Utilizing Soils Information and Data At the Resource Decision Maker Level

The NRCS and it's Conservation Partners are very appreciative of the invaluable data collected by soil scientists and others. Your information and the interpretations you make of the data is used in making resource planning decisions every day by those charged with this responsibility. Your databases, in it's many forms , are the envy of the world.

Soil Scientists are needed to accurately interpret soil information before decision makers integrate it in resource planning applications. If your data is misused it can be more damaging than not having it at all. Soil scientists are needed to provide training to

PARTNERSHIPS- NRCS IN NCSS

COMMITMENT MUST INVOLVE:

-COMMUNICATIONS

-RESPONSIVE TO EACH OTHERS NEEDS

-ADDRESSING RESOURCE NEEDS

-MAINTAINING RELATIONSHIPS

-ADVOCATING THE BIG PICTURE

USING SOILS INFORMATION-
CUSTOMER LEVEL

the decision maker on how to use the data and how to communicate it to others in a manner in which it is easily understood. You, as a soil scientist, have an obligation to the user or decision maker to communicate the information effectively . The same zeal that you put into collecting and packaging the data must be portrayed in the way it is used and communicated to the user.

I ask soil scientist to stay in touch with the users of their information to insure that the data being collected addresses the customers needs. Market your data and obtain feedback from those using the data, and, use this feedback to assist in filling gaps in your data bases . Work with your customers to identify new data needs and uses of the information. As you collect, assemble, and analyze your information keep asking yourselves, who will use the information and for what purposes? If you can answer these questions it means that you are thinking of why you are doing what you are, and who and how others will be impacted by your decisions.

As a resource planner your information is needed in the traditional planning process but there are many new or not so traditional processes or applications where quality soils information is needed. Soils information is needed to address pesticide and nutrient management, soil tilth and soil compaction problems, site-specific farming, and yes we still need to control erosion by wind and water etc. Soil scientists input is needed to address soil quality issues and to assist others to better understand the interrelationship between soil quality and other resource issues.

Technology Advancement

As we move **forward into** the twenty-first century we are expected to use more advanced technology. Soils information will be packaged in not so traditional forms as we know them today. The use of computer technology has allowed your data to be more assessable by many more users than the traditional soil survey publication allowed. The data can be used in a geographical information system with other layers of resource data, or as another example it can be assessed over the world wide web. This technology serves as an excellent tool to disseminate your data, but it also allows one to scrutinize the data more efficiently than the published soil surveys allowed. This is not all bad, if others can use technology to scrutinize your data, then so can you use it as a tool to improve your product.

I encourage you to be recognizant of new technology that will enable you to do your job more efficient and effective but lets stay customer oriented and focused toward the user. As we repackage our products and develop new data bases let’s get buy in from those that will be impacted or expected to use the product.

A Thank You To The Conference Participants

Purpose and Objectives

S. W. Buol

The "National Cooperative Soil Survey" is the auspice under which we meet this week. We title the occasion as a Work Planning Conference. These are the names used, but what is a name? The dictionary states that a name is "the title by which any person or thing is known or designated." I am reminded of the introduction to the nomenclature used in Soil Taxonomy as prepared by Professor Heller, Head of the Department of Classics at the University of Illinois and advisor to Dr. Guy Smith during the preparation of the 7th Approximation. On a recording that provided instruction on the pronunciation of the names used in Soil Taxonomy, Dr. Heller began with the expression *A name, is a name, is a name."

In this brief time I would like to express my opinion of what the names "National Cooperative Soil Survey" and "Work Planning Conference" signify based upon what I have experienced in the 40 years I have been part of the National Cooperative Soil Survey. The roots of what we are about go back in history to the first few years of soil survey in the United States. From reading the 1900-1905 reports of Dr. Whitney, first director of the then Division of Soils, it was his expression that soil surveys were to be done with the cooperation of the Federal Department of Agriculture and the professors of the State Land Grant Universities. The division of labor, among the groups, called for the Universities to add expertise to the technical and scientific aspects of the survey while the Federal agency was to concentrate on the practical aspects.

Certainly, through the nearly 100 years of soil survey in the U.S., this original concept has survived as demonstrated by our meeting this week in Charleston and the other similar meetings that will take place in the other regions. Among the many experiences I have had at work planning conferences, one of the most memorable was an occasion in the western region when the professors put their heads together and formulated a plan to better teach soil mapping at the universities. Upon hearing the plan, Dr. Kellogg, then Director of Soils in the Soil Conservation Service, took the floor and stated in effect "you professors need to concentrate on teaching the chemistry, physics and biology of soils; when we hire your students, we will teach them how to map soils."

In similar fashion, I remember the time when a professor from an adjoining region attended the Southern Work Planning Conference and rallied the university representatives to, in effect, fight those SOB's in Washington at every beachhead so that states could retain the "right" to publish soil surveys at the state level and not be reduced to the mediocrity that he predicted if standard formats for soil surveys were adapted.

From these experiences I see our meeting to be a time where we can candidly express our opinions and concerns in open and frank discussions. We should not all envision what we should do all things in the same way. We each occupy a unique vantage or the trunk of the entire beast. We each have unique experience within the entire spectrums of soil properties, soil-landscape relationships, and institutional organizations within which we work. As we relate these to each other during this week, we each become more enlightened about our task of presenting accurate information about the soils of this land, to the people who own and manage that land.

NATIONAL PERSPECTIVES
SOIL SCIENCE AND RESOURCE ASSESSMENT

Maurice J. Mausbach[1]

Prepared for
Southern Soil Survey Work Planning Conference
Charleston, South Carolina
April 15-19, 1996

INTRODUCTION

Thank you for inviting me to your work planning conference. Rich Duesterhaus expresses his disappointment for not being able to attend the conference and has asked me to talk to you about the Science and Technology Consortium of the Soil Science and Resource Assessment (SSRA) deputy area.

I will briefly discuss the consortium, its purposes, functions and operational structure; the institutes, centers, and cooperating scientists.

SCIENCE **AND TECHNOLOGY CONSORTIUM**

The national science and technology consortium (STC) was developed to ensure maintenance and enhancement of technical excellence in our agency. The STC is a result of the reorganization of the NRCS. One of its main functions is to support state and field office staff in technology development and delivery.

The consortium was established as a network of Divisions, Centers, Institutes, and Cooperating Scientists who work closely with academe, other Federal agencies, and outside organizations. The STC consists of 5 divisions at national headquarters, 6 institutes, 5 national centers and 4 cooperating scientists:

The principal purpose of the STC is to provide a mechanism for coordination, communication, and networking among consortium members in accomplishing its functions.

The functions of the STC are to:

- provide national policy leadership for agency technical responsibilities
- provide for consistency in development and delivery of technical products and services
- provide for communication and internal networking within the agency - Divisions, Institutes, Centers, Cooperating Scientists, and technical staffs
- coordinate technical activities among all levels of the agency (including other Deputy areas, Regional Offices, and State Offices

[1] Material drawn from Lee Herndon's presentation at the NACD meeting in February, and conversations with Rich Duesterhaus.

- coordinate networking among the Consortium and academe, non-governmental organizations, and the private sector
- ensure development of technology that is relevant to current and future agency priorities and is responsive to needs of the Field Offices

The STC is under the leadership of the Deputy Chief for SSRA, Rich Duesterhaus. Rich is assisted by the Consortium Scientist, Lee Herndon. The STC structure includes a Board of Trustees to help set direction for the Consortium. In addition national partnerships, such as the National Cooperative Soil Survey, will be consulted in the operations of the STC.

The Board of Trustees is presently being established and initially will consist of the Regional Conservationists, Deputy Chiefs, and one State Conservationist, Tom Christensen of Illinois. Once the Board of Trustees has time to organize and become fully functional, the board will be expanded and will include representation from the partners of the agency.

The Trustees will help set direction by recommending goals and by assessing performance. They also review and provide recommendations on the support structure of the Consortium. They will not be involved in the administration of the STC.

The National Partnerships play an important role in the STC. Partners include colleges and universities, other federal agencies, non-profit organizations, and other organizations including those that comprise the NCSS. The functions of the partners are to help define the role of science and technology in the NRCS and to work cooperatively with the STC on needed research and its application in the agency.

INSTITUTES

The concept of institutes is a totally new concept for NRCS. The institutes are charged to maintain and enhance the expertise of the NRCS in special emphasis areas. They are to help the agency become a national leader in these special emphasis areas. The institutes will accomplish this by networking with universities and other researchers in the development and acquisition of technology. The institutes can be considered applied research entities as their mission is more in acquisition of existing technology and in providing feedback to researchers on technology and research needs.

The institute's focus is on technical expertise to support and assist field operations. We have been charged to be relevant to the field, to be futurists, and to conduct training for first line technology transfer staff. The institute's are not staffed to provided service directly to the field. The institutes are small highly focused units that consist of about 3 dozen scientists working in about 19 locations throughout the U.S.

The six institutes include:

- Grazing Lands Technology
- Natural Resources Inventory and Analysis

- Social Science
- Soil Science
- Watershed Science
- Wetland Science

I will save discussion on Grazing Lands Technology, Soil Science and Wetland Science institutes until the panel discussion tomorrow.

Frank Clearfield is the director of the Social Science Institute and is located at North Carolina A&T University in Greensboro. Other staff are located at the University of Wisconsin, University of Arizona, Chester, PA and Grand Rapids, MI. They are working on Field Office tools (Guidebook for working with limited resource farmers), socio-economic health indicators, and economic software development.

Dean Thompson is the director of the Natural Resource Inventory and Analysis Institute and is located with the Statistical Laboratory at Iowa State University in Ames, IA. Institute staff are located in Fort Collins, CO, with the Forest Service and in Temple, TX, with the ARS and Texas Agricultural Experiment Station. Their charge is to improve NRCS potential to assess status, condition, and trends of our Nation's natural and environmental resources. They are conducting pilot studies of soil quality and new data collection tools to improve quality and timeliness of the National Resources Inventory.

The director of the Watershed Science Institute is Carolyn Adams and she is located at the University of Washington in Seattle. The other institute staff are located at North Carolina State University, Raleigh, NC; University of Nebraska, Lincoln, NE, and Burlington, VT. Their charge is to incorporate ecological principles into landscape planning. They are working on guidance for developing state standards for riparian forest buffers and a pilot project demonstrating wetlands restoration on a watershed scale.

COOPERATING SCIENTISTS

The concept of cooperating scientists in the NRCS is to locate NRCS scientists directly with research units developing new and emerging technology such as the wind and water erosion prediction projects. The cooperating scientists associated with these projects are located with ARS at Purdue University and Kansas State University. Their main function is to help transition the technology for use in our agency. Additional cooperating scientists include an agroforester co-located with the Forest Service Agroforestry unit at the University of Nebraska, and a cooperating scientist on air quality who is located with the ARS at Purdue University.

NATIONAL CENTERS

The National centers existed before reorganization and have undergone some downsizing and refocusing of missions. National centers differ from institutes in that they mostly produce a product or service that is unique to the agency. They tend to be much larger that institutes and are generally centrally located while institute staff are distributed at many locations.

The National Centers include:

- National Cartography and Geospatial, Fort Worth, TX - Dick Flosche is the director
- National Soil Survey, Lincoln, NE - Dennis Lytle is the Chair of the steering team
- Soil Mechanics, Lincoln, NE - Philip Jones is the Director
- Plant Data, Baton Rouge, LA - Scott Peterson is the Director
- Water and Climate, Portland, OR and Beltsville, MD - Wil Fontenot and Jon Werner are co-directors

NATIONAL DIVISIONS

The divisions existed in the old Technology Deputy area and have been downsized and refocused in the reorganization. The Divisions are now responsible for policy development and implementation and for program implementation such as in the Soils Division. They no longer have technology development responsibilities, at least at the Washington, DC level. Divisions have supervisory responsibility for the National Centers within the STC. The Divisions are:

- Soils - Richard Arnold, Director
- Natural Resource Inventory - Peter Smith, Director
- Biological Conservation Sciences - Gary Nordstrom,
- Conservation Engineering - Richard Van Klaveren, Director
- Resource Economics and Social Science -Jerry Hammond, Director

National Cooperative Soil Survey: University Perspective

Everett R. Emino
Assistant Dean of Research
Florida Agricultural Experiment Station
Institute of Food and Agricultural Sciences
University of Florida

It is a pleasure for me to be here today and be invited to make remarks on the National Cooperative Soil Survey. However, before I do that, I need to make my usual disclaimer that I am not a soil scientist. My role is that of administrative advisor to the Experiment Station scientists who participate in the National Cooperative Soil Survey.

It is becoming more and more apparent that the world of soil science is complex, dynamic, exciting, and constantly changing. It is changing in research as well as teaching. Many universities are becoming 'electronic" with multimedia, world-wide web, and long distance education. We are seeing soil maps being generated by GIS software, and other new technology being developed and we are hearing about the concept of soil surveys by major land resource area. We have seen many name changes in federal agencies as well as names of departments at colleges and universities. In the Soil Science Society of America, members of the S-5 division voted and officially changed the name to Pedology. We have also lost many outstanding soil scientists due to retirement and the federal registrar is open for entry-level soil science positions. Although, we can never replace their experience the opportunity to move forward in these exciting areas exit as new expertise and experience are gained.

Change always brings doubt and anticipation. I am excited about the future of the Soil Science Programs, including Pedology, at Agricultural Experiment stations at our colleges and universities. As an example, in my own institution, during the 1995-96 school year, a record number of undergraduate students are enrolled in the Soil and Water Science Department at the University of Florida. Clearly, environmental issues are attracting students to classes being taught. Increasing emphasis is being placed on environmental problems in the classrooms.

Even though I am enthusiastic about the growth at the universities, I also have concerns including the future of the National Cooperative Soil Survey. At the 1994 Southern Regional Soil Survey Work Planning Conference that was held in Little Rock, Arkansas, I discussed four areas related to the University perspective on the National Cooperative Soil Survey. Today, I

would like to follow-up with more observations and discussion on these four areas of: Resources, Education, Cooperation, or partnership and Research.

1. Resources - People and Dollars

a. Universities continue to be at or below a critical mass in terms of personnel involved in National Cooperative Soil Survey and related activities. With few or no new hires, existing pedologists at the Universities are being asked to do more teaching, research, extension, service and, in some cases, administration with the same or fewer resources. The Experiment Stations et many universities continue to operate at a zero level of federal funding for the National Cooperative Soil Survey. With little time and without financial support, there are few incentive for university cooperators to develop interest in National Cooperative Soil Survey activities. In addition, there is increasing demand on the university pedologists' time from agencies and groups outside the National Cooperative Soil Survey. As a result of these and other factors, attendance of university representatives at regional and national soil survey work planning conferences is declining. Experiment Station Scientists are becoming more involved in "non-soil survey" programs.

b. During the 'glory" years of the 1980's. and before, pedologists at the universities worked closely with the field soil scientists involved with soil mapping. Many significant research projects were developed and completed following soil sampling trips that were conducted during the soil surveys in each county. Today, in most of the states where very little soil mapping is taking place, there is very limited opportunity for university pedologists to initiate and develop field research projects with other personnel. Field studies must continue if the National Cooperative Soil Survey is going to continue as an outstanding program as it has been over the years. Somehow, state and federal legislators need to be shown and convinced that field research by pedologists is important and continued funding is needed. One of the most important attributes of pedologists has been their ability to carry out field studies as part of their total research program.

2. Education - It is essential that sufficient soil science faculty be maintained to continue the research, extension and teaching for the next generation of soil scientists in Agricultural Experiment Stations and Colleges

of Agriculture, This is an area in which the role of the National Cooperative Soil Survey is especially critical. If the National Cooperative Soil Survey does not continue with a strong program, and if new soil scientists are not needed, will pedologists at universities be needed? In some areas, such as hydric soil identification in wetland determinations, we are seeing an increasing amount of the work being done by non-soil scientists. The ecologists, biologists, botanists and others are quickly stepping into the void and making hydric soil determinations. A major role of the university pedologists should be to train new soil scientists working with the National Cooperative Soil Survey. Otherwise, pedologists will be training wetland scientists, environmental engineers, etc. The National Cooperative Soil Survey must adapt and move into the areas in which soil scientists' expertise is needed. The National Cooperative Soil Survey cannot expect to maintain its program solely on work related to soil mapping.

3. Coooeration or the partnership - The soil survey effort of the National Cooperative Soil Survey has clearly been a tremendous success story. A large part of this success can be attributed to cooperation. Even though the personnel involved at the federal level have continually changed over the years, the cooperation in this soil survey program continued year after year. As the soil mapping part of the soil survey program decreased, it appears that the cooperation has also decreased. This is not a negative comment, but a realistic one. For example, at the 1995 National Soil Survey Conference held in San Diego, it was apparent that a number of university pedologists were unhappy with lack of their input in the development by the National Resource Conservation Service of field indicators of hydric soils. Similarly, many cooperators did not feel that they had any input into the development of the MLRA concept for the updating of soil surveys. As I indicated previously, if a strong National Cooperative Soil Survey program is going to be maintained, input and cooperation from everyone involved as partners is essential.

4. Research - The need for good soils research is fundamental to the work of the university experiment station's pedologists. I see the university pedologists as leaders in soils research. Their role must be an active one not a passive, after the fact involvement. Thus, there is a need for all involved in the National Cooperative Soil Survey to continue to work closely with the university pedologists and vice versa. Hopefully, the National Cooperative Soil Survey can develop research projects involving the many complex environmental issues facing our world today.

In summary, the University Perspective on the National Cooperative Soil Survey is that the 1980's and earlier decades were a tremendous success for the soil survey program and its cooperative effort. Perhaps, because they were such outstanding years, we were expecting too much for the 90's. The 1990's, so far, has become a decade of challenges. Changes have occurred as soil mapping projects have been or are being completed. It is a decade with many technological advances to learn and new demands on the pedologists' time. The question that remains is whether the National Cooperative Soil Survey can adapt, develop a strong program, and continue. Are the initiatives in place to secure state and federal funding for the Experiment Stations activities in the National Cooperative Soil Survey? Without a strong National Cooperative Soil Survey program and funding, it will be difficult to maintain the interests in the University Pedologists in the National Cooperative Soil Survey. and it will be difficult for administrators to support the National Cooperative Soil Survey.

I hope these comments were useful to you as we begin this important and challenging work planning conference. As Administrative Advisor to the Southern Regional Soil Survey Work Planning Conference representing the Southern Association of Agricultural Experiment Station Directors, I wish for continued success of the National Cooperative Soil Survey.

NCSS Southern Region Soil Survey Work Planning Conference
Charleston, South Carolina, April 15-19, 1996

Presentation: NSSC Support to MLRA, April 15, 4:15-4:30 PM
By Warren Lynn

Greetings from Nebraska and the National Soil Survey Center. In Nebraska we are in the midst of a pattern - at least it seems a pattern - of wide swings in the weather. Last Thursday the high temperature in Lincoln was 93" while Harrison, Nebraska, in the northwest corner of the state received 6 inches of snow. The cold weather hit is Friday and Saturday. At the Soil Survey Center, in keeping with the weather mood of the season, we are playing cubicle upset. Perhaps some of you have played that game. If you have not, believe me it is better as a spectator sport. I had the opportunity of participating in the previous round of the game. Part of the present round is a new phone system and new phone numbers. Dennis Lytle is here and on the program. He may have some more on the serious side of the event.

Of course the big topic of the day for our agency is a new name and a new organizational structure. Each of you in the agency have been struggling with how that translates into the work-a-day world. We at the Soil Survey Center are experiencing the struggle. My basic message to you is this: We wish to be of service to you. Please tell us how we can be of help?

As a general approach, if you know who at the Center can provide you the information you need, or provide the assistance you require, by all means contact that person. We have no intentions of disrupting established links of communication. If you do not know whom to contact, feel free to call me and I will try to get you connected with the appropriate person. If I am not there, contact one of the other liaisons. I will come back to liaisons a bit later.

The Soil Survey Directory of Services, last printed in February, is a good source of whom to contact for infomtation on specific topics. Wherever they might be located.

At the Center - -

Sharon Waltman and help with Soil Geographics, including STATSGO, NATSGO. You will hear more from Sharon on Thursday morning. Sharon says she has never been this far south and east, so ya'll make her feel at home.

Jim Fortner can help with NASIS.

For data base validation and population, Ricky Bigler is the person

For water quality interpretations - Bob Neilson

Earl Lockridge has a more focused responsibility for training - Earl is on the program Tuesday afternoon (tomorrow).

Ellis Benham is here at the meeting -he has responsibility for the Soil Survey Laboratory data base and works with the pedon description program. Ellis has a problem, though. Besides being a good soil scientist and analyst, Ellis is more knowledgeable about computers than any of the rest of us at the lab, so we all seek his help.

Doug Wysocki is also here at the meetings. With Carolyn Olson and Phil Schoeneberger, Doug is focused on soil geomorphology, soil - landscape activities. Of interest in this region, Doug is engaged in a joint study with Helaine Markewich of the USGS on loess and alluvium stratigraphy in the Mississippi River south of Thebes Gap (Cairo). They have particular investigations sites in Arkansas, Mississippi, and Tennessee.

The NSSC liaisons are also the liaisons for Soil Survey Investigations and for analytical lab work. We are more directly and actively engaged in these activities. There are four of us now. Our geographic responsibility is roughly along the lines of the traditional NCSS regional soil survey conferences, but for Soil Survey, with some modification along MLRA - MO boundaries as outlined on the map and detailed in the table (both attached). Rebecca Burt has responsibility in the west, Tom Reinsch has the central USA, Phil Schoeneberger has the northeast, and I have the southeast. Changes I am sure are obvious to you, and probably not new. My area goes farther north in MO16 than before. Phil reaches farther south in MO13. Tom has a good share of Texas and Oklahoma. The handout you have details the same information. We feel an obligation and a desire to serve both the soil survey and the technical soil services activities. The table indicates the suggested linkages at this point - generally along MO boundaries for soil survey, and with the associated states for technical soil services.

What I said at the first still holds here. Working links with persons associated with the lab should remain. All of us still at the lab are engaged in project work. The strength of our work lies in interactive contact with the field (immediate, not remote - with soil scientists in jobs like most of you once held).

I hope to be able to talk with many of you about developing long range soil investigations plans during the week. Dream plans. Getting our crystal balls focused on things we think need to be done in the next 5 to 10 years. If you have thoughts on approaches to gather the information or on specific topics, please visit with Ellis Benham, Doug Wysocki, or me.

I will be talking to the assembly again next Thursday morning with a report from the Soil Survey Lab. Until then, don't be a stranger. Thank you.

NCSS Southern Region Soil Survey Work Planning Conference
Charleston, South Carolina, April 15-19, 1996

Presentation: NSSC Lab Report, April 18, 1996
By Warren Lynn, substituting for DeWayne Mays

As a result of our reorganization, the analytical function of the former National Soil Survey Laboratory looks a little different than it did before, but not a whole lot different. Our total analytical staff is smaller. It is shifted toward permanent technicians and away from part time employees. Lika any such shift there are gains and losses. We gain stability and continuity of the full time person. We loose some of the eagerness and creativity of the university student. With the new staffing plan, we estimate a production capacity about 80% of the average for the previous 4-5 years. This translates to about 8000 samples per year, down from 10,000 samples per year. The production level has not been tested. The earliest estimate for a fiscal year will be in October 1997.

We were out of production much of calendar year 1995 with remodeling. As a result we have and extra backlog. We have asked you to minimize requests for that period, and we have a similar request for the rest of this fiscal year. You have been cooperative and we appreciate it. Our goal is the get the backlog reduced by the end of the calendar year to a point that we can sustain a turn-around time to meet you needs in a timely fashion.

Overhead (copy attached): Samples Received (by month) for fy93, 94, 95
Fall has always been a high load time; late winter and early spring a low time; 1 was a bit surprised by the low load May through July.
Overhead (copy attached): Total Analyses and Samples Received (per fy)
From 1981 to present the sample load has been 7500 to 10,000; in the 90's we edged over 10,000 for four of the years. The total number of analyses has increased more rapidly in since 1990. With our reduced staff, the estimated output is about 8000 samples per year or about 80% of sample load during the 90's. It will be the end of fy97 before we have actual numbers to test against the estimate.

We are pretty much in an operational mode again. We are not running EGME (surface area) or atterberg limits. We are looking at existing projects to see if some can be reduced or delayed (with your concurrence). Reference projects we will try to get out in 3 months. Characterizations projects may take a bit more than a year to get back at this time. Our biggest backlog is in optical mineralogy; we are attempting to get a little extra summer help to whittle than down.

I passed out a letter last Monday indicating the liaison links we would like to establish.
Overhead (copy attached): NSSC Service Regions

You can address requests for investigations assistance to me or Tom Reinsch for MO9 or to Phil Schoenebcrger for M013. If analytical work is involved, please send a carbon copy to DeWayne Mays. This is mentioned in the letter I passed out on Monday. If there is someone on our staff that you would like to be Project Coordinator, tell us. Send that person a carbon copy of the request if you wish. We plan to spread the project work among the investigations staff and other staff at the NSSC.

It looks like for our records and for data distribution, indication of the MLRA in which the site is located will be important, if not necessary. I have requested that we include the MLRA on the data sheet, as well as in the description. For projects pending distribution, if we do not know or cannot figure out the MLRA, we may ask your help.

We certainly look forward to being back in full swing again.

Thank you.

NCSS Operations in the Reinvented NRCS

S. W. Buol

It appears to me that "our" pass play has been called, the quarterback is fading back into the pocket and it is up to "us" to break free of the cornerback, and safety, and "catch the ball."

There are several things that can happen. The quarterback may be sacked by a defensive lineman. This option is beyond our control but from what I have heard, the ball has left the quarterback's hand and is in the air.

A linebacker can block the pass. Again, this is beyond our control but it looks like the ball has cleared the line of scrimmage.

Is the throw accurate enough that we can either take it in full stride or alter our route in time to catch the ball? It may be a windy day and we will need to make a few "pass-route" corrections to be at the right place at the right time.

Have we put enough "moves" on the cornerback and safety that they will not bat the ball down before we can catch it? Is our quality such that our hands will be better than anyone elses when the ball arrives? Is our technical skill superior to others who would seek to take up the challenge of inventoring and addressing the country's natural resource of soil. Be assured there are others who are looking for a "juggled" ball. We must seize the ball and tuck it under our arm with no lost motion. If we "juggle the ball" or break stride in our pace of producing information to the public, we may not proceed far toward a touchdown.

Finally, we can be sure that the point of reception is not in the end zone. Perhaps in the scheme of things we will never define an end zone within the needs of society for information about soil and land. Various demands will be made of us as often as we catch the ball and proceed to run with it. We know many of these demands for information related to agriculture, forestry, waste disposal, and land use regulation. We have seen these uses increase and change with time. Be certain they will continue to change. We will need to be aware of new requests and perhaps since we are now "on our own" we cannot expect to receive any blocking from our teammates back on the line of scrimmage. In football parlance we will have to do some broken field running.

I certainly do not have any crystal ball to forecast all the obstacles we may encounter so anything I say may miss some and may create shadows where no substance exists but in a quick scan of the "broken field" before us, these are some of the things I think I see:

1) Will state and university support be agreeable to research that crosses state lines? I think so in my case but soil survey project leaders need to be prepared to inform their administrators of their expanded obligations to address MLRA projects.

2) Can soil survey expand in its technical function to include the regolith-saprolite "vadose" zone below the pedon (2m) and above hard rock? This is an area of great interest to waste disposal concerns and other hydrologic modeling of the "vadose zone" which in its broadest sense includes the soil. If soil scientists do not expand their observations to this zone "others" will and attempt to be inclusive of the soil in the information they represent.

3) Can we "tout our wares"? We will need to take up some of the public relation functions that perhaps we have come to rely too heavily on the conservationists within previously invented Soil Conservation Service. We must have sales regardless of the quality of our product.

4) New policies and procedures will need to be developed, tried, and refitted to fill the new landscape of operations. In my opinion, the most important aspect that we need to keep is a quality product. Certainly, our maps, data bases, and GIS presentations are part of that product. They must be capable of presenting not only the technical data we have about the soil and land but they must continue to be useable by non-soil scientists. To paraphrase the words of Dr. Witney in 1905 as he instructed the first soil scientists "Our maps must identify every landowner's house, school, church and cemetery in order to build their confidence in the technical and scientific information we attempt to convey in our soil surveys." That continues to be a requirement of our products.

Finally, the most important aspect of the reinvented soil survey is us. We, and those we work with, must be prepared to represent soil science in a professional manner befitting the grand charge we have to study that magnificent entity of nature - Soil.

Soil Survey Direction and the National Soil Survey Center

Soil Survey Staff

Presented by Dennis Lytle
South Regional NCSS Work Planning Conference

The National Cooperative Soil Survey (NCSS)

The soil (pedosphere) is the thin, critical interface between earth and atmosphere, supporting much of the terrestrial life of the planet, filtering much of the water we drink, and catalyzing many of the chemical transformations upon which we depend. Knowledge about characteristics of soils, and soil interactions with other factors, helps people predict and control the influences of human and natural phenomena as we seek to create a "Productive Nation in Harmony With a Healthy Land".

The NCSS helps people understand soils and their responses to a variety of natural and human influences. It accomplishes this through a multi-purpose science-based soil survey. NCSS products are:

(1) Information about the distribution and properties of soils, and of factors affecting the soil environment

(2) Predictions of soil behavior and of the natural systems of which they are a part, and,

(3) Guidance on how to apply the accumulated knowledge of soil survey.

A. Soil Survey **Division Thrust Areas**

1. **Enhance Quality of Soil Survey Information.**

    a. Continue MLRA Approach to Soil Survey - Erase Political Fault Lines and Fill in Voids in Data.

    b. Add Use Dependant and Temporal Soil Property Data for Soil Horizons.

    c. Create One Soil Survey For All U.S. Lands

    d. Create and Maintain National Standards for Soil Survey,

2. Accelerate Application of Soil Survey Information.

a. Develop Soil Survey Interpretations (R&D, NASIS, Training)

b. Create Technical Soil Services Program - State Soil Scientists in 34 states.

c. Provide Training to Develop Soils and Soil Survey Technical Skills of Field Office Staff.

d. Digitize 2500 Soil Surveys by 2000.

e. Re-engineer Publication Process.

f. Develop NCSS Role in Soil Quality Assessment (Baseline Indicators and Soil Condition Index)

g. Republish Soil Taxonomy.

3. Create **Easy Access to Soil Survey Information.**

a. Provide a National and International Soil Data Access Facility (WWW/INTERNET).

b. Provide a National and International Soil Data Capture and Standardization Software (Windows Pedon).

4. **Aggressively Apply New Technology in Soil Survey.**

a. Develop Remote Sensing Techniques for Soil Survey - ERDAS.

b. Develop GPS, GPR, etc. - Field Tools for Soil Survey.

c. Develop GIS - Select/Query/Report Tools for Soil Survey.

B. Supporting Processes

1. Create a NCSS Research And Development (R&D) Agenda.

a. Develop a Comprehensive Listing of R&D Needs for NRCS and Partners.

b. Select and Prioritize NSSC R&D Activities from NCSS R&D Agenda.

c. Leverage NCSS R&D Agenda to Increase and Strengthen Partnerships and Accomplishments.

2. Develop and Maintain a National Soil Information System (NASIS).

a. Create NCSS Software Tools.

b. Create a NRCS and NCSS Networked Information System.

c. Integrate Data From Other Agencies and Institutions.

d. Maintain and Manage 17 Integrated MLRA Natural Resource Data Bases.

3. **Provide for Resource (Human and Financial) Development.**

a. Develop Leadership: Project Management and Team Skills of NSSC, MLRA, State and Field Office Soils Staff.

b. Increase Diversity Within Soil Science Discipline.

c. Increase Funding for Mapping, Digitizing, Technical Soil Services and Soil Survey Laboratory - Investigate sale of products and services.

4. Increase National and International Policy Influence.

a. Monitor Soil Resource Condition and Trends and Draft Policy Recommendations.

b. Continue Active Outreach in International Organizations.

c. Ensure that Soil Survey Staff Remain in International Demand

5. Ensure Political Support for Soil Survey.

a. Develop and Implement Continuous Customer Feedback Process.

b. Actively Market Products and Services.

6. Ensure Scientific Credibility of Soil Survey.

a. Graduate Studies of field staff

b. Sabbaticals (national and international)

National Soil Survey Center Functional Group Assignments
(Initial Draft)

Data Base Population and Integration Group

. SHORT-TERM -- Assist the State, MLRA and Project Offices by providing; consultation, procedures and, methods to populate and coordinate MUIR data elements. Assistance is provided based on the needs jointly agreed to by states and the NSSC. Preference should be given to data elements needed for FOCS. Priorities may vary by state, region or MLRA. This is not an NSSC driven process. A key contact person should be established in each of the 17 MO regions.

Develop Soils of U.S. and Ecological Region (MLRA) small scale maps and data bases as organizing principles for data base population and integration.

. MID-TERM -- Develop a strategy for each MO region to populate new data elements (albedo, moisture states, use dependant elements, etc...). Priorities may vary by state, region or MLRA. This is not an NSSC driven process. The key contact person in each of the 17 MO regions should lead the process.

. LONG-TERM -- Evaluate the purpose and need for additional data elements based on soil survey division, agency and NCSS strategies and direction.

Soil Taxonomy Group

. SHORT-TERM -- Publish a revision of Soil Taxonomy (AH-496) before the International Soil Science Congress in 1998.

. MID-TERM -- Evaluate the need for further additions to Soil Taxonomy. Evaluate the effectiveness of Soil Taxonomy, other land classification systems such as Land Capability Class and the need for other soil classification systems. Make recommendations for future direction. Use ASA symposia etc.

Interpretations Group

. SHORT-TERM -- Work with states to develop a strategy to train state and field staff on how to develop interpretations criteria, and evaluate interpretations results for all interpretations (Urban, Grazing lands, Forest, Agronomic, etc...) Training should be coincident with the NASIS 3.0 Release of the Interpretations Module.

Implement new national interpretations.

Coordinate with Soil Quality, Wetlands Science, Grazing Lands, and to some extent other institutes to develop interpretations and support activities, for example the development of a soil condition index. Support national program needs and requests, for example soil data for CRP sign ups.

Develop and coordinate Soil and Ecological Science Standards.

. MID-TERM -- Work with states, institutes, NCSS and others to document interpretations needs, and develop strategies for developing these interpretations including coordination across political boundaries.

. LONG-TERM -- Examine the basic fundamentals of soil interpretations, including why interpretations are made, what is accomplished, etc...

Information Architecture Group

. SHORT-TERM -- Work with states to implement (distribute, train, support and procure hardware and software) NASIS 2.0. Coordinate with others programs such as FOCS on software, hardware and data needs.

Coordinate design of software for NASIS 3.0 and 4.0.

. MID-TERM -- Develop an action plan for integrating all soil information data

collection, management and distribution (field, lab, etc) from all NCSS sources and develop a system lifecycle plan. Integrate this strategy with other NRCS activities.

Evaluate the effectiveness of the National Soil Information System

. LONG-TERM -- Develop scenarios for next generation Soil Information Systems,

Analytical/Research Laboratory Group

• SHORT-TERM -- Eliminate backlog and establish a 3 month turn around for characterization projects and a 1 month turn around for reference projects. Dedicate no less than 50 percent of capacity to state driven demand. Acquire and implement a LIMS. Refurbish Basement. Learn about process mapping.

• MID-TERM -- Begin Laboratory Process Mapping --
- Cycle Times
- Workload Flows
  * Peak Demands
  * Staffing vs. Demand Function
  * Routine vs. Special Handling

Develop plan to implement results of process mapping and other ideas.
* Establish Testing Criteria for "Good or Bad idea".

International - World Soil Resources, John Kimble

. SHORT-TERM -- Develop a strategy and funding for scientific exchanges. Evaluate and document what soil and soil survey assistance and expertise is needed for key target countries and develop a 5 year program for meeting those needs. Evaluate and document where expertise [subject area and scientist(s)] exists in other countries that will help advance the NRCS and Soil Survey Strategic Plan.

. MID-TERM -- Develop an action plan for establishing a world soil data access facility, including data acquisition plan.

Training - Earl Lockridge and Lea Ann Pytlik

. SHORT-TERM -- Work with states to develop a needs assessment and training strategy for state and field soil scientists. Work with State Soil Scientists and other principle state staff to develop a needs assessment and training strategy for field office staff in soil, soil survey and related topics.

. MID-TERM -- Investigate training methods. Evaluate effectiveness of current training methods.

Investigations Group

. SHORT-TERM -- Develop proposal for segmentation of time between;

- Consultation/training - support to states and others
- Research - defined by NCSS and NSSC research agenda
- Support to NSSC functional groups and teams
- Support to the Soil Survey Laboratory

. MID-TERM --Define the NSSC component of the NCSS R&D Agenda

Soil Survey **Research and Development (R&D) at the NSSC**

Soil Survey R&D contributes to the understanding of soils and allows people to better serve changing agricultural, urban, and environmental needs. The research process includes global technology exchange, experimentation, development, delivery and training, to create, apply, and share the best possible science and technology.

NSSC research is done in cooperation with other NRCS scientists, universities, and other cooperating agencies and institutions. The soil survey program is focused on domestic resources, but the sharing of science and technology is global.

Reliable soil surveys require understanding and accurate prediction of distribution patterns. Reliable prediction of patterns requires an understanding of the processes and factors causing the patterns, and consistent, quality classification to organize that knowledge.

Reliable interpretations require predictions of soil behavior. This requires understanding of processes and properties affecting behavior. Soil survey R&D provides the understanding and technology to produce quality, multi-purpose, science-based products, and the logic and systematics to organize and deliver the knowledge.

Soil survey R&D develops and delivers:

(1) Procedures, standards, and systematics to assure quality in soil surveys information,
(2) Complex measurements, evaluations, and models that define natural processes and systems.
(3) Information to improve the technical capability of specialists to use these products
(4) Fact, relationships, and models that expand the application of soil survey information to current national and local concern

Current Concerns That are Driving Soil Survey R&D

Concern	Driving Forces	R&D Focus
Soil Quality	Need to define, monitor, and predict the status of the soil resource.	-Calculations from soil survey data -Methods of characterization -Predictive model development (WEPS, WEPP, RUSLE, etc.) and data to support them. -Biological Characteristics of soils
Water Quality	Need to define, monitor and predict the status of the water resource.	-Soil landscape hydrology data for soil survey (water movement) -Predictive models (NAPRA, NLEAP, NPURG and data to support them.

Climate Change	Soil information for carbon sequestration and and climate change models	-Impact of CRP -Inventory and maps of soil carbon -Methods to monitor soil climate -Predictions of soil impacts
Wetlands	Need to understand hydic soils	-Characterizing redox processes and water table regimes.
Soil Genesis/Landscape Evolution	Basic research needed to understand soil formation, processes and interactions as back stop for all NRCS programs.	-Soil Stratigraphic Studies -Andisol Studies -Hydrothermal Soils -Anthropogenic Soils -Soil Survey Project Questions -Use Dependant Temporal Properties
Soil Survey Lab and Field methods and Technology Development	Procedures and tools to help laboratory and field staff	-New Lab Characterization methods -Geophysical tool development -GIS tool development -Neuronetworking

Current and Future Research Topics

Soil Quality Indicators. The definition of soil quality is close to that of Larson and Pierce. Research by the NSSC provides methods for assessing inherent quality of the soil, and for assessing the soil condition relative to that inherent quality. Collaboration beyond the NCSS includes helping people understand soils, soil geography, soil processes, soil survey data, and application of soil survey data. It also includes the development of concepts and approaches to issues under the banners of soil quality, soil health, resiliency, and fragility.

Topics:

a. Properties that indicate quality
b. Data relationships to estimate properties that indicate quality.
c. Field procedures to measure properties that indicate quality.
d. Interpretations that indicate status of soil quality (are we sustaining the resource?).
e. Interpretations that imply status of other ecological components.

Soil Quality and Use Dependent Soil Properties. This encompasses those soil qualities that vary with use and that affect predictions of soil performance. Present emphasis is on survey and prediction of surface horizon crusting and sealing that affects water intake rates, water transmission, root penetration and seedling emergence, and erodibility. Plow pan formation is included. Future emphasis will include chemical changes through agricultural practices,

Water intake and transmission affect a wide array of interpretations. Use-dependent ranges are greater than ranges in soil permeability classes. Water management models, erosion prediction models, and a host of other present and future simulations to predict sustainability are dependent upon soil survey data as input.

Research on the physical qualities encompasses the development and testing of survey procedures, and procedures for populating the NASIS data base. This requires collaboration with scientists who are familiar with model requirements, and with practitioners who are developing applications dependent upon the soil survey data base. It encompasses literature reviews and consultations with experts to determine which procedures and qualities are practical predictors. It also encompasses consultative work with those who wish to use the soil survey to assess soil qualities, or to predict effects of alternate land uses.

Topics:

a. Identifying the important land uses in order to stratify the information.
b. Identifying important soil qualities.
c. Field measurements, including intake rates and hydraulic conductivities.
d. Procedures for creating and populating the data base.
e. Protocols for use with interpretations.

Future Research will encompass pH effects of fertilizers, and the accompanying changes in nutrient availability, toxicities, and hydraulic conductivities. Research will include literature review, consultations, and testing of criteria for predicting susceptibility to change.

oil Quality and Erodibility. This topic encompasses the methodologies and criteria for assessing and modelling (WEPP and WEPS) soil erodibility by wind and water. It is limited to collaborative work with scientists developing methodologies, and with practitioners applying predictive tools.

Topics:

a. Collaboration on setting up experiments to test soil erodibility.
b. Selection of soil properties to test for predictive value.
c. Selection of predictive criteria against known soil performance
d. Development of methods survey new predictive properties and populate the NASIS data base with new data elements.
e. Improvements in descriptive soil survey information to accommodate predictions, for example, developing ways to indicate locations of map unit components in the paths that water must take along a hillslope.

Water Quality and Soil Hydrology This topic encompasses the understanding of water movement and storage in landscapes in order to understand soil patterns, and potential changes in soil patterns with natural or induced changes. Water movement contours most of the erosion/deposition in most landscapes. Water infiltration, percolation, and storage affects much of the biological activity and movement of chemicals both over and though the soil.

Current emphasis is on methods and partnerships to consolidate and incorporate our knowledge of soil hydrology into soil survey products and consultation with model developers and those who are applying the model.

Topics:

a. Landscape models showing edaphic, physiographic and ecological influences as the basis for predicting effects of potential change.
b. Methods for measuring hydraulic conductivities.
c. Methods for calculating hydraulic conductivities from soil properties.
d. Data and methods for predicting and measuring seasonal and annual variations in water states.

Water Quality and Chemicals in the environment. This topic encompasses the methodologies and criteria for assessing and modeling chemicals that have been added to the soil, It is limited to collaborative work with scientists developing methodologies and models to use soil survey data such as those in FOCS.

Topics;

a. Salinity
b. Heavy Metals
c. Nitrogen, Phosphorus, and Potassium
d. Pesticides

Climate Change This topic encompasses the soil data required to predict effects of greenhouse gases on global climate change, and the effects of man on greenhouse gases. It is limited primarily to the priorities of the USDA global change initiatives.

Topics:

a. Carbon sequestration in soils, including influences of man and climate.
b. Development of soil data bases at Long Term Ecological Research and other research locations.
c. Assistance to scientists in use of soil survey data to model global change.
d. Studies of soil climate and tests of predictive value of soil features in reconstructing past climate.
e. Documentation of current crop yields by soil and climate.
f. Preparation of North American and United States soil maps and characterization data for use in global change studies.

Wetlands and Hydric Soils. This includes research relating soil morphology to wetland regimes, and detailed studies of water tables in soil and landscapes.

Other.

-Soil Genesis and Landscape Evolution
-Soil Survey Laboratory and Field Methods and Technology Development
-Soil Productivity Modeling
-Prescription Farming
-Soil Survey Reliability
-Soil Variability and Map Unit Composition (Statistical Approaches)
-Soils and Human Health

October 1995 STATUS REPORT

THE SOIL SURVEY PROGRAM OF NRCS

EXECUTIVE SUMMARY

Staff

- There are currently 925 soil scientists in NRCS. Only 33 of those are at entry level grades of GS-5 and GS-7. The staff is aging quickly.
- 353 soil scientists are assigned to soil survey project work, about 50 are assigned to MLRA Offices, 55 are assigned to NMQ, NSSC/Lab., and the Soil Quality Institute Offices. (see map for distribution of these soil scientists)
- An equal number are assigned to state office staff and to providing technical soil services.

National Soil Survey Center

- Provides internationally recognized standards.
- Leads the world in developing an internationally accepted soil classification system.
- Supports the agency in providing research in ways to better conduct soil inventories and to interpret data.
- Links with many other agencies and institutions to provide data needed for modeling water erosion, wind erosion, water quality and soil quality indicators, and soil productivity indices.

State Operations

- Currently implementing the MLRA Office Concept for soil survey project management. Implementation concept varies by region and by state.
- Currently there is insufficient data base management, cartographic, and editorial staff identified to carry out the work load.
- Project offices are not sufficiently equipped with computers to efficiently manage the soil data they are producing.
- Many states have high personnel demands for soil scientists to assist in effectively using soil information to solve resource problems. States have been reluctant to place this expertise into the programs that need the assistance. This results in about 505 of the staff being assigned to work other than soil survey projects.

Program

- About 87% of the private lands have soil surveys.
- Only about 10% are digitized, and most of those are not to current standards.
- Insufficient staff is trained to produce quality digitized information that will meet standards.
- NRCS maps about 2 1 ,OOO,OOO acres per year.
- NRCS publishes about 55 soil survey each year. Currently there is a backlog in publication, and insufficient trained staff to work through it.

INTRODUCTION

The soil survey strategic plan outlines five major *program* **focuses** *and serves as a background for designatedyear-by-year items of emphasis. The 5 focuses are: improving data quality, effective information management, maintaining a highly qualified staff, conducting the inventory of soil resources, and continuing to work through* **our** *partners in the National Cooperative Soil Survey.*

Our major FY-96 focus is on Data Quality.
Quality data is needed to satisfy FOCS expectations, support Wetland mandates, assist CFSA and NRCS with soil ratings for CRP and other land use decisions, complement urban community efforts, help evaluate soil quality indicators, and fulfill our commitment to customers and partners who requested standard soil survey reports. It is to address this need of high quality, consistent soil data that we have restructured the way NRCS Soil Survey is organized to produce soil information. A parallel focus is keeping the soil information management system, NASIS, on track and on target. NASIS proves the mechanism for NRCS and its partners to store, manipulate, and deliver soil information, A Beta test of NASIS 2.0 indicates that states will be able to effectively convert previous data sets used in CAMPS to FOCS formats, improving the data quality, and also continue strengthening the information system.

To obtain satisfied customers we will rely, in large part, on our ability to obtain and provide appropriate, timely and cost-effective data and data interpretations. This involves producing and providing databases, digital text and spatial resource information for multi-scale GIS, integrated environmental assessments, field

DEPLOYMENT OF SOIL SURVEY PERSONNEL

The current assignment of CO-02 (Soil Survey) supported agency staff is not known accurately at this time due to the recent reorganization. Their approximate distribution is shown on the attached maps. In January 1995 there were 900 soil scientists in State and Field Offices. There were 165 in State Offices, 558 doing production mapping and 177 delivering technical soil services.

Since 1985, the FSA and FACTA farm bills have caused major diversions of soil scientist expertise from the systematic survey and database development to other high priority technical services in support of SCSMRCS program activities, notably identifying HEL cropland and hydric soils. The agency has not emphasized the need to hire additional soil scientists required to carry out both the soil survey function and the technical soil services function. This has had a negative impact on completing an initial inventory of the U.S. soil resources and publishing the results. These worthwhile goals are identified in our enabling legislation and are consistent with honoring our previous commitments to customers. This process and its dovetailed schedule to meet agreed on standards are, however, fairly complex. The broad steps are mapping, correlation, technical assessment, English edit, map compilation, finishing and digitizing, certification, and report publication. Long range plans still call for completion of the inventory consistent with today's standards. About 88% of the private land is mapped and about 45% of the Federal land. It is estimated to require about 4160 staff years to complete the private land and 5530 staff years to complete the Federal land. With staffing levels as of Jan. 95 it would take about 6 years to complete private land mapping and another IO years to complete the Federal lands, assuming that the personnel are exclusively devoted to this task. There are some difficult priorities to be made for the future.

SOIL SURVEY AREA REPORTS

Since about 1900 the U.S. has published reports on the kinds, qualities and capabilities of soil resources, often on a county basis. The formats have been modified, databases updated, and interpretations added as the number and kinds of users increased. All inventories underway will be digitized as a matter of course, however the task of transferring old survey maps to appropriate controlled base maps is both expensive and time consuming but now necessary to meet Federally mandated standards for spatial data

The personnel of the soil survey editorial staff train field scientists in manuscript preparation, provide counsel on test segments of text, provide an English edit, do page layout, and prepare texts to meet USDA requirements and for GPO publication as required by current Government regulations. These activities were once centralized in NHQ, then dispersed to the 4 NTCs, then again centralized at the NSSC in Lincoln. The current restructuring will disperse the activities to the 17 MLRA offices where production coordination will be concentrated. Although we understand the process and know the status, we do not have the resources necessary to expeditiously clean out the slowly increasing backlog of manuscripts and reports for which we have made obligations to customers and partners in previous years. The authorities and responsibilities are being delegated to MLRA offices from the NSSC consistent with the NRCS Business Plan, however trained staff capable of continuing current publication rates are not available. The agency is also reluctant to set the funding aside to pay for the publication of these

reports as evidenced by the proposed $500,000 reduction from the amount requested and needed in 1996.
There are 3240 soil survey areas in the U.S. About 72% have published reports (includes those now out-of-date); another 15% are completed but not yet published, and about 14% yet to be completed.
Information about the current workload and status of each survey in each MLRA and Region is being provided. There are 90 manuscripts which have had a technical review and now await revision at State level; there are 87 manuscripts ready for English edit and for these, 58 also have the soil maps completed by the Cartographic Center.
Recommendations on ways to reduce and eliminate the backlog will be shared with appropriate Regional and State personnel as they are identified and are in location. There are some difficult priority decisions to be made.

MAINTAI ' OUALITY SOIL INFORMATION

Changing technology in using and managing land, rapid urban expansion, environmental awareness and concern, and evolving legislation dealing with integrated land use have all impacted the need for up-lo-dale relevant soil and soil-related information. The strategy selected has been to update spatial and attribute data by natural physiographic areas and then tailor the information for clients and customers, insofar as our capabilities permit. We call it the "MLRA approach ". It appears to be sound, however we have not yet been able to effectively channel resources for this effort as "MLRA projects ".

Work is currently underway in about 3 1% of the MLRAs involving about 200 former survey areas. The States estimated the staff years to upgrade all soil surveys to meet current Federal standards assuming it could be completed by 2020. It ranges from about 660 staff years per year in the next five-year period, declining to about 375 staff years per year during the S-year period ending in 2020. There are some difficult priorities to be set for the future.

THE CHANGING ROLE OF THE NATIONAL SOIL SURVEY CENTER

For many years the National Soil Survey Laboratory (NSSL) operated in support of the soil survey program but as a separate entity. In 1988 the Lab. as a core, was surrounded by other technical staffs. It was a move to unify and heal a slowly diverging soil survey program This centralization provided quality assurance but not quality control: it provided database developmental support; it initiated GIS technology; it began R&D in interpretations; it continued the field investigations of trained experts: and it provided high quality laboratory data for the scientific explanations that help us understand soils as landscapes.

The Soil Survey Center has had, and still maintains, good linkage with a number of ARS laboratories and staff which are working on similar problems. Especially important have been the cooperation on the water and wind erosion models where we have sampled and characterized soils and provided data and interpretations. This includes work with the National Soil Erosion Lab, National Soil Tilth Lab, Waterways Experiment Station, Wind Erosion Lab and the various groups assigned to develop the models. In addition work associated with soil productivity and erosion, such as the EPIC model at Blacklands Experiment Station, Temple; the hydrology models like GLEAMS and CREAMS, and the

Soil Quality teams of ARS at Ames, Lincoln and Pullman are examples of joint work. We have scientists working with EPA on terrestrial indicators and modeling; another works with Fish and Wildlife on hydric soils; several work with USGS on landscape stratigraphy and global change; and others work closely with University scientists on issues such as wetland processes, permafrost characterization, soil classification, and yield productivity indices. We also have soil scientists working with international institutes and organizations providing expertise in soil characterization, database development, soil interpretations, and GIS applications. Sustainability of the resources is the major theme of these activities.

Our soil characterization laboratory procedures and their interpretations are well known in much of the world. Scientists in many countries recognize the strength and integrity of the laboratory for its impartial dedicated service to soil science. The Laboratory's reputation is still world class. It is the only national laboratory for soil characterization in the United States and is a respected leader for labs around the world.

This blending of R&D, research, and production support and oversight is being changed as the Agency Business Plan changes. The role of the NSSC is shifting to a stronger emphasis on R&D for new techniques, new data elements, new interpretations, re-vitalized training, expanded soil classification, and new outreach to soil scientists throughout the world

The transfer of authority for most production activities away from the Center and back to the Regions is accompanied by a renewal in the basics of scientific investigation and interpretation that are essential to supporting the basis for stewardship of America's soil resources.

We have several scientists who have worked with many others over the years, have developed and tested techniques that are cutting edge, and others who diligently lead the development of world consensus in soil classification. We can stay in there, but not unless we provide a shield and haven for those who are different, and who reach beyond the short-term demands of the day.

We have a new laboratory facility, one of the finest we can have with the resources that were available. But we have just about used up the storehouse of prior research and now is the time to recognize that the future has to take some risks and let us protect and nurture the spirit of outstanding researchers, both basic and applied. There are some difficult priorities to be made for the future.

PRESENTATION TO NATIONAL COOPERATIVE SOIL SURVEY SOUTHERN WORK PLANNING CONFERENCE -APRIL 151996
BY JOHN H. THORP, SOIL CLASSIFICATION SCIENTIST - WESTVACO FOREST RESEARCH, SUMMERVILLE SC. USA

WESTVACO'S SOIL SURVEY - MAPPING AND INTERPRETING FOR INTENSIVE SILVICULTURE

Good Morning:

I'd like to make it clear right up front that I recognize that the National Cooperative Soil Survey has broad objectives and serves a wide array of users. So please remember I today's regulatory environment it is prudent, often necessary, to have a technically defensible inventory of one's landbase.

How did we create a classification system that made sense for our particular landbase and organization? We initially investigated many different methods from regression analysis of soil-site factors to existing Soil Conservation Service maps. We also involved our "customers" in the development of a pilot mapping project, so we lcould earn their expectations and perceptions. Any system we chose had to withstand the scrutiny of our foresters and operational managers, in other words, it had to be credible, practical, and cost-effective. They needed more than a broad-brushed, low intensity approach but were unwilling to pay for detail and data that had little impact on typical silvicultural decisions. We asked them to critique our first maps for format, scale and detail. We also learned that our "customers" measure of survey quality is really not the spatial variability of soil properties within a map unit, but rather their level of confidence in site-specific silvicultural interpretations when they use the maps.

A key difference between this project and traditional soil surveys is that some of the qualities of the land we map are outside the scope of existing soil series. Additional characteristics of our special purpose soil mapping units include local geologic parent material, landscape position, soil fertility, understory plant communities, and several key physical properties. Many of these characteristics are integrated by our crop trees over several decades into what foresters often call "site". Some soil series include different types of sites and some sites include different soil series. You may wish to think of them as forestry "phases". Our mappers' goal was to delineate our soil mapping units consistently, accurately and with an awareness of how their maps would be used.

Mapping scale was chosen at 1:7,920 (1 inch = 660 feet) on color infrared aerial photography. A multi-year contract was awarded to a small firm that specializes in forest soil surveys. Soil mapping unit boundaries were initially photo-interpreted, then refined with systematic collection of field data. Plot density varied from 1 plot per 14 acres on pineland to 1 plot per 40 acres on major floodplains. Once I inspected and approved the maps; the lines, labels, and data points were transferred onto large mylar basemaps, then digitized and imported into Westvaco's geographic information system. Standard map products are basic land classification maps (with roads and boundaries) or a simple overlay of the timber inventory layer with land classification.

How do we translate high quality silvicultural basemaps and quantitative mapping unit descriptions into a useful decision support tool? The starting point is to write good, practical descriptions of soil mapping units - descriptions that land managers can understand and use readily. Statistical summaries of all recorded soil descriptions help me explain variation and inclusions. We conduct field reviews that include foresters, researchers, and mappers collating current best knowledge on benchmark soil mapping units. Capturing their accumulated experience into a classification framework strengthens the credibility of the system's management interpretations. It also identifies gaps or weaknesses in from field reviews and the mapping unit descriptions are incorporated into a handbook that supports the maps. Actually, this book is like a customized, expanded version of the Woodlands Suitability section in a county soil survey.

Good, hard copy maps and written handbooks can take land classification a long way, however today's technology provides us a new tool to make this information even more useful. Geographic information systems can enhance the utility and flexibility of landscape level information, provided one's system is properly constructed and user-friendly. It also has allowed me to manage a very large and detailed mapping legend. For example, on a forest District of 75,000 acres, there are typically around 60 to 70 unique soil mapping units. The total legend across our nine county ownership of 500,000 acres will be around 300 to 350 mapping units. The beauty of GIS is that it allows me to simplify this detail at the interpretive stage rather than blunting the accuracy of the field mapping. The next sequence of slides will show you the construction and application of the land classification layer in our multi - layer GIS decision support system.

These are some of the most common applications of our land classification system, which is about 85% complete in South Carolina. We anticipate significant macro - scale benefits when the entire landbase is complete; such as strategic predictions of equipment operability and improved precision of timber inventory. In addition, our wildlife biologists find these maps to be helpful when designating areas as streamside buffers, wildlife travel corridors, or special habitat areas. This landscape layer in Westvaco's GIS system ensures that our forest managers understand the "anatomy" of our timberlands in a time when more decisions are being made by fewer people farther from the woods.

I am quite proud of our land classification system, not just because of its accuracy and detail, but mainly because it has been accepted by our operating personnel - who are taking it from an initial cost and turning it into a bottom line benefit.

Thank you for your attention.

WETLAND ISSUES

The President signed the 1996 farm bill on April 4, 1996. Although there are many parts of the bill, the following are the parts that affect wetlands:

Wetland Conservation (Swampbuster)
The 1996 Farm Bill makes several policy changes to the Swampbuster and wetland conservation provisions of the 1985 and 1990 Farm Bills.

1. The Bill expands areas where mitigation can be used and what type of land can be mitigated. Individuals can now work with other producers, conservation districts, or other relevant entities to select the best area for mitigating wetland values and functions

2. Provides more options for mitigation. The change allows mitigation to occur through restoration, enhancement, or creation as long as wetland functions and values are maintained.

3. Speeds up the time on "minimal effect" determinations.

4. Stipulates that wetland conservation activities, authorized by a permit issued under section 404 of the Clean Water Act, which make agriculture production possible, will be accepted for Farm Bill purposes if they are adequately mitigated.

5. Revises the concept of "abandonment" to ensure that as long as land is used for agriculture, a certified Prior Converted (PC) wetland designation remains in effect (once a PC, always a PC). When done under a plan, landowners with Farmed Wetlands (FW) and Farmed Wetlands Pasture (FWP) can allow an area to revert to wetland status, and convert it back to a FW or FWP without violating the Swampbuster provision. In addition:

Wetland determinations must be certified by NRCS.

Previous wetland determinations will be certified to verify the accuracy of the determinations.

A certified wetland determination will remain in effect as long as the land is used for agricultural purposes or until such time the owner or operator affected by the determination requests a review from the Secretary.

6. Provides the Secretary discretion, under the good faith

provisions, in waving penalties for ineligibility and in granting time to restore converted wetlands.

7. Provides the Secretary with authority to identify for individual producers which programs are affected by Swampbuster violations and the amount of penalty to be assessed.

8. Establishes a pilot program for wetland mitigation banking. Allows USDA to assess how well mitigation banking works for agriculture.

Wetlands Reserve Program (WRP)

The WRP is extended through 2002 with an enrollment cap of 975,000 acres. Program changes provide greater flexibility and assist landowners in working toward a goal of no net loss of wetlands. The revised WRP:

1. Requires that, beginning October 1, 1996, one-third of total program acres be enrolled in permanent easements, one-third in 30-year easements, and one-third in restoration only cost-share agreements. Individuals can choose the type of category for their eligible land.

2. Stipulates that effective October 1, 1996, no new permanent easements can be enrolled until at least 75,000 acres of temporary easements have entered the program.

3. Provides landowners with 75%-100% cost-sharing for permanent easements; and 50%-75% for 30-year easements, and 50%-75% for restoration only cost-share agreements. Cost-sharing is to help pay the costs of restoration practices.

WETLANDS MEMORANDUM OF AGREEMENT (MOA)

The Farm Bill expands the definition of agricultural land contained in the interagency Wetlands MOA to include not only cropland and pastureland, but also rangeland, native pastureland, other land used for livestock production, and tree farms.

OTHER PARTS OF THE BILL INCLUDE:

Conservation Reserve Program is extended through 2002 with a limit of 36.4 million acres at any one time.

Environmental Quality Incentives Program (EQIP) - A new program that combines the functions of the Agricultural Conservation Program, Water Quality Incentives Program, Great Plains Conservation Program, and the Colorado River Basin Salinity Control Program. EQIP is funded at $130 million in FY 1996 and $200 million annually afler that.

TRAINING

Under the MLRA Concept

Prepared for the

Southern Regional
Soil Survey
Work Planning Conference

by
Earl Lockridge
Training Coordinator
Soils Division

CHARLESTON, SOUTH CAROLINA
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STRATEGIC ISSUE 4: PROVIDE A HIGHLY SKILLED, PROFESSIONAL, DIVERSIFIED CADRE OF SOIL SCIENTISTS AND SUPPORT STAFFS CAPABLE OF PRODUCING AND DELIVERING SOIL INFORMATION TO MEET AGENCY AND NATIONAL NEEDS

OBJECTIVE A: **Proactively bridge the gap between soil survey information (data) and the customer (soil data user).**

Where are we now: **Have soil expertise dedicated primarily to the conduct of soil survey, and a few assigned to provide technical services to users of soil information.**

Where we want to be: **Have individuals in many different positions within the NRCS who have soil expertise and the ability to use the soil information in solving resource problems.**

What are we doing to get to where we want to be:

1. **Providing soil survey funds to support a limited number of technical services soil scientists.**
2. **Working with agency personnel staff to provide opportunities for individuals to maintain their 470 job series in non-soil scientist jobs.**
3. **Reinvent the soil survey program structure to more efficiently and effectively manage soil survey project activities on an MLRA basis and provide technical soil services through the agency's state structure.**

How are we measuring our progress: **Through the agency reinvention schedule,**

OBJECTIVE B: Actively integrate soil survey expertise into and develop linkages with NRCS programs.

Where we are now: The division provides assistance to other programs and divisions when they need help in understanding and applying soil information.

Where we want to be: Each division and program to have staff who understand and can effectively use soil information,

What we are doing to get to where we want to be: Encouraging other divisions and programs to place soil scientists on their staffs to provide them with the capability of using and understanding soil information. Currently soil expertise is available on wetlands mapping staff, ecological sciences staff, with EPA on Ag and Forestry EMAP projects, and with Fish and Wildlife Service Wetlands staff,

How are we measuring progress: Through the agency reinvention schedule

OBJECTIVE C: Provide soil scientists to assist in the use of soil survey information who are skilled in the science of recognizing, mapping, and explaining soil and its relationship in the landscape.

Where we are now: Most soil scientists have had experience in mapping and understanding soil-landscape relationships, but with fewer surveys starting this expertise is not provided to all.

Where we want to be: Well qualified soil scientists with mapping and soil landscape expertise using soil information to solve resource problems.

What we are doing to get to where we want to be: Establish a Model interface team to:

1. Provide soil data consulting services to model developers and users.
2. Develop contacts with ARS and CSRS modelers and ensure relevant soil data is available and used to develop and test natural resource models.
3. Develop strategies and recommendation for providing soil data to modelers and make project and action recommendations to the steering team.

How we are measuring our progress:

1. Following Model Interface Team action register:
   - Mar 95 - Develop and review (KSAT) database
   - Mar 95 - Complete long range plan
   - Jun 95 - Develop ARS and CSRS liaisons
2. Have soil scientists report number of cooperators and numbers of groups assisted.

OBJECTIVE D: Promote the development of teams for solving resource problems and developing program alternatives and provide soil scientist expertise in support of those items.

Where we are now: Initial teams formed at the National Soil Survey Center to provide expertise in a limited number ofprogrammatic areas.

Where we want to be: Three extra program staff for the NRCS field to National Headquarters working on multi-agency, multi-functional teams to develop and provide soil information and to aid in its use.

What are we doing to get to where we want to be:

1. Establish National Soil Survey Interpretations Team to:
   - Develop standards, guidelines, and procedures for soil survey interpretations and soil performance.
   - To review, maintain, and provide guidance on standard and ancillary interpretation and soil performance rating guides, data elements, site features, and climatic data used to develop soil behavior and performance ratings.
   - Recommend establishing teams for specific assignments to the steering team.
   - Review standards, guidelines, procedures, and rating guides developed.
   - Ensure coordination of soil data elements, site features, climatic data, soil survey performance data and interpretations.
   - Provide quality assurance review of soil data elements, site features, and climatic data used in soil interpretation and performance rating guides.
2. Regional NRCS offices being established to evaluate resource needs and status on a broad basis.

How we are measuring our progress: Following team schedules and NRCS reorganization plans.

OBJECTIVE E: **Fulfill the role of international leaders in soil survey and the use of soil survey information.**

Where we are now: The agency responds to requests for assistance through the State Department of through the USDA Office of International Conservation and Development. Soil Management Support Services is supported by the Soils Division. It is funded through the State Department as a part of the Soil Management Collaborative Research Support Program.

Where we want to be: Have legislated authority and program funding dedicated to addressing the soil survey needs of the developing countries.

What are we doing to get to where we want to be:

1. SMSS has developed a proposed "New Agenda" that details collaborative research with host-country research entities.
2. Providing a pool of soil management specialists as resources for USAID.
3. Providing direct support to USAID Missions in areas of project assessment, special services, and specialized in-country activities such as training and workshops.
4. Developing and providing global information, databases, and expertise for U.S. and other country researchers.
5. NRCS is developing an initiative to obtain some international program authority.

How are we measuring our progress: USAID and host country program evaluations.

OBJECTIVE F: Develop a soil scientist training program that recognizes new and emerging technologies and issues, such as soil and water quality and computer modeling, and provide training for other disciplines both inside and outside NRCS in effective use and interpretations of soil information.

Where we are now: Training is provided for Soil Survey Techniques, however, the applications of data collected are not addressed.

Where we want to be: Have a core curriculum of training to develop soil scientists in soil survey and in the applications of soil information to solve resource problems. Training should also be developed to help the users of soil information to better understand and apply that information in solving resource problems.

What we are doing to get to where we want to be:

1. Two courses in the application of soil information (Soil Technology) are being developed and will be piloted in FY-96.
2. Established a training committee to identify training needs and recommend training strategies and set training priorities for NRCS and it NCSS partners.
3. Soil Correlation and Basic Soil Survey - Field and Lab courses are being updated.
4. Developing a "Advanced Hydric Soils for Soil Scientists" course to be taught as workshops in FY-96.

How we are measuring our progress:

1. Report numbers of individuals trained to provide special assistance in solving resource problems with soil data.
2. Report number of FPPA requests serviced.

TRAINING DATES FOR FISCAL YEAR 1996

COURSE	DATES	LOCATION
Soil Correlation	4/22-26/96	Lincoln, NE
Basic Soil Survey	5/6-17/96	Lincoln, NE
Soil Technology - Measurement and Data Evaluation	7/22-26/96	Sullivan, MO
Soil Technology - Measurement and Data Evaluation	8/5-9/96	Sullivan, MO
Soil Technology - Programs and Application	Canceled	
Soil Science Institute	2/19-3/17/96	Raleigh, NC

CURRENT TRAINING BEING SUPPORTED BY SOILS DIVISION

Formal Courses:

Basic Soil Survey - Field and Lab (2-weeks)
Soil Correlation (1 week)
Soil Science Institute (4 weeks)(contracted to a university [i.e. North Carolina State University])
Soil Technology - Measurement and Data Evaluation
Soil Technology - Programs and Application

Informal Training:

Workshops
- Map Compilation
- NASIS
- Soil Survey Manuscripts
- Advanced Hydric Soils for Soil Scientists (approved as a formal NEDS course in FY-97)
- Field Training on Soil Descriptions

State/MO Meetings

On-the-Job Training:

Details of State and Field Staff to NSSC/NHQ
Field Visits
- Soil Survey Manuscript Review
- Soil Description (Pedon)
- Map Compilation/Digitizing
- Project Management
- Map Unit Design Techniques
- Quality Control Techniques

Soil Survey Laboratory Sampling Techniques

Other Training:

Graduate Studies
Tours (International)
Foreign Assignments

Training Under the MLRA Concept

Following are some musings about what I see as being the direction of training in next few years and a bit about what kinds ofactivities are currently being conducted.

As I see training under the MLRA concept, I really don't see the kinds oftraining that have been taught in the past as changing all that much. That is, we will still present on an as needed basis the courses we are currently presenting. What will be different is the way we will present the training and the locations where the training will be held. 1 can see a real need to bring the training to the students. Shrinking budgets as well as the need to regionalize the training materials both as to scope as well as application.

The use of alternative training techniques will likely become more prevalent. Techniques such as Satellite training, Modular training, Use of CD-ROM as a presentation medium, use of video with workbooks in self-paced sessions, use of the Internet, and many others. Each of these has potential to deliver training to students at a more economical rate and in a form that still enables the student to interact with the trainer in one way or another.

The Soils Division in cooperation with the National Educational Development Center will continue to develop new training courses as the need arises. It will be imperative that each of you help us keep a finger on the pulse of the soil survey program to enable us to move in the right directions in this training effort

It is our goal to have a Cadre of trainers for each of our courses. This will enable us to maintain consistency in the material we present as well as ensure the expertise of the Agency is available to help train our less experienced soil scientists.

The Soils Division has established a Training Committee to oversee current and future training issues. The Committee met April 1-3, 1996 in Lincoln, NE. There were two major goals. (I) To develop a Core Curriculum which can be used by our employees to guide their career development. We made good progress on this task and have made recommendations to the keeper of the Training Information System regarding this curriculum. You will be seeing this in the next few months. (2) To develop a method for acquiring information from states, MOs, and project offices about current and future training needs. We have a draft worksheet which we are proposing to use in gathering this information.

The Soils Division has also assigned a soil scientist to facilitate efforts in training being provided in the area of Technical Soil Services. This soil scientist is LeaAnn Pytlik. LeaAnn is located at the NSSC and is currently working on formulating a strategy for gathering training information from across the nation. One of the proposed strategies is to make this information available to all states in a format which can be easily accessed for ideas and for acquiring professionally developed training materials. If you have any training materials you are currently using to train users of soil information (i.e. District Conservationists, Soil Conservationists, Technicians, other customers outside our Agency, etc.) and would be willing to share those with other soil scientists across the nation, please give LeaAnn a call at the NSSC. The number is in the new Directory which was recently distributed.

South Region Soil Survey Work Planning Conference
Charleston, SC, April 15-19, 1996
Field Trip

The tour looked at soils and wild life management on the low country Coastl Plain- Pamlico Terrace. The soils were all wet soils, some qualify for hydric soils and in some the water table was too deep to qualify as a hydric soil. Soils in each of the sites had sandy layers. some of the sites had horizons with more clay and some of the sites had spodic Bh horizons. In my estimation and observation the relatively clayey layers were primarily sedimentary; I could not find any convincing evidende of argillation. The relatively clayey layers were all wet (satiated to saturated); They should be examined after drying to confirm presence or absence of clay argillans. The soils without spodic horizons and one of the soils witha spodic horizon had red oxymorphic concentrations in the sandy layers above the relatively clayey layor or the spodic horizon. In general these concentrations had the color appearance of lepidocrocite which is consistent with oxidation associated with organic matter. In some cases the oxymorphic Fe was more disseminated in smaller segregations as if that were the upper limit of a fluctuating water table (S96SC-19-3). The spodic soils were in a landscape sequence with the thicker, firmer Bh horizon on the edge of a flat landform and the less developed spodic on the flat, perhaps slightly convex surface. Water table appeared lower in the center and the profile had oxymorphic Fe segregations sandy E layers above the Bh The site on the edge was wetter; the E horizons above the spodic did not have oxymorphic segregations of Fe.

SOIL QUALITY INSTITUTE
Maurice J. Mausbach
Prepared for
Southern Soil Survey Work Planning Conference
Charleston, South Carolina
April 15-19, 1996

INTRODUCTION

Thank you for inviting me to your work planning conference and to be part of this panel discussion on institutes. Yesterday I discussed the structure and functions of the Science and Technology Consortium (STC) of which the institutes are a part. Today, I will concentrate on the soil quality institute and a major project that we are working on with other partners in the STC.

Perhaps more than any one document or source the National Research Council (NRC) book entitled ***"Soil and Wafer Quality: An agenda for Agriculture"*** has raised the awareness of the importance of soil quality to the environment, agriculture, and the quality of life for future generations. The writers state that:

> *Protecting **soil quality, like** protecting **air and water quality,** should be a fundamental goal of **national** policy.*

The authors go on to state that soil and water quality are inherently linked and that protecting soil quality is the first step in protecting water quality. The NRC listed many challenges among which were the need to quantitatively define soil quality, to develop measurement and assessment tools, and to develop a monitoring system to track trends in the quality of the nation's soil resources. The authors of the report expressed concern that policies oriented to controlling erosion and maintaining productivity are too narrow and must be expanded to other aspects of soil such as salinity, compaction, acidification, and loss of biological activity.

Why did the NRCS establish a soil quality institute? One of the main reasons is that soil quality, soil condition, soil landscape integrity, and soil-plant interactions are essential considerations for the application of holistic-based assistance to the mission of the Natural Resources Conservation Service (NRCS). Soil Quality adds meaning to the NRCS vision, ***"aproductive nation in harmony with a quality environment,"*** In addition, the NRCS, together with its partners, has three areas of expertise that provide a foundation for the development of the Soil Quality Institute (SQI):

(1) The National Cooperative Soil Survey Program provides the basic information on soil properties/interpretations, soil-landscape relationships, and geographic distribution of soils at three scales (SSURGO, STATSGO, NATSGO) as a base for evaluating soil quality;

(2) The National Resources Inventory provides the statistical sample basis for monitoring and assessing the state of the nation's soil resource and a database of previous assessments (trends) of soil quality. NRCS staff at all levels provide the expertise for conducting the assessment; and

(3) The technical assistance delivery system for private sector land managers is the most extensive in the Federal Government. This is accomplished by over 60 years of partnerships with Conservation District and experience in providing assistance to private land owners and operators on the protection of the soil resource.

SOIL QUALITY INSTITUTE

The Soil Quality Institute (SQI) was designed after consultation with individuals from potential partnering agencies including the Agriculture Research Service, Forest Service, Environmental Protection Agency, Universities, and NRCS staff. We contacted all of the 1860 and 1890 Land Grant Universities by letter to obtain their suggestions for developing the institute and to inquire about their research activities with respect to soil quality. We also worked with a team of about 15 NRCS individuals to develop the mission and function statements of the institute.

The soil quality institute is small with a total of 6 scientists at three locations. The staff was finally completed in mid February 1996. The staff includes:

- Maurice **J.** Mausbach, Director - Located at the National Soil Tilth Laboratory, Ames, IA. In addition to administrative and leadership responsibilities, I will function as a pedologist working with Agricultural Research Service (ARS) scientists, collaborate with the others in the STC on developing a system to monitor soil quality over time, and develop technical tools on soil quality for NRCS **field** staff.
- **Debra Hendriks,** GIS specialist - Located at the National Soil Tilth Laboratory, Ames, IA. Debra is a geologist who will utilize existing geographical information including soil survey to develop tools for evaluating soil and related resources concerns on a watershed basis.
- **Arlene Tugel,** Soil Scientist - Located with the Crops and Soil Science Department, Oregon State University, Corvallis, OR. Arlene will address landscape issues concerning soil quality and will work on the biological aspects of soil quality for western systems.
- **Cathy Seybold,** Soil Scientist - Located with the Crops and Soil Science Department, Oregon State University, Corvallis, OR. Cathy has a background in chemical movement in soils and will concentrate on the use of models in developing soil quality assessment tools.
- M. Lee Norfleet, Soil Scientist - Located at the National Soil Dynamics Laboratory, Auburn, AL. Lee will work on soil quality concerns, indicators and technical tools for soils in the southeastern U.S.
- **Mike Hubbs,** Agronomist - Located at the National Soil Dynamics Laboratory, Auburn, AL. Mike will develop tools for evaluating the effects of conservation and cropping systems on the quality of soil and related resources and the use of models in projecting the effects of conservation systems on soil quality.

The Soil Quality Institute will provide leadership in soil quality; build partnerships; and acquire, develop and transfer technology and information. We are focusing on issues that have national and multi-state applicability and are relevant to the field. We will seek out emerging technologies for future incorporation into the NRCS program. These technologies will be developed for multiple scales including on-site, watershed, and ecosystem/regional/national levels. Our shared vision, **"Soil quality as the foundation of a productive nation in harmony with a quality environment"** leads us to look at soil quality in the broadest sense possible.

The mission of the soil quality institute is:

> Cooperate with partners in the development, acquisition, and dissemination of soil quality information and technology to help people conserve and sustain our natural resources and the environment.

We have developed a business plan centered on the following initiatives for 1996:

1. Collaborate with other institutes, centers, NRCS employees, agencies and the research community on soil quality.
2. Determine customer needs and solicit feedback on our products.
3. Develop science-based tools and guidelines for assessing, inventorying, and monitoring soil quality (NRI, CTA, NCSS, etc. programs) at scales that include on-site (on-farm), watershed, and ecosystem/regional/national levels.
4. Develop resource management approaches that address the interaction of soil with other resources including water, air, plants, animals, and humans, and include cumulative impacts.
5. Enhance customer awareness of the importance of a healthy soil resource base.

These initiatives have been developed through feedback received at the soil quality and watershed science planning meeting at St. Louis last November. At this meeting, we received feedback from all levels in the NRCS and partners on products and assistance needed from the institutes. We have identified the following major products for this year:

- Initiate a soil quality/National Resources Inventory pilot study at various areas in the U.S.
- Review the literature on soil quality and provide an annotated list and summary of the literature to the field staff.
- Test the soil health kit developed by John Doran and the field methods of Bob Grossman with interested field staff.
- Develop educational materials on soil quality such as a primer on soil biology.
- Began developing tools to assess the effects of management systems on soil quality using the conservation practice physical effects (CPPE) matrix in the Field Office Technical Guide.

Most of the preceding information is available on our home page. You can access our home page either from the agency home page (http://www.ncg.nrcs.usda.gov/) or directly at:

http://www.statlab.iastate.edu:80/survey/SQI/sqihome.html

PILOT STUDY - SOIL QUALITY/NATIONAL RESOURCES INVENTORY

The pilot study will evaluate soil quality measurements and interpretive indices using the scientific, spatial framework of the National Resources Inventory (NRI) sample database. The goal of the pilot project is to test the feasibility of sampling soils and measuring soil quality indicators at points within the NRI sampling framework. This includes development and evaluation of necessary protocols to monitor the status and changes in soil quality as a result of various land uses; and the development of a framework to assess soil quality and interpret the results. The pilot project evaluates a national application and adaptation of current research on indicators of soil quality.

Specific objectives are:

1. Test operational aspects, such as:
   - Soil quality indicators, their scope and applicability to the sample frame
   - Sampling design for estimation of soil quality indices over large areas
   - Plot design for soil quality measurements
   - Resource allocations necessary to incorporate soil quality measurements in NRI (personnel, equipment, laboratory, and budget requirements)
2. Develop a framework and process for interpreting the data to include:
   - Area wide interpretation of data by using the MLRA approach
   - Soil specific interpretation by testing a benchmark soil approach
   - Soil quality indices of soil quality
   - Application of interpretative models such as EPIC or CENTURY for projecting future trends from existing data and data collected at soil quality measurement sites
   - Assessment of seasonal variability of indicators
   - Assessment of within site variability of indicators
3. Develop a long-range plan for assessing and measuring soil quality in future NRI's and related resource inventories.
4. Develop interagency partnerships for measuring long term trends in soil quality.
5. Prepare prototype report

Scope:

The pilot study will be conducted in four Major Land Resource areas (MLRA's) of the country. Sampled MLRA's represent various major land uses, soils, and conservation and farming systems. The study in 1996 has two general approaches:

1. MLRA Wide Assessment of soil quality. Results will be interpreted by summarizing the effects of land use and conservation and farming systems over all soils in the MLRA. Approximately 100 Primary Sample Units (PSUs) will be drawn at random to represent each MLRA. This approach will be used in:
   - MLRA 9, The Palouse and Nez Perce Prairies located in eastern Washington and western Idaho
   - MLRA 105 Northern Mississippi Valley Loess Hills - Driftless area, located in northeastern Iowa, southeastern Minnesota, and southwestern Wisconsin

2. Soil Series (benchmark soil) assessment of soil quality. A method to define the effects of land use and conservation and farming systems on the quality of a specific soil series will be assessed. The soil series selected will be representative of a larger group of soils that function similarly so that results for the study can be extended to other similar soils. Up to 100 points that are representative of the specified soil series will be randomly selected. The study areas include:

- MLRA 67, the Central High Plains in Colorado, Wyoming and Nebraska. The Ascalon soil will be used in the study and land use includes irrigated corn, alfalfa, sugar beets, and vegetables, dry land grains, and native short and mid grass range.
- MLRA 77, the Southern High Plains in Texas and Oklahoma. The Amarillo soil will be sampled in the study. The land use is irrigated crops, dry land grains and cotton, and range land.
- Possible additional area is MLRA 136, the Southern Piedmont, Virginia, North Carolina, South Carolina, and Georgia

Methods

The initial sampling scheme includes:

- 100 Primary Sampling Units (PSU) per pilot study area or a total of 400 to 600 PSU's
- 2 points at each PSU will be sampled for a total of 800 to 1200 points. At each point two samples at different depths from the upper 25 cm of the soil will be sampled for a total of 1600 to 2400 soil samples.

The following measurements are planned:

Soil Quality Indicator	Responsible Unit
Root restricting layers	Field Team
Landscape position (site characteristics)	Field Team
Pedon description soil classification	Field Team
Land cover/use	Field Team
Tillage	Field Team
Relative weed density	Field
Weed species present	Field
Conservation/fanning system (residue conditions)	Field
Bulk Density	Field (laboratory - NSSC)
Organic C and N	NSSC/partner laboratories
CEC	NSSC/partner laboratories
Extractable Al and bases	NSSC/partner laboratories
pH	NSSC/partner laboratories
Texture (clay, silt, sand %)	NSSC/partner laboratories
Electrical conductivity, SAR	NSSC/partner laboratories
Aggregate stability	NSTL/Partner laboratories
Potentially Mineralizable N	NSTL/Partner laboratories
Microbial biomass	NSTL/Partner laboratories
Basal resoiration	NSTL/Partner laboratories

Proposed soil quality evaluation framework.

GRAZING LANDS TECHNOLOGY INSTITUTE

RHETT H. JOHNSON
DIRECTOR

FUNCTIONS

The principle functions of the GLTI are the development, enhancement, acquisition, adaptation, coordination, evaluation, and training and delivery of technology for grazing lands. The team will assist and act as liaison with other NRCS institutes, centers of excellence, regional, and state offices; federal and state agencies, scientists, and research institutions; universities; national and regional environmental, conservation and producer groups; and international organizations on grazing land conservation and technology issues.

GRAZING LANDS INSTITUTE MEMBERS

A core group is located in Fort Worth, Texas, with team members located at Oregon State University and with the Aariculture Research Service at Pennsvlvania State University. The following is a king of the team members and their addresses.

Mailing: P.O. Box 6567
Fort Worth, Texas 76115-0567

Phone: 817-334-5232

Deliveries: 501 W. Felix Street, FWFC, Bldg. 23
Fort Worth, TX 76115-3495

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Director
Extension: 3606
VCOM: 965-2175
EMAIL: Rhett_Johnson@glti.ftw.nrcs.usda.gov

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Enterprise Diversification Spec.
Extension: 3622
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PRODUCTS

The GLTI is establishing a communication relationship with the regions as they develop their grazing lands technology coordination and delivery plans. We have been invited to either attend are have input into all of the regional grazing lands strategic planning committee meetings. As these regional teams develop their strategic plans, technology development and product needs are becoming very evident. Some of these technology needs can be met locally. Others will need to be addressed by the GLTI or be a cooperative effort between a region(s) or a state(s) and the GLTI. We see this as a cooperative effort that will be very fruitful to the future of the grazing lands program of the NRCS and the grazing land resources of this nation.

There are a number of products that the Grazing Lands Technology Institute is currently involved in or will be in the near future.

A. National Grazing Lands Handbook
This is a major undertaking on which the entire institute is currently working. The following is a brief summary of major revisions being made to what was the National Range Handbook.

1. The handbook is being revised to include principles and management for all grazing land uses-rangeland, grazed forestland, naturalized pasture, pastureland, **hayland** and grazed cropland.

2. The handbook will contain the technical knowledge base required to understand and operate the Grazing Lands Automation software.

3. Address the revision of **range site descriptions, forest understory descriptions and pasture suitability groups to** reflect new ecosystem technology and the database needs of **GLA**.

   We now have an ongoing effort on this issue that includes the Soil Survey Center, Information Technology Center, Plants **Data** Center, **state** specialist, and the Grazing Lands Technology Institute. This group is currently working out the details on the data base design. These data bases will be developed on the MLRA basis.

4. Develop the technology and provide technical guidance concerning the **Range, Pasture, and Forest Health** issue. We are pursuing this effort at the present and will be conducting a test this summer of the procedures in cooperation with the Soil Duality Institute and the Natural Resources Inventory and Analysis Institute.

5. Expansion of the **Inventory and Monitoring chapter.**

6. Expansion of the Livestock Nutrition, Husbandry and Behavior Chapter.

7. New chapter on Hydrology of Grazing Lands.

8. New chapter on Diversified Uses of Grazing Lands.

9. Rewrite of chapter on Grazing lands Economics to reflect knowledge base required by GLA.

10. New chapter on Grazing Lands Automation.

11. New chapter on Conservation Planning on Grazing Lands. It will include new guidance on Prescribed Grazing that is basic to assisting a land manager to develop a **Grazing Management Plan.** This will provide the technical basis for the forage inventory, livestock inventory and the grazing scheduler in GLA.

The schedule calls for the Handbook Review Draft to be in the hands of state range conservationist, grazing lands specialist, Institutes, Centers, Regional Offices and Divisions by April 20, **1996.** They will have time for a 30 day review. We will prepare a new draft to go back to the same group and to other grazing lands peers (Universities, user groups, etc.) for review. We will then prepare the final for publishing by mid to late **August.**

B. GLA

In order to implement the GLA program across the six regions, each region will have to develop a plan of action. We in the institute cannot train all 50 states and provide the technical assistance to each state specialist on a continuing basis. We propose that each region establish a GLA training team that is responsible for providing the leadership to implement GLA. We will serve as mentors and tutors to this team as they train themselves to become proficient in the program. They then will be responsible for the training program and follow-up technical assistance to those learning the program. The regional team should field all questions from the field. If the regional team has questions, we will provide the needed assistance.

Data base development that are soils interpretations on rangeland, forestland, pastureland and cropland are essential and a major step in the implementation of GLA. Grazing Lands Specialist and Soil Scientist must work together to develop these data bases on the state, MLRA, and local level.

The GLTI will prepare a revised Users Manual, designed to answer more of the questions and provide more complete guidance in use of the program.

C. NEDS Training Courses

Current Courses:

Prescribed Burning- Texas Tech, Oklahoma State, Utah State
Range Ecology- Texas A&M
Plant Herbivore Interactions- Utah State
Working with Livestock Producers- Texas Christian University

New proposed courses:

Pastureland Ecology - North Carolina State University, Dr. Jim Green
Pastureland Dairying - Penn State

Proposed:

Develop a CORE Curriculum for all GS levels of Grazing Lands Specialist. Then develop Tier Level courses that states can use to train their people from new employees through their career development.

Grazing Lands Certification Program.

D. Extension and University Grazing Management Short Courses.

Package all current University and Extension Grazing Management Short Courses and provide the information to states. States can send personnel to these for a tuition.

E. GLTI Training Product8

The GLTI has been requested to develop and publish **a** number of items. We are in the process this year of publishing the following.

1. Pastureland Newsletter for Eastern U.S.
2. 'Economics Made Simple' to assist with GLA
3. Howard Passey "Notes on Range Planning and Application"
4. GLTI Quarterly Newsletter
5. "Pinyon Juniper Ecosystem' publication
6. "How Plants Grow' publication

Tuesday pm Panel Discussion
Wetland Science Institute

Mission: Develop, adapt, and disseminate the science and technology needed to protect and restore wetlands, in support the programs of NRCS and others.

Members of the Institute:
Billy Teels, Director, Laurel, MD
Leander Brown, Wetland Scientist, Laurel, MD
Norman Melvin, Plant Ecologist, Laurel, MD
Michael Whited, Wetland Scientist, Univ. of Nebraska, Lincoln, NE
Russell Pringle, Wetland Soil Scientist, Louisiana State Univ. Baton Rouge, LA
Wetland Hydrologist located in Oxford, MS not selected at this time.

Training Role of the Institute:
- Hydric Soils - 4 courses this year
- Hydrology Tools - 5 courses this year
- HGM (Hydrogeomorphic classification of wetland functions) - one course Prairie pothole region
- Wetland Restoration - 3 courses
- Plant Identification - 4 courses
- Advanced Hydric Soils - 3 classes

Projects:
- Publish the Field Indicators of Hydric Soils in the US.
- HGM Northern Plains regional depressional model.
- Revise and finalize "Hydrology Tools Document"
- Continue to refine and field test MARSH
- Put National List of Hydric Soil Field Indicators on the INTERNET

Technology Development Projects:
Delineation:
- Northeast hydric soil field indicators
- Gulf coast hydric soil field indicators
- Mid-Atlantic hydric soil field indicators
- Computerized hydric soil training
- Investigation into western US playa study

Restoration:
- T&E species habitat improvement - North Carolina
- Plant materials development (mid-Atlantic)

Function/Health Assessment:

- Refine HGM northern plains regional depressional model
- Virginia mitigation study
- Maryland restored wetland reference base

COMMITTEE 1

MLRA SOIL SURVEY OPERATIONS

BACKGROUND: On October 1, 1995 NRCS began implementing a plan to reorganize the National Cooperative Soil Survey (NCSS) based on 17 Major Land Resource Area (MLRA) regions. Some NCSS partners in the South Experiment Station Region have expressed concerns about some of the changes that will take place as a result of soil survey reorganization. These concerns have been expressed by state conservationtist, state soil scientist, State Experiement Station representatives and other federal, state and local partners.

CHARGE:

1. Identify and list the major concerns that NCSS partners currently have related to the reorganization of the NCSS based on MLRA Regions.

2. For each major concern identified, amke a recomendation(s) that if implemented would help to eliminate the expressed concern.

Chairman: Darwin Newton

Vice Chairman: Stan Buol

Members: Charles Cail
Steve Carpenter
Mary Collins
Marc Crouch
Jerry Daigle
Bob Eppinette
Charles Fultz
John Kelley
Michael Lilly
David Pettry
Carroll Pierce
Dean Rector
Carmen Santiago
James Slaybaugh
Alan Terrell
Larry B. Ward
Larry West

COMMITTEE 2

RESEARCH NEEDS

BACKGROUND: Due to reduced budgets and staffing for both the NRCS and its partners in the National Cooperative Soil Survey, it is essential to maximize the impacts of both budget dollars spent and corresponding personnel input. Duplication of research must be eliminated and a well thougM out research agenda must be developed to meet the research needs of the SRSSWPC area.

CHARGE:

1. Inventory existing research.
2. Identify current research that supports the National Cooperative Soil Survey.
3. Determine research needs to support the National Cooperative Soil Survey.
4. Recommend method for disseminating data throughout the region.

Chair: Warren Lynn

Vice Chairman:

Members:
Bob Aherns
John Ammons
Frederick Beinroth
Steve Coleman
Milton Cortez
Everett Emino
R.H. Griffen
C.T. Hallmark
G. Wade Hurt
John Kimble
Dewayne Mays
W. Frank Miller
Dan Neary
J.M. Soileau
Clyde Stahnke
Allan Tiarks
M.J. Vepraskas
Douglas Wysocki

COMMITTEE 3

FUTURE INTERPRETATION NEEDS

BACKGROUND; The demands placed on soil surveys and the interpretations made from them continues to increase. Issues related to wetlands, water quality, nutrient management, and soil quality places emphasis upon the need for reliable soil interpretations. The NCSS is being challenged to meet the current and Mure needs of soil survey customers. Meeting these challenges will require a vision of customer requirements and a strategy for meeting these needs.

CHARGE:

1. Identify new interpretations needed to meet Mure demands.
2. Identify present interpretations that need improvements or modifications to meet the current demands and outline corrections.
3. Identify new research and investigations needed to support the interpretations.

Chairman: Roy Vick

Vice Chairman: James Baker

Members: Debbie Anderson
Charles Batte
Paul Benedict
Randy Brown
Brian Carter
Harry Davis
Edward Ealy
Robert Eigle
Andy Goodwin
Bob Grossman
Warren Henderson
Jim Keys
Dan Manning
Henry Mount
Ken Murphy
Mike Risinger
Bruce Rowland
H. Raymond Sinclair
Ken Watterson
Richard Scharff

COMMITTEE 4

ELECTRONIC SHARING OF PEDON DATA

BACKGROUND: Many cooperators have pedon data that has been collected for multiple purposes. This data is in many different formats and not readily available in most cases. This data would be useful for all cooperators if made available and it could reduce duplication of effort and expenditure of funds. This data needs to be made available to all NCSS cooperators.

CHARGE:

1. Inventory NCSS pedon data bases across the region.

   a. Kind of data
   b. Database format
   c. Compute platforms and operating systems

2. Recommend most feasible method for electronic data sharing.

3. Recommend format for delivery.

Chairman: William E. Edmonds

Vice Chairman: Cam Loerch

Members: Scott Anderson
Bruce Dubee
Richard Fielder
Andy Goodwin
David Kriz
Kenneth Lawrence
Paul Martin
David McMillen
Fred Minzenmayer
Vivian Owens
Tommie Parham
Rodney Peters
Gerald Sample
Bruce Stonernan
Phillip Tant

COMMITTEE 5

FUTURE OF THE SOUTH REGIONAL WORK PLANNING CONFERENCE

BACKGROUND: Many of the NCSS Cooperating Partners have undergone major restructuring and reorganization over the past few years that may impact the future of the SRSSWPC. This restructuring and reorganization has created a need for the cooperators to address the following charges.

CHARGE:

1. Recommend functions of future conference.
2. Recommend makeup of Steering Committee.
3. Recommend conference participants.
4. Recommend conference framework and fellow up.
5. Revise By-Laws

Chairman: Craig Ditzler

Vice Chairman: Larry Wilding

Members: Sam Brown
William Craddock
Jimmy Ford
Wayne Gabriel
B.L. Harris
Wayne Hudnall
David Jone
H.J. Kliess
Conrad Neitsch
Jerry Ragus
E. Moye Rutledge
Horace Smith
Ben Stuckey
Larry Ward

Draft Work Plan for
Developing a Common Spatial Framework of Ecological Units for the United States

Sharon W. Waltman
USDA-NRCS-National Soil Survey Center
Lincoln, NE

Introduction

NRCS, USFS, BLM, USEPA, and USGS collaboration on the topic of Interagency Ecological Mapping represents a 2 1/2 year effort. Since 9/93,

1. Minimizing Redundancy
   - According to OMB Circular A-16, which established the Federal Geographic Data Committee (FGDC), Federal data stewards are encouraged to work cooperatively to build their respective geographic databases which are bound together by corporate data dictionaries to facilitate effective use of Federally funded data. This effort goes a step beyond Circular A-16, by allowing existing data stewards and their state partners to contribute their collective skills and knowledge to create a common framework with joint ownership that can be an effective indexing tool to access FGDC data sets through the National Spatial Data Infrastructure (NSDI) and National Information Infrastructure (NII) largely known as the Internet.
   - NSDI is mandated in Executive Order 12906, April 11, 1994 (Coordinating Geographic Data Acquisition and Access: The National Spatial Data Infrastructure (NSDI). This Order requires the consultation of the NSDI prior to expending Federal resources to create new geographic data, thereby reducing further unknowing redundancy in effort. Policy makers could view the separate and independent development of FS Ecological Units, NRCS MLRA/LRU (Land Resource Units), and USEPA Ecoregions as competing and redundant efforts. At the present FGDC recognizes only the digital MLRA (as NATSGO) as a Soil Geographic Data Base with NRCS as the Data Steward). This collaborative effort removes the possible criticism of redundancy in data development.
   - Specific examples:
     - Provide an integration of diverse skills using a common process and data base, linking many resources
     - More efficiently collect, use, store, retrieve, maintain, re-cycle, organize, and share digital data
     - Reduce duplication of efforts spent on data gathering, inventory, analysis, research, reporting, monitoring, etc
     - More effectively coordinate the characterization of land, water, and social-economic values
     - Show that many agencies can work together to support local communities in developing a common spatial framework of integrated resource information based upon ecological potentials
2. Budget:
   - Report to Congress on projects/expenditures involving issues of regional/national controversy, preventative or remediating work on catastrophic events (wildfires, floods, unhealthy land conditions, and others)
   - Screen projects on a broad scale for cost effectiveness, public safety and resource needs; and Provide a common stratification of landscapes according to potentials to respond to treatments or remediation
3. Existing Programs that benefit:
   - Index for NSDI (National Spatial Data Infrastructure)
   - Framework for summarized GAP (NBS) Analysis
   - Framework for NAWQA (USGS-water quality) data
   - Framework for combined NRI (NRCS-National Resource Inventory), FIA (FS-Forest Inventory Assessment), and EMAP (USEPA) National and Regional Interagency Assessments
   - Reporting units for "State of the Environment" Report by NBS
   - Interagency product for new release of the "National Atlas (digital) by USGS" planned for 1998
   - NASA - Mission to Planet Earth educational programs
   - US Global Change Research Projects
   - Reporting units for BLM "Land Health" and other land status reporting
   - Salinity Research and Remediation

- Correlation of Technical Guides across the Nation (NRCS Field Office Technical Guide)
- Natural framework for presentation of Research Findings and Funding Evaluation

Agency Protocols and Source Data Sets

The MOU identifies a 3 tiered structure within which this work will occur. At the NHQ level, a National Interagency Steering Team (NISI') is made up of "inside the beltway" agency representatives. Also at the national level, a National Interagency Technical Team (NITT) is made up of agency representatives from many locations from across the nation At the state or regional level, a body of State/Regional Coordinators (S/RC-principally scientists involved in mapping) who contribute to the product and provide the state-wide forum for its review by all interested groups.

Existing NRCS, FS, and USEPA mapping protocols were examined by S/RC representatives during 3/95 and recommendations made to the NITT. NITT is developing a common mapping protocol and process for ecological mapping at the 1:1,000,000 scale. A common set of "primary" source data have been identified: STATSGO (State Soil Geographic Data Base-NRCS), AVHRR-NDVI Land Cover Characteristics (USGS), 500 meter DEM for 48 states (USGS), LJSEPA Ecoregion/subregions - Level III/IV, USFS Ecoregions-sections/subsections, MLRA from STATSGO (NRCS), B-digit Hydrologic Units (USGS), Potential Natural Vegetation (Kuchler), various surficial and bedrock geology data, various spatial climate summaries (NRCS), cultural information, and other references.

The 5 year project plan for the Interagency Ecological Unit mapping, identifies a short term goal for creation of a Common Spatial Framework of Ecological Units map product (first approximation) for the U.S. at a 1,000,000 scale with brief narrative map unit descriptions in FY '96; an equivalent digital product (second approximation meeting FGDC standards) will be created in FY'97; and the publication of this product (hard copy-1:3,500,000 map/booklet; digital map and tabular data base-CD/ROM or Internet accessible) in FY'98. The long term goal is the creation of a Common (hierarchical) Spatial Framework of Ecological Units map product for the U.S. with the most detailed levels mapped at a 1:250,000 scale with narrative map unit descriptions by the year 2000.

All products bear member agency seals and version. Ownership is assumed to be joint among all members. NIST/NITT should contact FGDC Secretariat for recognition and support of the Common Spatial Framework of Ecological Units of the U.S. effort.

Short Term Work Plan

The Short Term Work Plan contains four basic steps:

1. **Creation of "first draft delineations"**
   "Core" NITT members (one per agency) combine FS Subsection, NRCS MLRA's from STATSGO, and USEPA's level III and IV Ecoregions to create a "first draft" set of delineations and identify "gray areas" that reyuire further study by State or Regional Coordinators for the Common Framework 1:1M scale product.
2. **Review of "first draft delineations"**
   "First draft" hardcopy is sent to interagency field offices (regional and state offices) for local review and comment. This is done as an interagency team, rather than in independent agency reviews.
3. **Creation of first approximation (digital) and peer review**
   NITT core team develops the First Approximation (digital) by consensus from review recommendations for digital 1:1M data with brief descriptions and attribute data base and present it as poster/map at 1:3.5M scale. Seek peer review (University community). NITT incorporate review recommendations.
4. **Publication of 1:3.5M map and descriptions**
   NITT and NIST publish 1:3.5M map in hardcopy and on CD-ROM and follow with professional journal article (Journal of SWCS, Conservation Biology, Terrestrial Ecosystems, etc.)

Each of these four steps is broken down into:

1. Skills or who will do the work
2. Process
3. Timeframe (staff time and calendar time)
4. costs

Step 1 - Creation of "first draft delineations"

1. Skills or who will do the work
   8 member core team from NITT, and support specialists
   - Jim Keys - USFS
   - Sharon W. Waltman - NRCS
   - Steve Gregonis - BLM
   - Jim Omernik - USEPA
   - Mark Shasby - USGS
   - ?? - NBS
   - ?? - NPS
   - ?? - F&WS

2. Process

-organize interagency review teams (S/R Coordinators)
-pull maps together - identify source maps
-develop tile framework for lower 48 states (Waltman & Keys)
-prepare source maps at 1:1M scale
EPA level III/IV (Omernik and Shasby)
FS subsection (Keys)
MLRA from STATSGO (Waltman)
Analytical Hillshade 500m or 1000m DEM (Keys & Waltman)
Hydrography 1:2M DLG, with water bodies (Keys)
AVHRR-NDVI (1990?) (Shasby)
PNV Kuchler (Keys)
(Product - 10 copies of each source map (18 tiles each) on 5 mil double matte mylar and digital files to each NITT member; production will be at one location - USFS Atlanta Geometronics - Omernik, Waltman and Shasby should send ARC covers to Keys)
-identify "gray" areas - gather documents and questions
-produce "first draft" - pencil on mylar with decisions and source units documented
-manually digitize or scan to capture in digital form

3. Timeframe (staff time and calendar time)

-organize S/RC Teams through NRCS MO leaders (under the guidance of NRCS Regional Office Partnership Liaisons)		2/96-4/96
-map preparation,		1/96-3/96
-pre-work		4/96-5/96
30 days x 8 NITT members	= 240 staff days	
30 days x 2 USFS people	= 60 staff days	
-identify "gray" areas, make 1 map from 3		6/96
20 days x 8 NITT members	= 160 staff days	
-digitize "first draft" delineations		7/96-8/96
10 days x 2 USFS people)	= 20 staff days	
Total staff days	**= 480**	

4. costs

-map plotting materials (mylar)	$ 7,000
-travel for summit meeting (8x$1500)	$12,000
Total Costs	**$19,000**

Step 2 - Review **of "first draft delineations"**

1. Skills or who will do the work

Regional and State Coordinators

-NRCS MO leaders (under guidance from NRCS Regional Offices) will take lead in scheduling Interagency/Interdisciplinary meetings through the State Soil Scientist or other designated NRCS state level representative.

-The following MO to state relationship is proposed as a starting point for the purpose of scheduling state-wide meetings where review of "first draft" delineations takes place.

MO1	Portland, OR	WA,OR
MO2	Davis, CA	CA
MO3	Reno, NV	NV,UT
MO4	Bozeman, MT	MT,ID
MO5	Salina, KS	NE, KS
MO6	Lakewood, CO	WY,CO
MO7	Bismarck, ND	ND,SD
MO8	Phoenix, AZ	AZ,NM
MO9	Temple, TX	TX, OK
MO10	St. Paul, MN	MN,IA,WI
MO11	Indianapolis, IN	MI,IL,IN,OH
MO12	Amherst, MA	ME,VT,NH,MA,CT,RI,NY
MO13	Morgantown, WV	PA,WV,KY,TN
MO14	Raleigh, NC	NJ,MD,DE,VA,NC,SC,GA
MO15	Auburn, AL	MS,AL,FL
MO16	Little Rock, AR	MO,AR,LA

-A list of state and regional contacts for NRCS, BLM, USFS, and USEPA has been assembled to facilitate the coordination of meeting attendees, places and times. Member agencies are encouraged to contribute meeting facilities.

2. Process

-In the interagency S/R Coordinator meetings (these are recommended to be state-wide/area with state agency, University, and NGO partners invited) the NITT seeks the review of the "first draft" map delineations, descriptions, and attribute tables.

-The review process will be detailed in another document, but basics are given here:

Reconcile areas where delineations are uncertain (flagged as "gray" areas by NITT)

Evaluate usefulness of "first draft" product

Edit/modify names and/or descriptions

Add additional references (documenting decisions relating to spatial and attribute data, etc.) as basis for suggested changes.

3. Timeframe (staff time and calendar time)

State Coordinator review process 6/96-8/96

(8) S/RC's x 10 days x 48 states = 3840 staff days

Regional coordination and correlation

(16) MO leaders (NRCS) x 20 days = 320 staff days

Total Staff Days = 4160

4. Costs

-Travel to underwrite interagency state-wide meetings

$1000 x 48 states = $48,000

Total Costs = $48,000

Step 3 - Creation of first approximation (digital) and peer review

1. Skills or who will do the work

Core NITT members

2. Process

-NITT meets and consolidates review comments from S/R Coordinator meetings. Delineation symbols, names, and brief distinguishing characteristics statement are finalized and digital edits made to "first draft" copy.

3. Timeframe (staff time and calendar time)

-Consideration process 8/96-9/96

10 days x 8 NITT members = 80 staff days

Total Staff Days = **80**

4. costs

8 NITT members x $1500 = $12,000

Total Costs = $12,000

Step 4 - Publication of 1:3.5M map and descriptions

1. Skills or who will do the work
   -NIST will **provide** resources to cover publication costs and secure agency approvals for publication release
   -NITT will handle publication details and draft manuscript for journal article
   -University "Blue Ribbon Panel" (assembled by NIST) will conduct peer review of map, descriptions, and journal article

2. Process
   -Publication negative preparation (map with collar and descriptive legend) will be prepared by USGS and 5,000 paper copies printed.
   -CD-ROM premaster will contain same information plus attribute tables in digital form to meet FGDC standards. 600 CD-ROMs will be produced and USGS will also do the necessary CD-ROM work.
   -Manuscript will be drafted by NITT members with agreed NITT members serving as a the corresponding authors (those who carry the burden of dealing with publishers and manuscript formats, etc -- Shasby with assistance from agreed NITT members)
   -Suitable Journal to seek review of article will be identified by NITT.
   -Color plates will be included in article

3. Timeframe (staff time and calendar time)

-Arrange to get publication on USGS publication schedule		5/96
-Publication process		10/96-10/97
1 person USGS x 40 days	= 40 staff days	
8 NITT members x 20 days	= 160 staff days	
Total Staff days	= 200 staff days	

4. costs

-USGS Map negative preparation & printing (5,000 copies)	= $25,000
-USGS CD-ROM production (600 copies)	= $5,000
-Color plates for article	= $1,500
Total Costs	= $31,500

Summary Costs

	$$'s	Staff Days
Step 1	$ 19,000 (travel & materials)	480
Step 2	$ 48,000 (travel)	4,160
step 3	$ 12,000 (travel)	80
Step 4	$ 31,500 (publication)	200
Totals	$110,500	4,920

NCSS Southern Region Soil Survey Work Planning Conference
Charleston, South Carolina, April 15-19, 1996

Presentation: NSSC Lab Report, April 18, 1996
By Warren Lynn, substituting for DeWayne Mays

As a result of our reorganization, the analytical function of the former National Soil Survey Laboratory looks a little different than it did before, but not a whole lot different. Our total analytical staff is smaller. It is shifted toward permanent technicians and away from part time employees. Lika any such shift there are gains and losses. We gain stability and continuity of the full time person. We loose some of the eagerness and creativity of the university student. With the new staffing plan, we estimate a production capacity about 80% of the average for the previous 4-5 years, This translates to about 8000 samples per year, down from 10,000 samples per year. The production level has not been tested. The earliest estimate for a fiscal year will be in October 1997.

We were out of production much of calendar year 1995 with remodeling. As a result we have and extra backlog. We have asked you to minimize requests for that period, and we have a similar request for the rest of this fiscal year. You have been cooperative and we appreciate it. Our goal is the get the backlog reduced by the end of the calendar year to a point that we can sustain a turn-around time to meet you needs in a timely fashion,

Overhead (copy attached): Samples Received (by month) for fy93, 94, 95
Fall has always been a high load time; late winter and early spring a low time; I was a bit surprised by the low load May through July.
Overhead (copy attached): Total Analyses and Samples Received (per fy)
From 1981 to present the sample load has been 7500 to 10,000; in the 90's we edged over 10,000 for four of the years. The total number of analyses has increased more rapidly in since 1990. With our reduced staff, the estimated output is about 8000 samples per year or about 80% of sample load during the 90's. It will be the end of fy97 before we have actual numbers to test against the estimate.

We are pretty much in an operational mode again, We are not running EGME (surface area) or atterberg limits. We are looking at existing projects to see if some can be reduced or delayed (with your concurrence). Reference projects we will try to get out in 3 months. Characterizations projects may take a bit more than a year to get back at this time. Our biggest backlog is in optical mineralogy; we are attempting to get a little extra summer help to whittle than down.

I passed out a letter last Monday indicating the liaison links we would like to establish
Overhead (copy attached): NSSC Service Regions

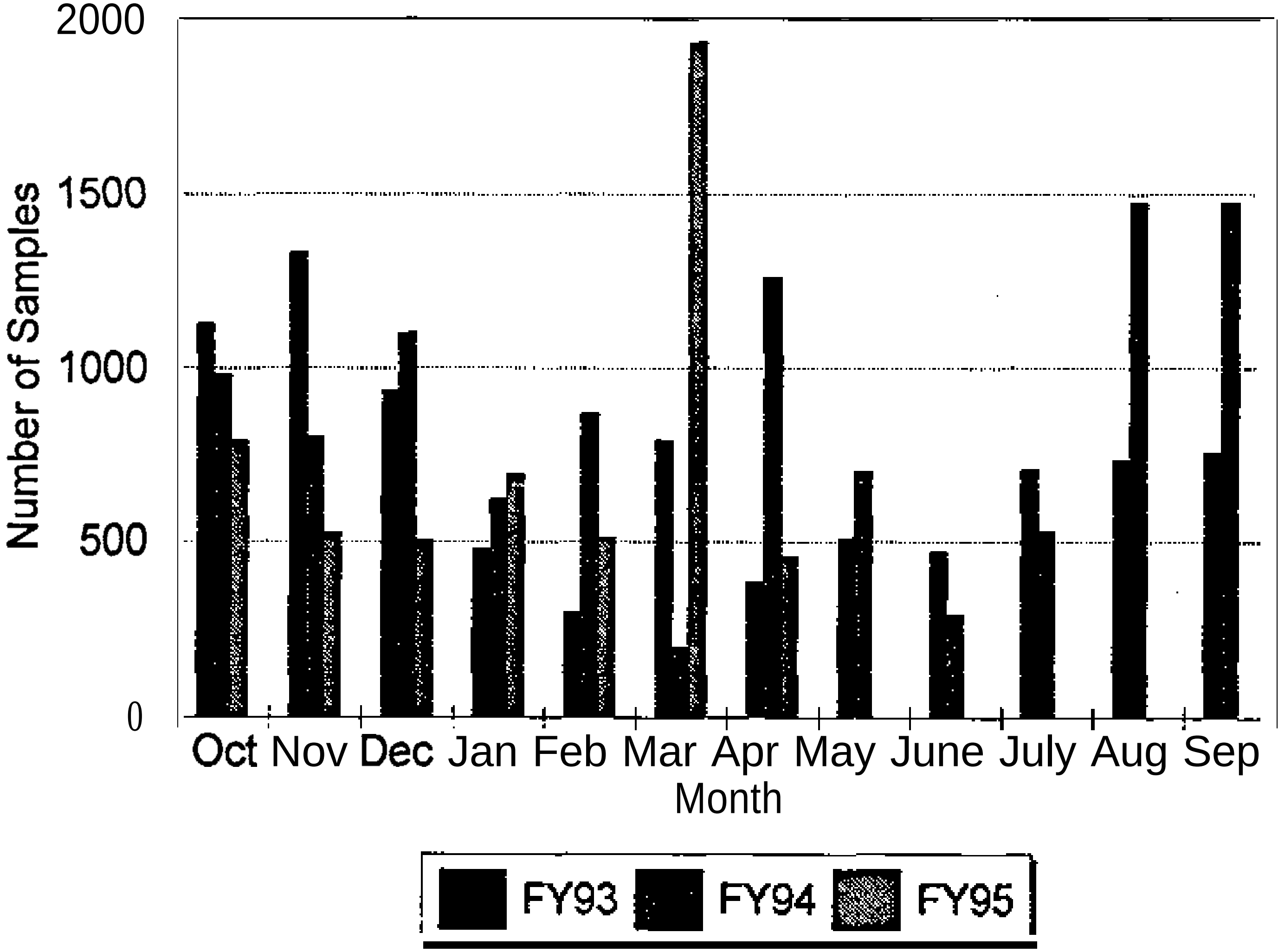
You can address requests for investigations assistance to me or Tom Reinsch for MO9 or to Phil Schoeneberger for M013. If analytical work is involved, please send a carbon copy to DeWayne Mays. This is mentioned in the letter I passed out on Monday. If there is someone on our staff that you would like to be Project Coordinator, tell us. Send that person a carbon copy of the request if you wish. We plan to spread the project work among the investigations staff and other staff at the NSSC.

It looks like for our records and for data distribution, indication of the MLRA in which the site is located will be important, if not necessary. I have requested that we include the MLRA on the data sheet, as well as in the description. For projects pending distribution, if we do not know or cannot figure out the MLRA, we may ask your help.

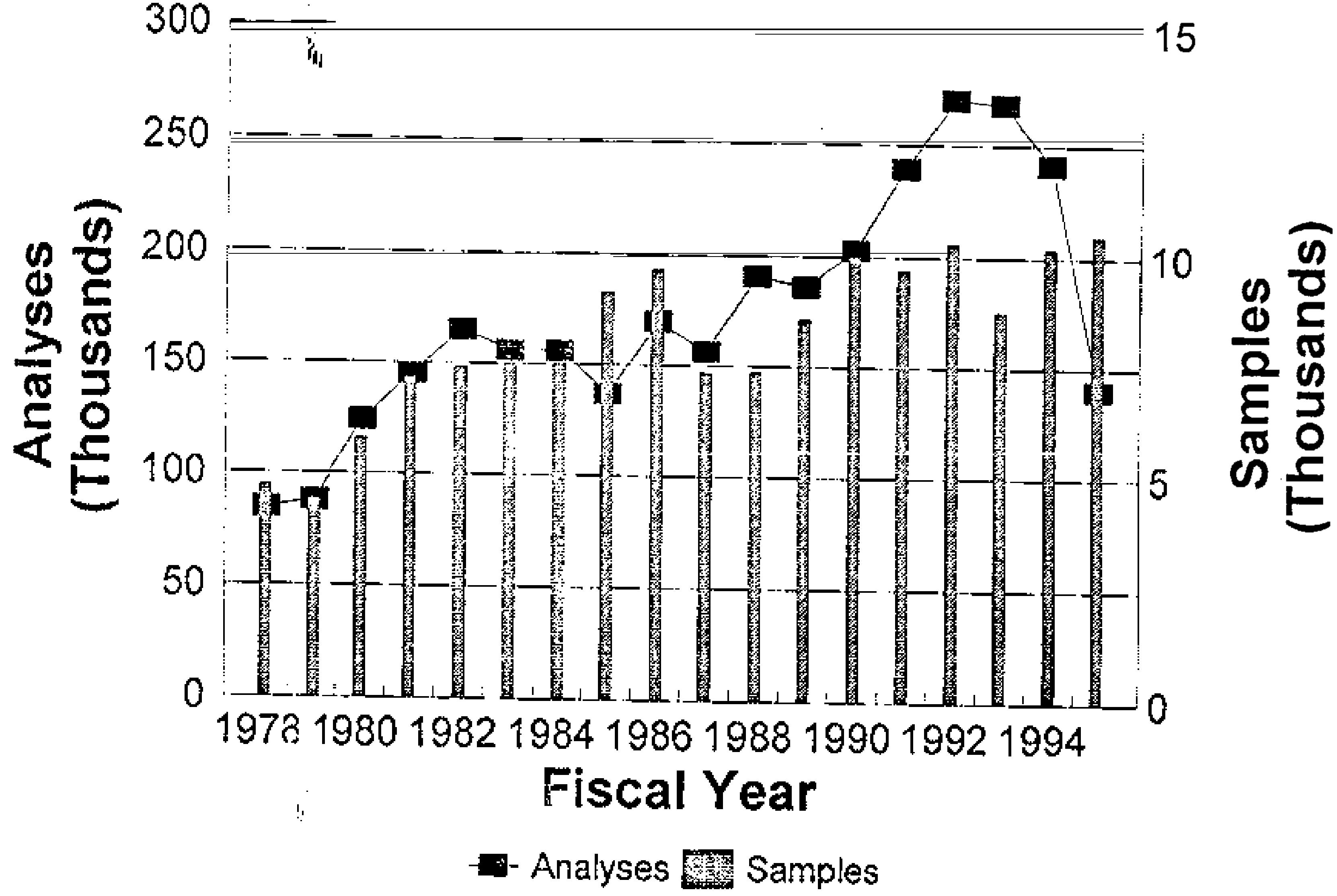
We certainty look forward to being back in full swing again.

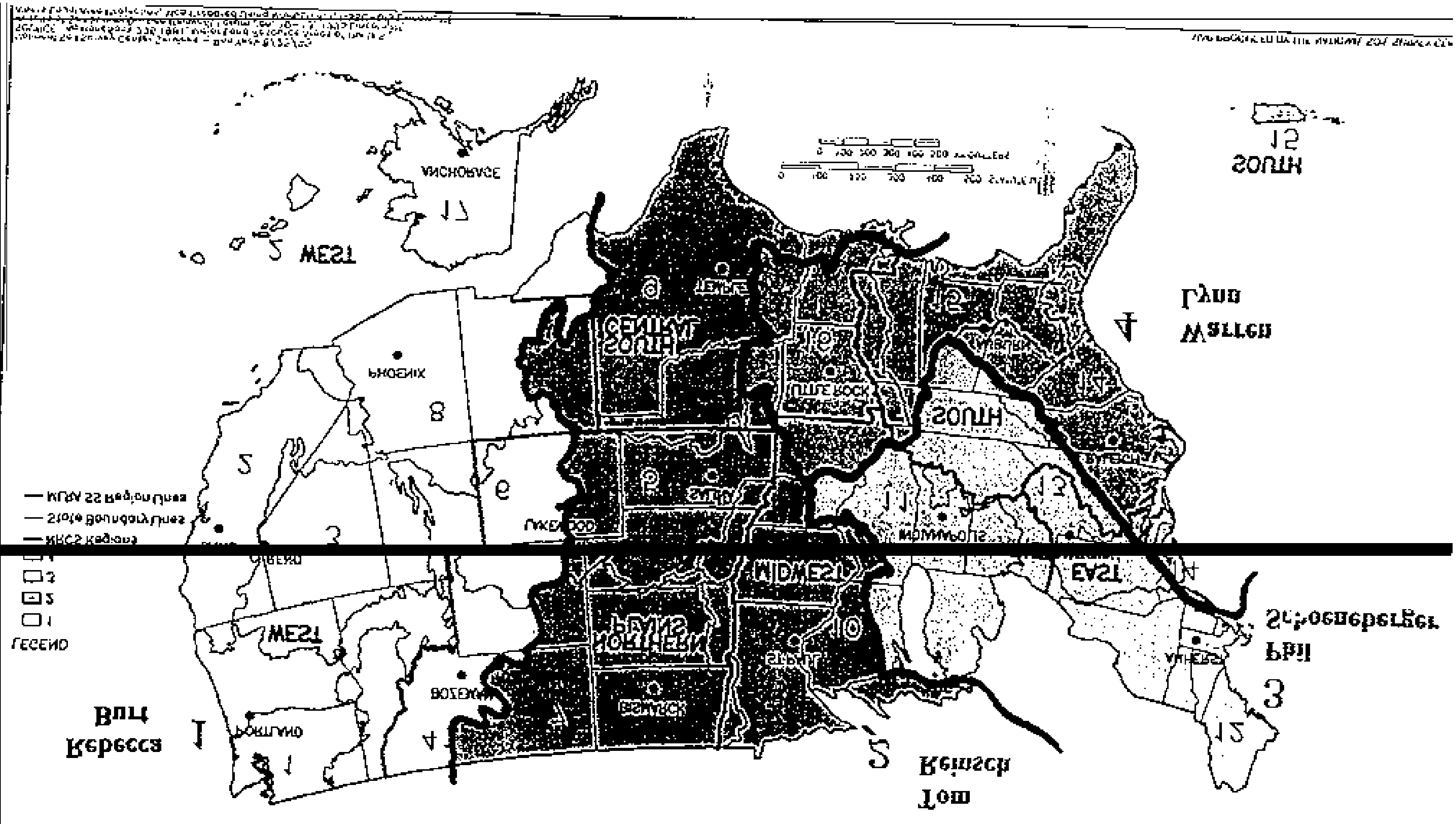
Thank you.

Samples Received



Total Analyses and Samples Received





NATIONAL SOIL SURVEY CENTER (NSSC)
SERVICE REGIONS

SOUTHERN REGIONAL SOIL SURVEY WORK PLANNING CONFERENCE
April 18, 1996
Charleston, S.C.

TECHNICAL SOIL SERVICES

BY
DAVID HOWELL, RESOURCE SOIL SCIENTIST
Lake City, FL

-- The National Cooperative Soil Survey in Florida is actively involved in providing training and assistance to users and potential users of soil survey information, under the leadership of the Natural Resources Conservation Service, and the Cooperative Extension Service, in cooperation with Soil and Water Conservation Districts, Water Management Districts. and local units of Government. In addition, Florida NRCS provides technical soil services and direct assistance to all users of soil survey data by staffing Resource Soil Scientist positions.

Of Florida's 67 counties, 53 have published soil survey reports, 10 are mapped but unpublished, 1 is in progress, and the remainder are dominated by national parks and other federal lands.

-- The objective of staffing Resource Soil Scientist positions is to provide technical soil services needed to help people use existing soil maps and their associated descriptions and interpretive data as a basis **for their decisions** concerning the use and management of soils.

The Florida NRCS soils staff is now dominated by Resource Soil Scientists. It consists of 12 Resource Soil Scientists, 2 Ground Penetrating Radar Specialists, 3 Project Leaders, and 2 state soil staffers.
Note: Within the last 2 years, 4 **soil scientists have retired, and within the last 6 months 2 have transferred to other states for promotions.**

-- There are three basic areas oftechnical soil services I will focus on today. The services we give to NRCS Field Offices, to our customers and cooperating agencies, and services rendered to satisfy specific details of agreements with data users.

-- In support of Field Offices, Resource Soil Scientists are responsible for updating sections of the Technical Guide, updating soil databases and interpretations. and non-technical descriptions used in FOCS. Some of us are honing our computer skills needed to produce products for field office use, and also to train other NRCS and SWCD personnel. All RSS's in Florida are trained in FSA wetland delineation and are all certified in Reg. IV Corp Manual. RSS's provides the soils information necessary for field offices to fulfill their obligations under the Farm Bill.

-- Water quality, water quantity, and soil quality are basic motivations for technical soil services. The rapid increase in our state population is putting a severe strain on our natural resources. Therefore, we devote a great deal of time on site evaluations, especially SHWT and hydric soil determinations.

We also try to perpetuate our profession and provide a service to our cooperators by assisting with the soils portion of land judging contests, envirothons, farm tours, and other conservation district sponsored events.

Sending requested data to field offices, writing definitions and explanations of soils phenomena, and giving verbal responses to the many questions we receive from NRCS conservationists, engineers, and others, also consumes much of our time.

-- Much time and energy is spent performing technical soil services as a result of requests or questions generated from outside sources. Whether its a request for GPR assistance in locating buried objects, a request to provide unpublished soil survey data to a forester or developer, or request for evaluating a site for a landfill, the RSS is equipped to handle all requests. We also provide the instruction for more than 100 workshops per year across the state.

-- Florida NRCS has several agreements with state agencies. Contracts with 3 of the 5 Water Management Districts in the state involve 3 resource soil scientists who provide quality control of soils data, quality control of digitizing projects, site evaluations, staff training, input on environmental impact reports, and a variety of map products, many of which are generated by GIS.

Aside from Water Management Districts, we also have an agreement with Florida Health and Rehabilative Services (HRS). This agreement calls for the services of 2 Resource Soil Scientists; 1 located in the capitol city of Tallahassee, the other in Orlando.

--Work performed for HRS basically include soils training, investigations & mediation, and technical assistance to state HRS staff.

-- HRS entered into agreement with NRCS primarily because of their need to provide quality standardized training to their County Public Health Unit (CPHU) personnel who are evaluating soils for septic tank absorption fields. The main goal for the current level of soils training is to increase the level of proficiency of CPHU staffs in describing soils, consistently. Three parts of the training program for these Environmental Specialists are (1) program development, (2) implementation, and (3) tracking.

Note: Florida legislature passed law requiring the use of SHWT estimates & USDA soil texture analysis in septic waste disposal permitting.

-- Program Development for HRS training includes the development of a 2 day training course. The course, developed and administered by the contract RSS, consists of lecture, texture sampling, developing teaching aids, field exercises, soil survey book exercises, and an exam.

--Implementation begins with the planning and scheduling ofworkshops. Some workshops will involve HRS personnel from several counties, while others will involve only one county. Desirable field sites are selected by local HRS personnel and the local soil scientist. The workshop is culminated by an exam.

-- Graded exams are filed by county after scores are logged. Records are kept of name of the individual taking the course, office location, date, pre-test score, multiple choice exam score, soil survey exam score, pass/fail status, and instructor's initials.

-- Onsite investigations are conducted to (1) investigate the cause of system failure, (2) to settle disputes between two parties when they cannot reach agreement otherwise, (3) to evaluate qualities of fill materials, (4) and to provide the best available and most reliable on-site soils information for special situations.

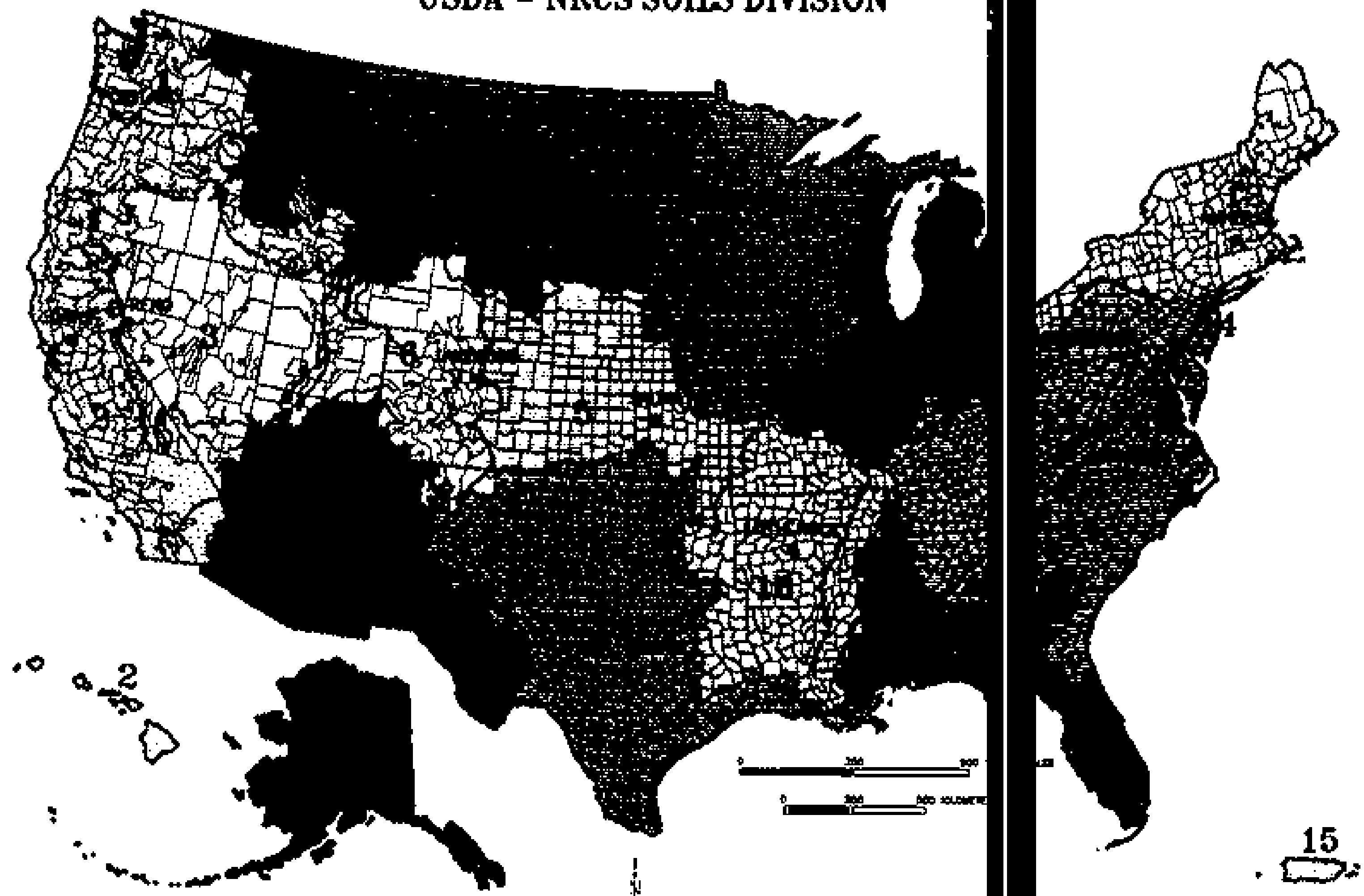
-- Technical assistance to staff (HRS) is defined as the transfer of knowledge from a soil scientist to a non-soil scientist, but does not include information generated from site investigations, nor does it include formal soils training. (Example: assists with technical wording of state legislation).

-- In summary, Resource Soil Scientists are providing technical soil services in support of NRCS Field Offices and SWCDs. We also respond to and meet customer expectations, fulfill requirements of written agreements with other agencies, and maintain quality, up-to-date soils information to the extent of our federal resources.

-- Detailed soil surveys are completed on more than 95% of Florida's land area. With hundreds of new residents moving into the state daily, increasing the strain on fragile natural resources, and because of policy and legislative protections placed on water quality, the continued need for expert technical soil services is becoming critically more important day by day.

-- So, by providing accurate soils data and interpretations to land users, we can be assured that the odds are improved that a healthy water supply will be available for future generations.

MUIR DATA STEWARDSHIP BY
MAJOR LAND RESOURCE AREAS (MLRA) SOIL SURVEY RE[redacted]ONS (MO'S)
USDA – NRCS SOILS DIVISION



TECHNICAL SOIL SERVICES

The State of Texas has 254 counties. Soil surveys are published on 183 survey areas. There are 13 survey areas to be completed in the next 5 years. As of September 30, 1995, 94% of the 170,756,333 acres were completed. Mapping accomplishments in 1995 were 2.36 million acres and in 1996 goals are 1.5 million acres.

There are 29 counties out-of-print with only loan copies available. Correlations older than 25 years, dating back to 1949, number 71. Update of the High Plains (MLRA 77) began in 1992. Plans are being finalized for an update of the Coast Prairie (150A, 150B, 151) and Flatwoods (152A,152B) with initial staffing this summer. Other updates are being planned.

There are 28 completed survey areas awaiting publication. Even before the soils reorganization we had a backlog of soil survey manuscripts. Staff is being planned to take on this backlog in the near future with publication specials.

We have 41 soil scientists in Texas. The soil scientists average almost 25 years of tenure. Years of service range from 8 to 36 years. We have three soil scientists with less than 10 years service. About 48 percent of all the soil scientists have 25 or more years service. The numbers of personnel have continually declined while funding has been stable to a slight increase. We currently have four project leader positions and one resource soil scientist position vacant. We also have two project soil surveys fully staffed.

In Texas we currently have:

- 1 MO Leader/State Soil Scientist
- 20 Field Project Soil Scientists
- 10 Field Resource Soil Scientists
- 2 Field Resource Soil Specialists (Wet Soils & IWM)
- 8 MLRA Office Staff and includes:
  - 1 Soil Geomorphologist
  - 1 Technical Manuscript Editor
  - 6 Soil Data Quality Specialists and includes:
    - 1 Soil Databases
    - 2 Soil Interpretations
    - 3 Soil Correlation

Total 41

These Resource Soil Scientists provide assistance on all aspects of soils. Keeping jobs off of soil survey parties so they can do survey activities. The major activities of the resource soil scientists are:

- directs assistance to F.O. and other technical staff
- assistance to soil survey parties
- providing interpretation of soils information to soil survey users.
- on-site investigations
- educational workshops
- soils training of NRCS personnel as well as individuals outside the agency
- Irrigation Water Management (IWM)
- hydric soil determinations and assistance
- FSA assistance
- FOTG development and certification
- FOCS soils data base certification and assistance dealing with FOCS soils out put
- working with soils professors, graduate students, and researchers at universities
- special soil studies
- cultural resource coordinators
- NRI assistance
- assist in soil correlations by providing local regional experience
- land judging contest for SWCD, collegiate, FFA and 4H
- double-up as a party leaders
- TQM trainers/ facilators
- soil survey details - mapping/data collection

EXAMPLES OF RESOURCE SOIL SCIENTIST PROJECTS

General Soil Maps

General soil maps are printed by Texas Agriculture Extension Service and Texas Experiment Station with the map and interpretive information provided by NRCS. A total of 110 counties are available for distribution.

State General Soil Map (STATSGO)

A state general soil map has been compiled at a scale of 1:250,000 using GIS technology. All 50 quads have been, digitized and certified. The purpose of STATSGO is to link digitized soil map unit delineations with soil interpretations to analyze and display soils data with other spatially referenced resource and demographic data. This is available for distribution electronically on CD.

Cooperative Soil Investigations

A. Cooperative agreement with the High Plains Underground Water Conservation District at Lubbock is a continuing project.

B. NRCS has entered into an agreement with the Department of Defense to update the soil survey at Ft. Bliss in Texas and New Mexico. A similar proposal has been submitted to update the soil survey of Ft. Hood, Texas.

C. Global Climate Studies

Climate Instrumentation Sites:
- Prairie View A&M, Texas
- Bushland, Texas

Organic Carbon Sites:
- Parmer County
- McLennan County

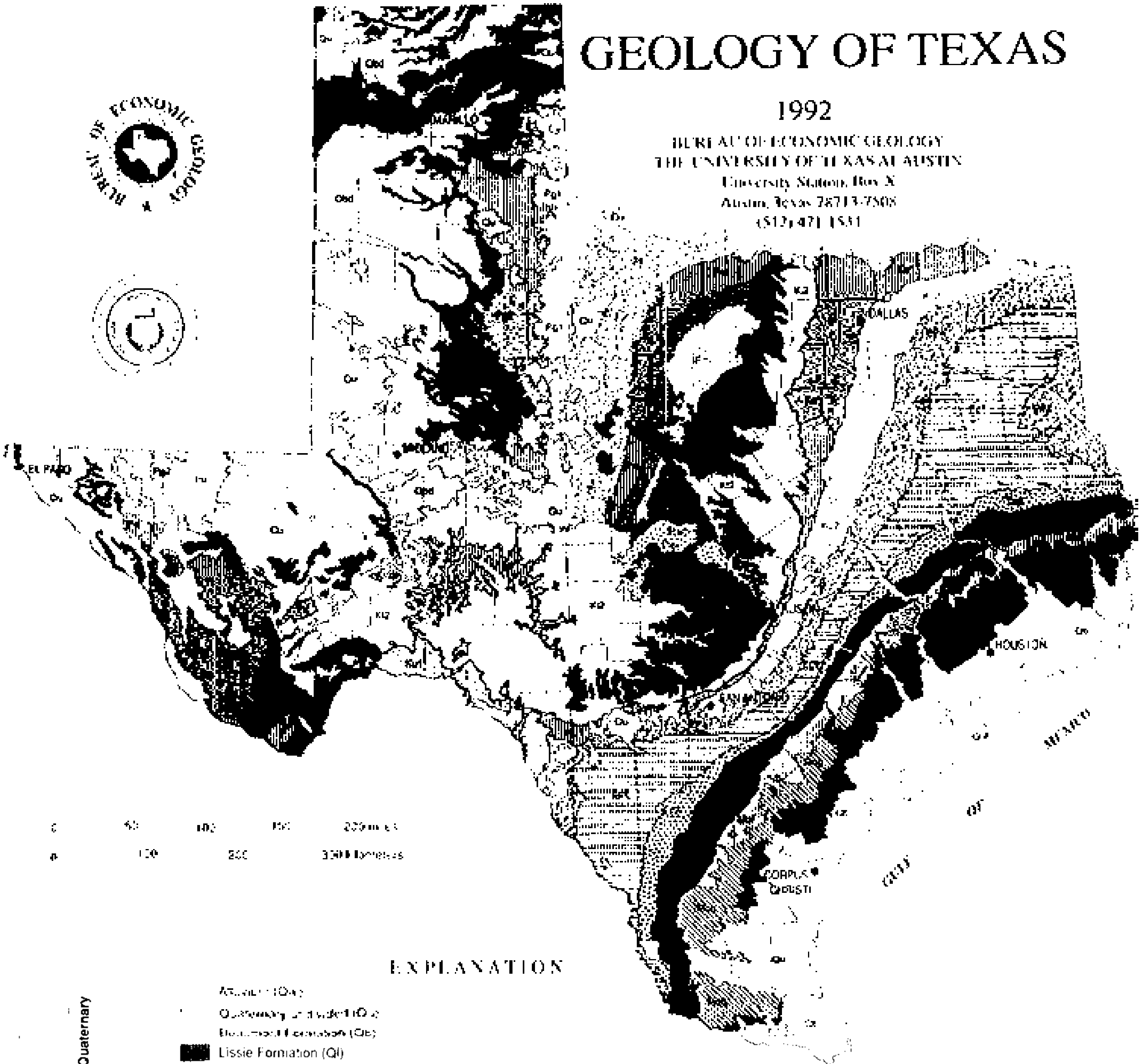
D. Soil Moisture Monitoring
- ISCOM VIII sites continue
- Greenburg (MS-TAMU) ustic-thermic site
- Starowitz (MS-TAMU) udic-hyperthermic
- Others with project offices

E. Classification Problems and Amendments
- Aquic or oxyaquic or epioxyaquic
- Vertic or typic
- Vertisols-gilgai configeration

GEOLOGY OF TEXAS

1992

BUREAU OF ECONOMIC GEOLOGY
THE UNIVERSITY OF TEXAS AT AUSTIN
University Station, Box X
Austin, Texas 78713-7508
(512) 471-1534



EXPLANATION

CENOZOIC

Quaternary

Lissie Formation (Ql)

Tertiary

Eocene

MESOZOIC

Cretaceous

Fredericksburg and L. Washita Groups (Kl2)

PALEOZOIC

265 m.y.

Ordovician undivided (MDO)

505 m.y.

Cambrian (-C)

Pre-cambrian

97

Geology of Texas

The geologic history of Texas is recorded in lhc rock strata that fill the many subsurface sedimentary basins and crop out across the state. The origin of these strata documents a changing geography that began several billion years ago in the Precambrian Era. Mountains. seas, rivers, volcanoes, and earthquakes are part of the geologic story oi Texas. and the resources produced hy gcotogic phenomena (petroleum, coal, lignite, metals, ground water, salt, limestone, ceramic clays, and various soils) arc the legacy of the state's changing face.

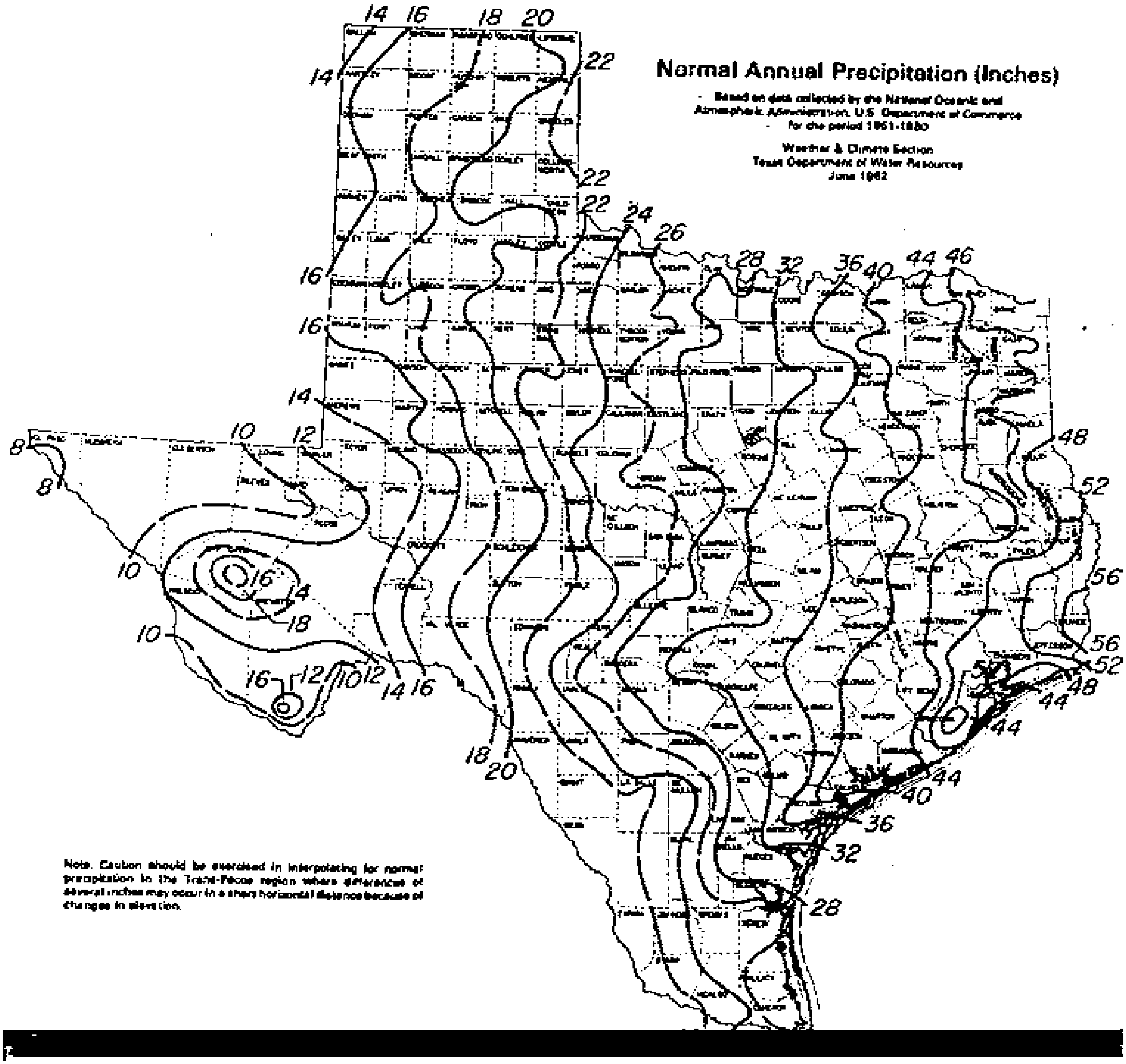
Texas is underlain by Precambrian rocks more than 600 million years old. The dcionned ancient volcanic and intrusive igneous rocks and sedimentary rocks were Conned early in the Earth's history. They are now exposed in the Llano Uplift and in a few small areas in Trans-Pecos Texas.

During the early Paleozoic, broad inland seas inundated the stable West Texas region (Texas Craton), depositing widespread limestones and shales. Lower Paleozoic rocks arc now exposed around lhe Llano Uplift and in the mountains of Trans-Pecos Texas. The Texas Craton was bordered on the east and south hy lhe Ouachita Trough, a deep-marine basin extending along lhc Paleozoic continental margin from Arkansas and Oklahoma lo Mexico. Sediments accumulated in the Ouachita Trough until late in lhe Paleozoic Era when the European and African continental plates collided with lhe North American plate. Convergence oi the North and South American plates in this area produced fault-bounded mountainous uplifts (Ouachita Mountains) and small basins tilled by shallow inland

Normal Annual Precipitation (Inches)

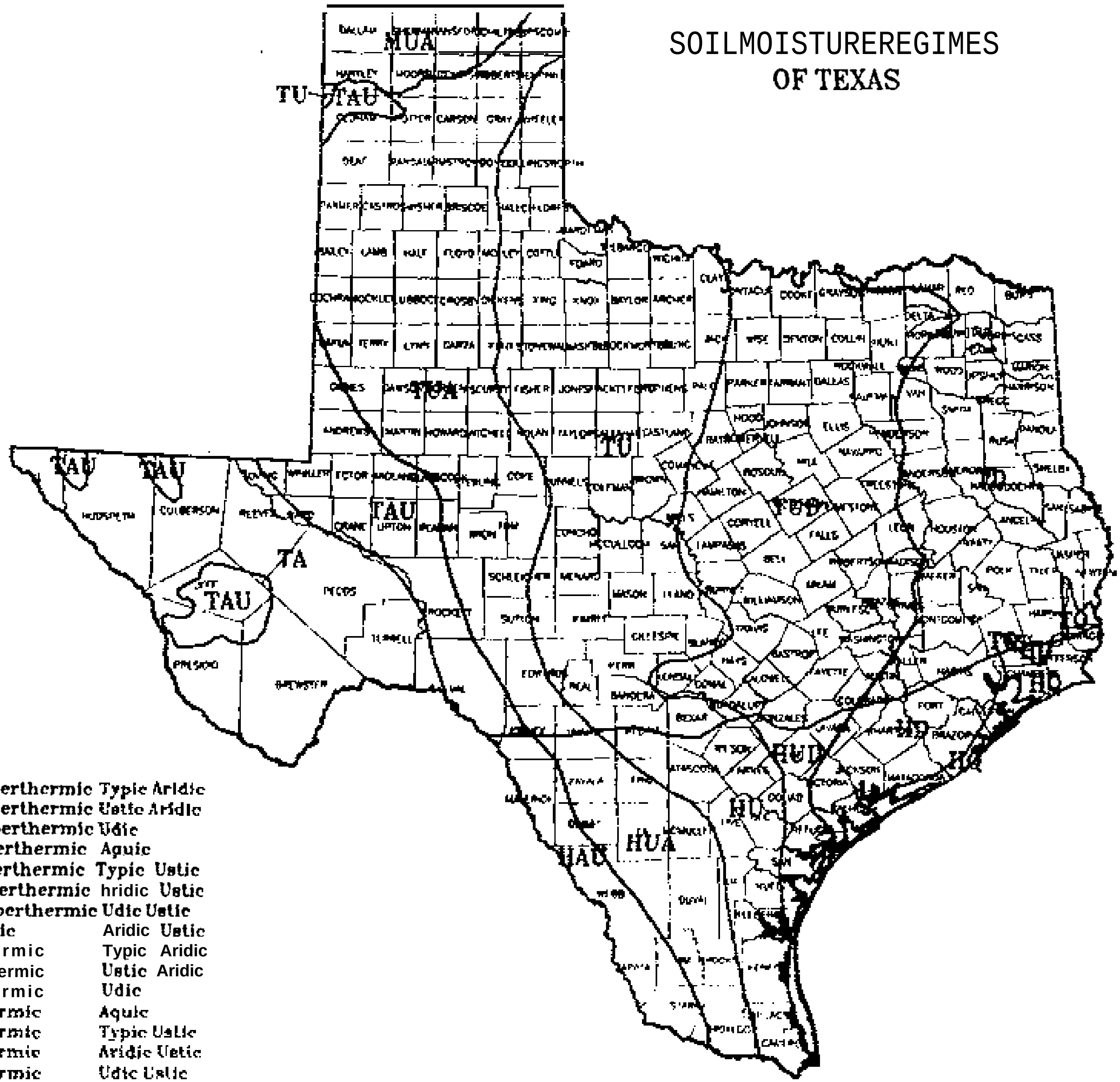
- Based on data collected by the National Oceanic and Atmospheric Administration, U.S. Department of Commerce
- for the period 1951-1980

Weather & Climate Section
Texas Department of Water Resources
June 1982



Note. Caution should be exercised in interpolating for normal precipitation in the Trans-Pecos region where differences of several inches may occur in a short horizontal distance because of changes in elevation.

SOILMOISTUREREGIMES OF TEXAS



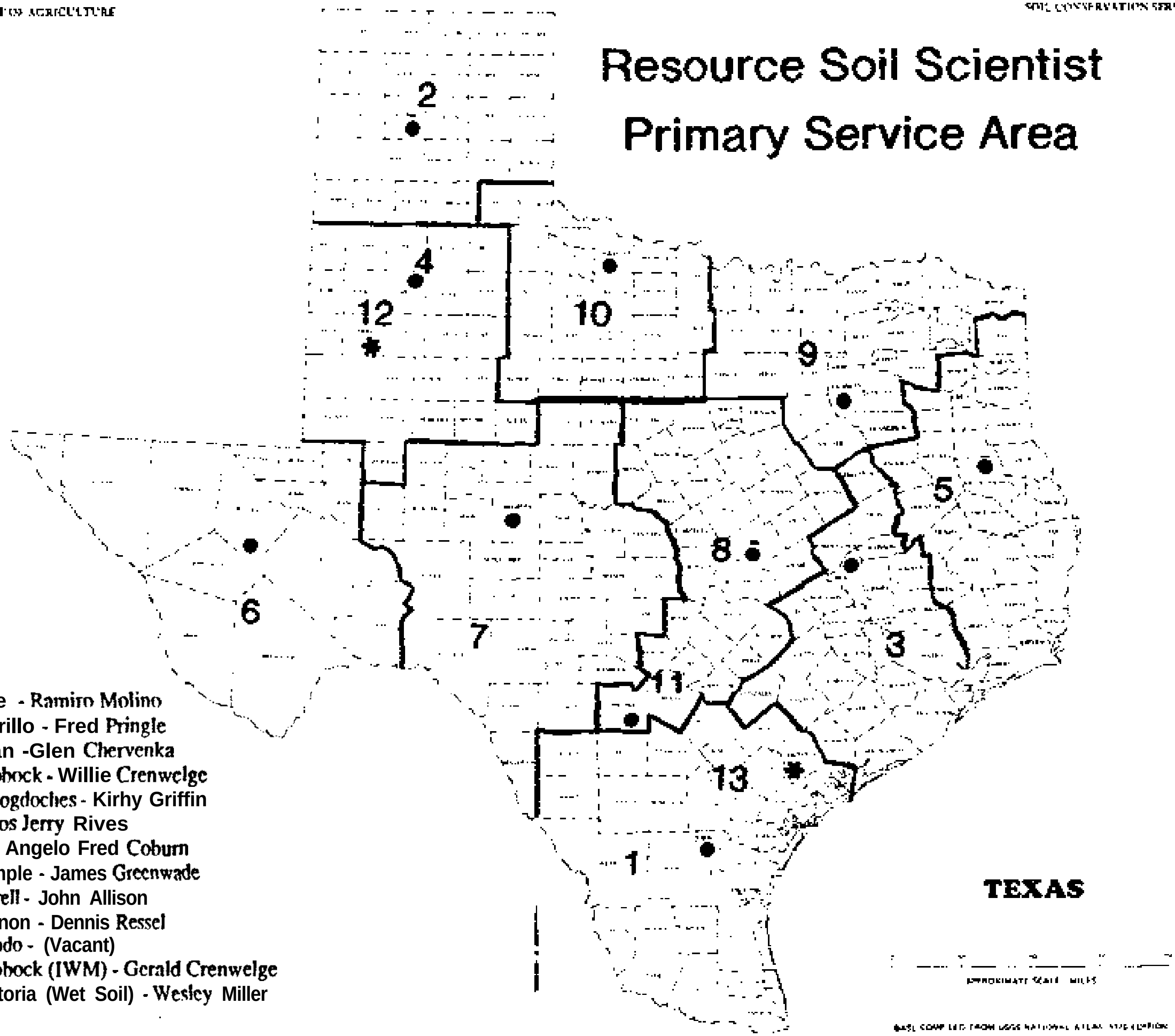
HA Hyperthermic Typic Aridic
HAU Hyperthermic Ustic Aridic
HD Hyperthermic Udic
HQ Hyperthermic Aquic
HU Hyperthermic Typic Ustic
HUA Hyperthermic hridic Ustic
HUD Hyperthermic Udic Ustic
MUA Mesic Aridic Ustic
TA Thermic Typic Aridic
TAIJ Thermic Ustic Aridic
TD Thermic Udic
TQ Thermic Aquic
TU Thermic Typic Ustic
TUA Thermic Aridic Ustic
TUD Thermic Udic Ustic

Data [illegible] by State Office [illegible].
Map [illegible] by CARTO/GIS Section, USDA, SCS, [illegible] 1993.

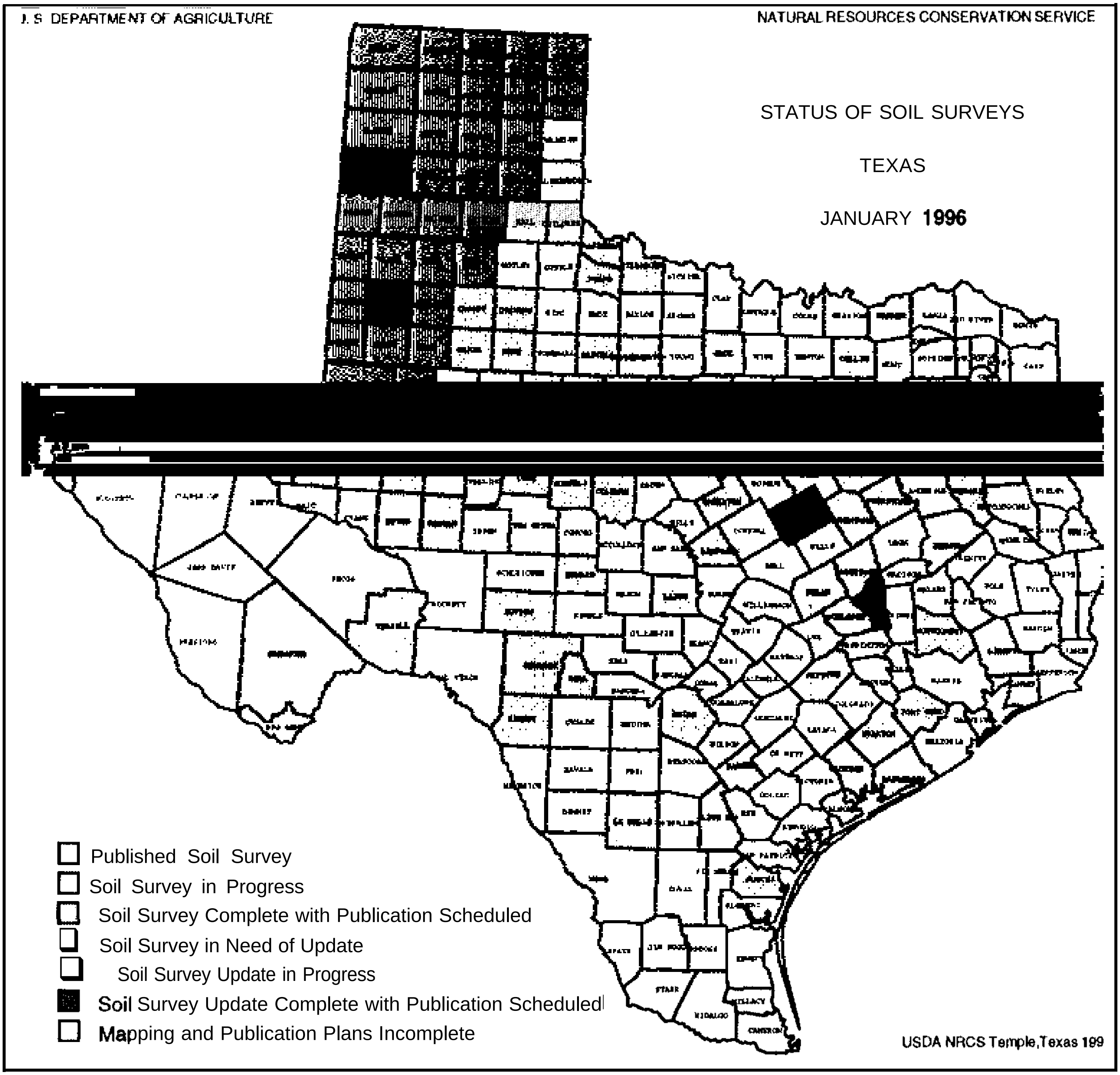
U.S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

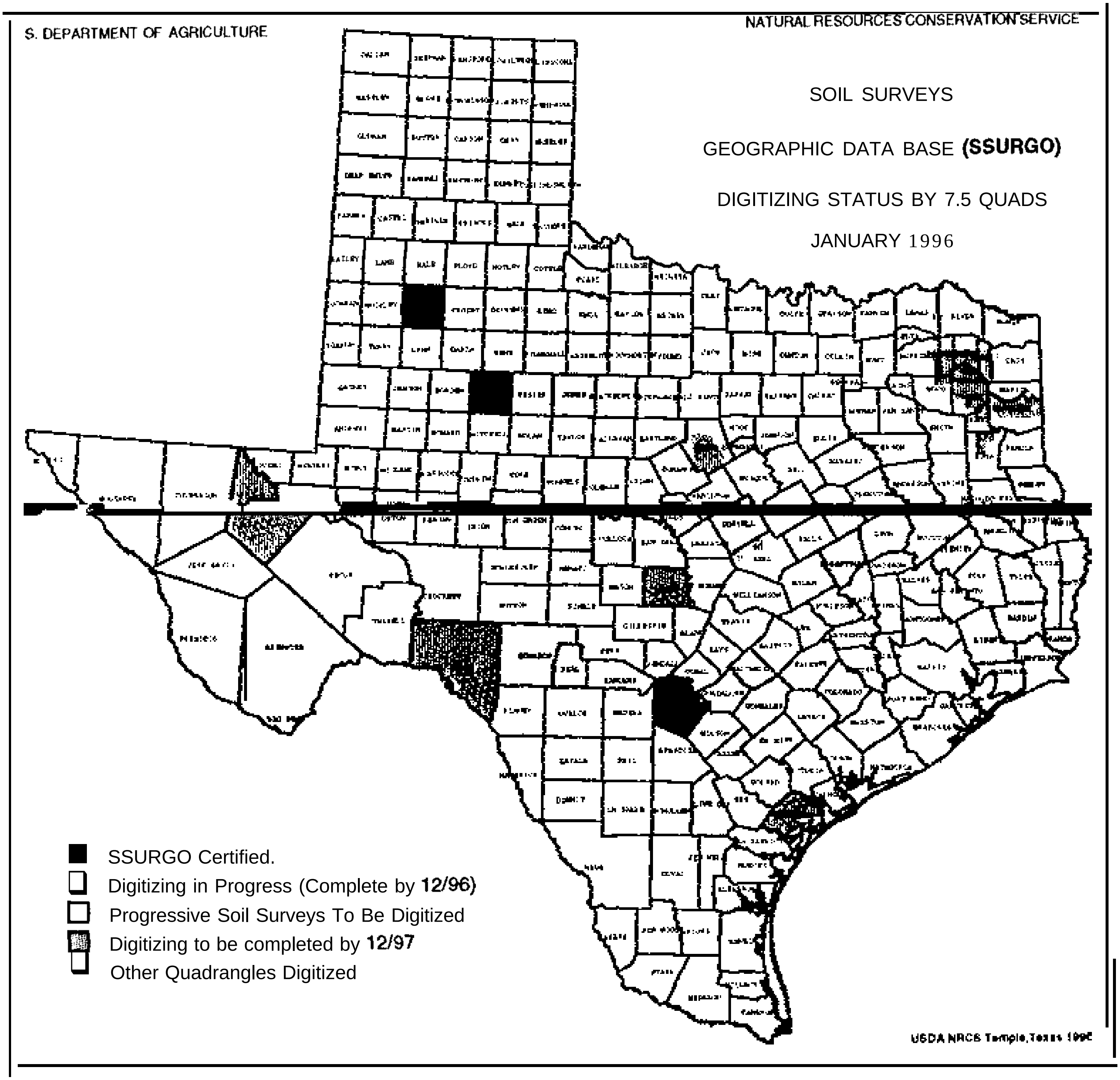
Resource Soil Scientist Primary Service Area

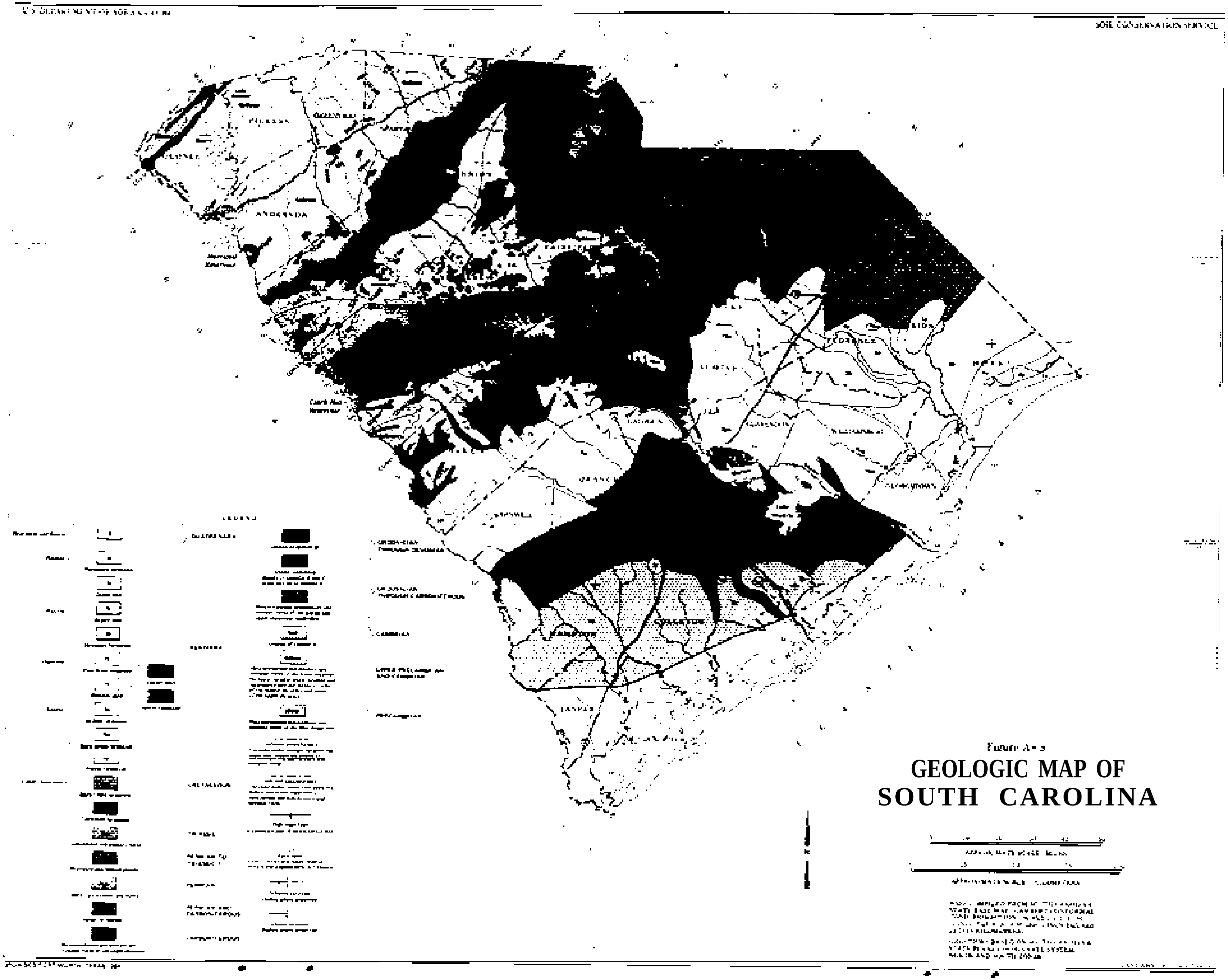


1 Alice - Ramiro Molino
2 Amarillo - Fred Pringle
3 Bryan -Glen Chervenka
4 Lubbock - Willie Crenwelge
5 Nacogdoches - Kirhy Griffin
6 Pecos Jerry Rives
7 San Angelo Fred Coburn
8 Temple - James Greenwade
9 Terrell - John Allison
10 Vernon - Dennis Ressel
11 Hondo - (Vacant)
12 Lubbock (IWM) - Gerald Crenwelge
13 Victoria (Wet Soil) - Wesley Miller

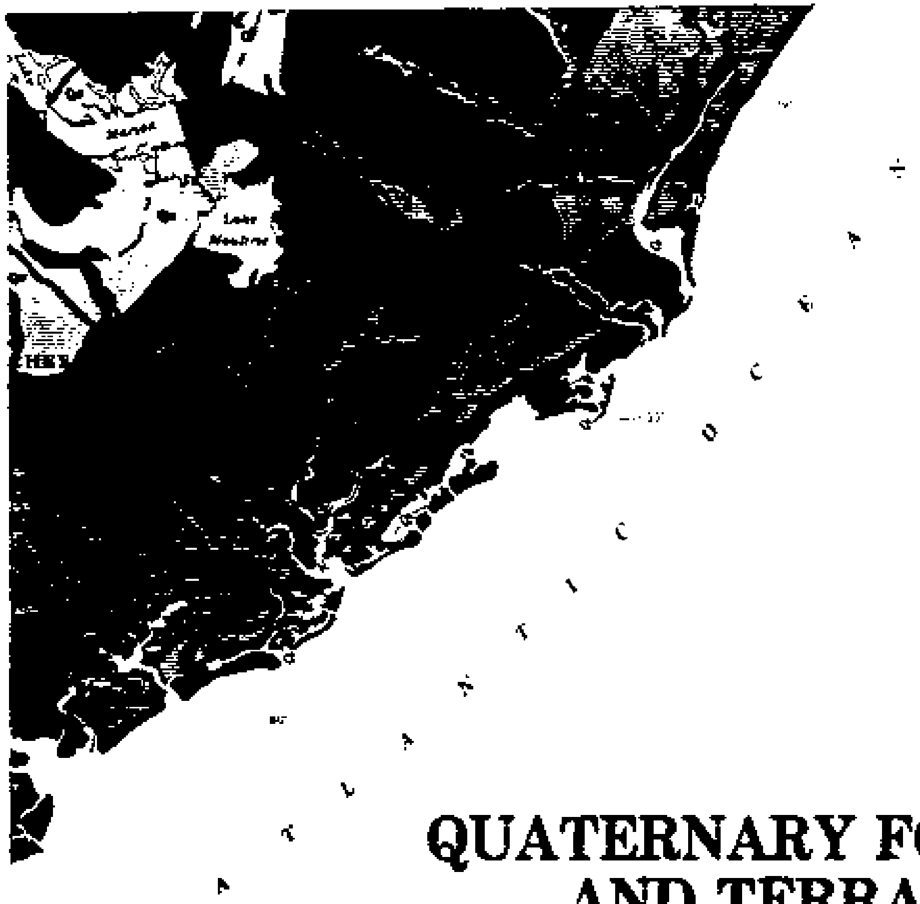


J. S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
STATUS OF SOIL SURVEYS
TEXAS
JANUARY 1996
Published Soil Survey
Soil Survey in Progress
Soil Survey Complete with Publication Scheduled
Soil Survey in Need of Update
Soil Survey Update in Progress
Soil Survey Update Complete with Publication Scheduled
Mapping and Publication Plans Incomplete
USDA NRCS Temple,Texas 199


S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
SOIL SURVEYS
GEOGRAPHIC DATA BASE (SSURGO)
DIGITIZING STATUS BY 7.5 QUADS
JANUARY 1996
SSURGO Certified.
Digitizing in Progress (Complete by 12/96)
Progressive Soil Surveys To Be Digitized
Digitizing to be completed by 12/97
Other Quadrangles Digitized
USDA NRCS Temple, Texas 1995



GEOLOGIC MAP OF SOUTH CAROLINA



LEGEND

Recent

Recent terrace
Shore line of present sea level

Pamlico terrace and formation
Shoreline about 25 feet above present sea level

Talbot terrace and formation
Shoreline about 42 feet above present sea level

Penholoway terrace and formation
Shoreline about 70 feet above present sea level

Pleistocene

Wicomico terrace and formation
Shoreline about 100 feet above present sea level

Sunderland terrace and formation
Shoreline about 170 feet above present sea level

Coharie terrace and formation
Shoreline about 215 feet above present sea level

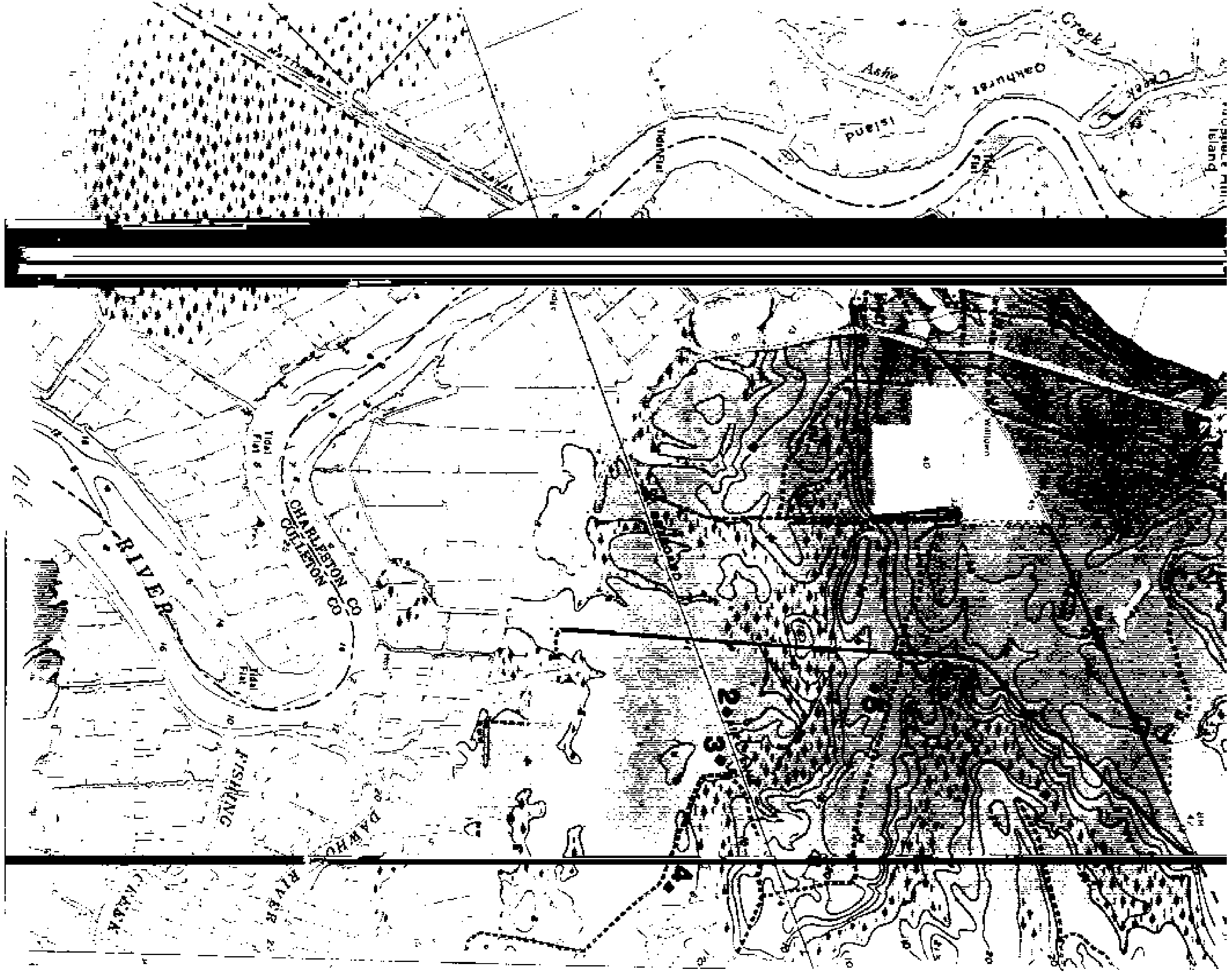
Brandywine terrace and formation
Shoreline about 270 feet above present sea level

QUATERNARY FORMATIONS AND TERRACES OF SOUTH CAROLINA

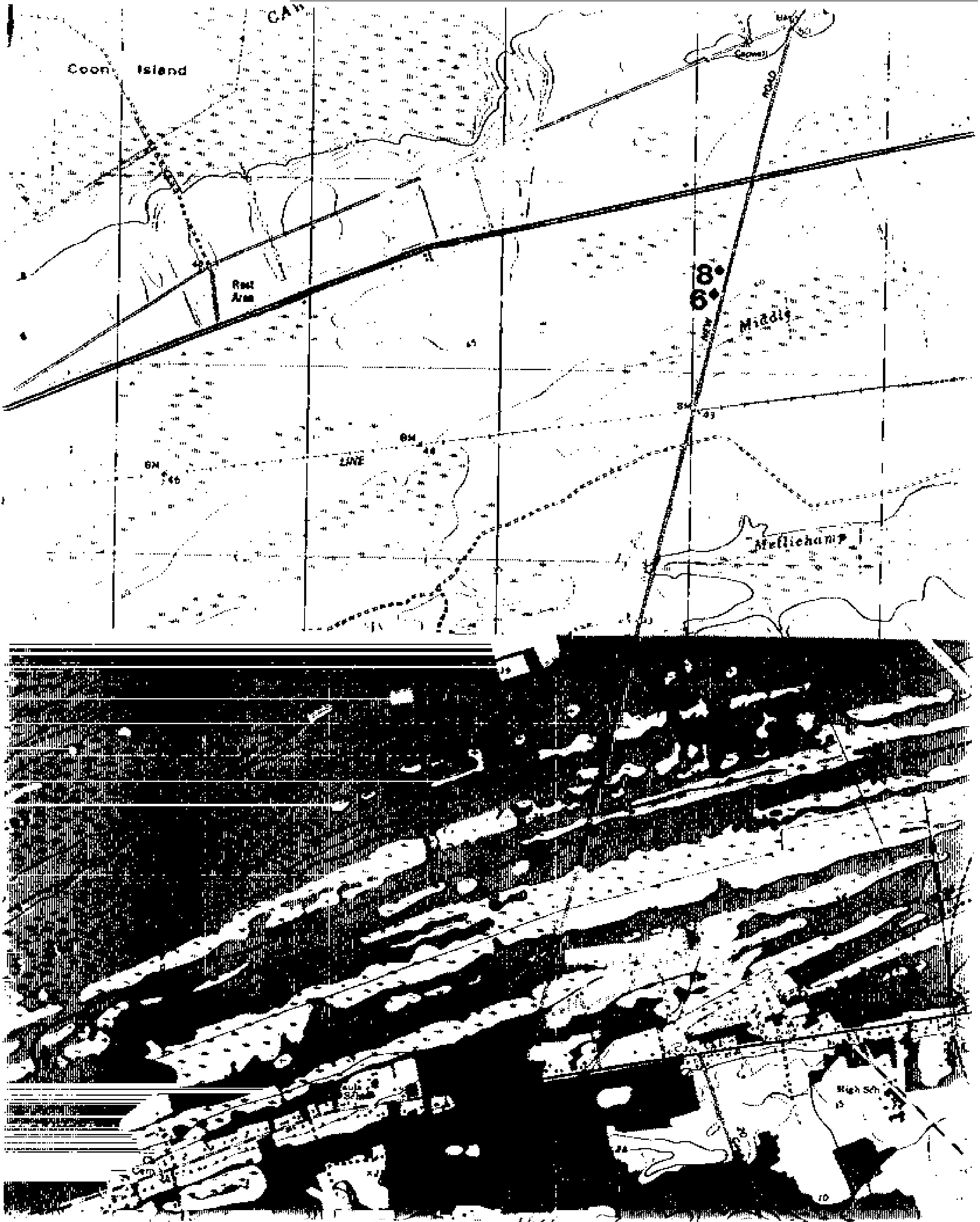
N

0 10 20 30 40 50
APPROXIMATE SCALE - MILES

0 25 50 75 100
APPROXIMATE SCALE – KILOMETERS



RIVER
CHARLESTON CO
COLLETON CO
Tidal Flat
DAWHO RIVER
FISHING
CREEK
Ashe
Creek
Oakhurst
Island


Coon Island
Rest Area
LINE
Middle
Mellichamp
High Sch

Pedon Descriptions and Data

Series: Wadmalaw
Classification: Fine-loamy, mixed, thermic Umbric Endoaqualfs
Geographic Setting: Nearly level broad flats and drainageways
Parent Materials: Loamy marine sediments underlain by alluvial marly sands and clays
Drainage: Poorly drained; slow runoff, moderately slow permeability
Pedon Number: S96SC019-2

TYPICAL PEDON

Wadmalaw fine sandy loam; about 12.9 miles southwest of Hollywood; 10.2 miles west on primary state highway 162; 2.6 miles southwest on secondary state highway 346; 1050 feet northwest on farm road; site is 55 feet north of road.

0 -- 1/2 to 0 inches: very dark brown (10YR 2/2) fibric material; 75 percent fibric material after tubbing; friable; fibers are of moss leaves, twigs and roots; extremely acid; gradual wavy boundary.

Al -- 0 to 4 inches; black (10YR 2/1) fine sandy loam; weak fine granular structure; very friable; moderately acid; gradual wavy boundary.

A2 -- 4 to 8 inches; black (10YR 2/1) fine sandy loam; weak fine granular structure; very friable; moderately acid; gradual wavy boundary.

El -- 8 to 14 inches; grayish brown (10YR 5/2) fine sand; common medium distinct black (10YR 2/1) depletions along root channels; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

E2 -- 14 to 18 inches; pale brown (10YR 6/3) fine sand; common medium distinct yellowish brown (10YR 5/6) mottles; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

Btg -- 18 to 40 inches; light brownish gray (2.5Y 6/2) sandy clay loam; common medium'distinct brownish yellow (10YR 6/8)

SERIES: Wadmalaw

SAMPLE NUMBER: S96SC019-2

COUNTY: Charleston

HORIZON	DEPTH	% SAND V COARSE	COARSE	MED.	FINE	V.FINE	TOTAL	% SILT	% CLAY	TEXTURE
A1	0-4	0.3	1.1	1.5	56.9	8.5	70.7	23.6	5.5	Fine Sandy Loam
A2	4-8	0.4	0.6	1.2	53.7	6.7	74.5	20.7	4.8	Fine Sandy Loam
E1	8-14	0.2	0.6	1.4	77.1	9.2	88.5	10.2	1.3	Fine Sand
E2	14-18	0.2	0.4	0.8	78.2	8.2	88.0	11.2	0.8	Fine Sand
Btg	16-40	0.3	0.6	1.5	49.1	8.8	59.9	16.6	23.5	Sandy Clay Loam
BCg	40-48	0.3	2.3	4.9	64.3	6.1	79.9	6.0	14.1	Fine Sandy Loam
2Cg2	64-69	0.1	0.7	3.0	64.5	1.6	69.8	9.4	20.8	Sandy Clay Loam

HORIZON	DEPTH in.	------EXTRACTABLE BASES------ Ca	Mg	K	Na	EXTRACT ACIDITY	CEC SUM CATIONS	CEC NH4OAc pH 7.0	BASE SAT SUM CATIONS --%--	EXTP Al -meq/100g-	Al SAT SUM BASES + Al --%--	ECEC BASES + Al -meq/100g-	pH	ORG C -%-
		----------meq/100g SOIL----------												
A1	0-4	3.35	0.15	0.11	0.19	10.64	14.44	9.60	26.32	0.78	17.03	4.58	4.30	5.64
A2	4-8	2.35	0.05	0.04	0.11	11.02	13.57	5.41	18.79	0.78	23.42	3.33	4.80	2.06
E1	8-14	1.40	0.02	0.02	0.09	6.46	7.99	1.47	19.15	0.90	0.00	1.53	5.70	0.22
E2	14-16	0.75	0.01	0.01	0.09	3.42	4.28	3.22	20.09	0.00	0.00	0.86	6.40	0.10
Btg	16-40	10.45	0.02	0.08	0.37	3.80	14.72	6.37	74.16	0.00	0.00	10.92	7.10	0.24
BCg	40-48	5.40	0.14	0.06	0.22	3.04	6.86	4.82	65.69	0.00	0.00	5.82	7.30	0.08
2Cg2	64-68	9.45	0.24	0.06	0.77	1.26	12.82	7.96	82.22	0.00	0.00	10.54	7.60	0.05

Clay mineralogy: Btg 50% Kaolinite [illegible] Smectite

Series:
Classification: Loamy, siliceous, thermic Grossarenic Paieudalfs
Geographic Setting: Nearly level convex slopes
Parent Materials: Sandy and loamy marine sediments
Drainage: 'Moderately well and somewhat poorly drained; slow runoff; moderate permeability
Pedon Number: S96SC019-3

TYPICAL PEDON

loamy fine sand; about 12.9 miles southwest of Hollywood; 10.2 miles west on primary state highway 162; 2.6 miles southwest on secondary state highway 346; 2400 feet northwest on farm road; site is 45 feet south of road.

A -- 0 to 6 inches; dark grayish brow (10YR 4/2); loamy fine sand; single grained; loose; moderately acid; clear wavy boundary.

El -- 6 to 21 inches; light yellowish brown (10YR 6/4) fine sand; single grained; loose; slightly acid; clear wavy boundary.

E2 -- 21 to 35 inches; very pale brow (10YR 7/3) fine sand; single grained; loose; strongly acid; clear wavy boundary.

E3 -- 35 to 42 inches; very pale brow (10YR 7/4) fine sand; common medium distinct brownish yellow (10YR 6/6) and few medium distinct yellowish brow (10YR 5/8) mottles; single grained; loose; strongly acid; clear wavy boundary.

Bt -- 42 to 50 inches; brownish yellow (10YR 6/6) fine sandy loam; common medium distinct strong brow (7.5 YR 5/8) and common medium distinct light gray (10YR 7/2) mottles; moderate medium subangular blocky structure; friable; moderately acid; clear wavy boundary.

Btgl -- 50 to 62 inches; gray (10YR 611) sandy clay loam; common medium distinct strong brown (7.5YR 5/8) and common medium distinct red (2.5YR 4/6) mottles; moderate medium subangular blocky structure; friable; moderately acid; clear wavy boundary.

Btg2 -- 62 to 66 inches; gray (10YR 6/1) sandy clay loam; few medium faint greenish gray (5BG 6/1) and few weak distinct yellowish brow (10YR 5/8) mottles; moderate medium subangular blocky structure; friable; moderately acid; clear wavy boundary.

2BCg -- 66+; light brownish gray (2.5Y 612) sandy clay loam; common medium distinct yellowish red (5YR 516) mottles; moderate medium subangular blocky structure; friable; moderately acid; clear wavy boundary.

SERIES:

SAMPLE NUMBER S96SC019-1

COUNTY: Charleston

HORIZON	DEPTH	% SAND V COARSE	COARSE	MED	FINE	V.FINE	TOTAL	% SILT	% CLAY	TEXTURE
Ap	0-8	1.0	1.1	7.1	70.9	6.0	86.2	5.9	7.9	Loamy Fine Sand
E1	8-21	0.3	1.2	7.2	74.5	6.1	89.2	7.8	3.0	Fine Sand
E2	21-35	0.1	0.9	7.5	77.1	4.7	90.2	5.9	3.9	Fine Sand
E3	35-42	0.2	0.8	5.5	79.6	6.5	92.5	3.8	3.7	Fine Sand
Bt	42-50	0.1	0.4	2.4	65.7	6.5	74.9	7.3	17.8	Fine Sandy Loam
Btg1	50-62	0.1	0.3	2.2	55.6	10.4	68.6	7.9	23.5	Sandy Clay Loam
Btg2	62-66	0.2	0.5	1.9	50.3	13.7	66.5	0.1	33.4	Sandy Clay Loam
2BCg	66+	0.1	0.2	1.9	24.6	22.0	48.7	25.9	25.4	Sandy Clay Loam

HORIZON	DEPTH in.	EXTRACTABLE BASES Ca (meq/100g SOIL)	Mg	K	Na	EXTRACT ACIDITY	CEC SUM CATIONS	CEC NH4OAc pH 7.0	BASE SAT SUM CATIONS --%--	EXTR Al -meq/100g-	Al SAT SUM BASES + Al --%--	ECEC BASES + Al -meq/100g-	pH	ORG C -%-
Ap	0-8	1.50	0.17	0.10	0.07	9.12	10.96	3.33	16.79	0.00	0.00	1.84		
E1	8-21	0.70	0.07	0.05	0.08	7.27	8.17	9.36	11.08	0.00	0.00	0.90		
E2	21-35	0.28	0.02	0.02	0.06	3.80	4.18	0.42	9.09	0.00	0.00	0.38		
E3	35-42	0.26	0.06	0.04	0.07	2.66	3.09	0.42	13.92	0.00	0.00	0.43		
Bt	42-50	3.85	0.91	0.09	0.10	4.18	9.13	4.68	54.22	0.00	0.00	4.95		
Btg1	50-62	6.75	1.49	0.13	0.13	4.56	13.06	7.46	65.08	0.00	0.00	8.50		
Btg2	62-66	10.10	2.16	0.19	0.19	2.66	15.30	7.91	82.61	0.00	0.00	12.64		
2BCg	66+	7.75	1.99	0.15	0.06	2.28	12.23	8.83	81.36	0.00		9.95		

Clay mineralogy: Bt 55 kaolinite 25 smectite
Btg1 45 kaolinite 45 smectite

Series: Ogeechee
Classification: Fine-loamy, siliceous, thermic Typic Endoaquults.
Geographic Setting: Nearly level flats, drainageways, and slight depressions
Parent Materials: loamy fluvial and marine sediments
Drainage: Poorly drained; slow runoff; moderate permeability
Pedon Number: S96SC019-4

TYPICAL PEDON

Cgeechee loamy fine sand: about 12.9 miles southwest of Hollywood; 10.2 miles west on primary state highway 162; 2.6 miles southwest on secondary state highway 346; 1050 feet northwest on farm road; 2100 feet south on unmarked farm road; site is 52 feet west of road.

0 -- 1/2 to 0 inches: very dark brow (10YR 2/2) fibric material; 75 percent fibric material after rubbing; friable; fibers are of moss leaves, twigs and roots; extremely acid; gradual wavy boundary.

A -- 0 to 6 inches; black (10YR 2/1) loamy fine sand; weak fine granular structure: very friable; extremely acid; gradual wavy boundary.

El -- 6 to 9 inches; dark grayish brow (10YR 4/2) fine sand weak fine granular structure; very friable; extremely acid; gradual wavy boundary.

E2 -- 9 to 20 inches; light brownish gray (10YR 6/2) fine sand; weak fine granular structure; very friable; very strongly acid; gradual wavy boundary

Btgl -- 20 to 28 inches; gray (10YR 6/1) sandy day loam; common medium distinct reddish yellow (7.5YR 6/8) mottles; moderate medium subangular blocky structure; friable; very strongly acid; gradual wavy boundary.

Btg2 -- 28 to 42 inches; gray (N/5) sandy clay loam; common medium distinct yellowish brow (10YR 5/8) mottles; moderate medium subangular blocky structure; friable; very strongly acid; gradual wavy boundary.

Bcg -- 42 to 62 inches: light brownish gray (2.5Y 6/2) loamy fine sand; common medium distinct yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; friable; few medium distinct gray (N/5) day depletions on surface of peds; very strongly acid; gradual wavy boundary.

2Cgl --

SERIES: Ogeechee

SAMPLE NUMBER: S96SC019-4

COUNTY: Charleston

HORIZON	DEPTH	V COARSE	COARSE	MED.	FINE (% SAND)	V.FINE	TOTAL	% SILT	% CLAY	TEXTURE
A	0-6	1.1	1.5	2.6	66.2	8.7	80.0	14.8	5.2	Loamy Fine Sand
E1	6-9	0.4	1.7	2.6	76.6	9.8	91.0	6.5	2.5	Fine Sand
E2	9-20	0.3	1.8	3.0	78.7	9.2	93.2	4.8	2.0	Fine Sand
Btg1	20-28	0.3	1.0	2.4	50.9	7.2	61.7	17.8	20.5	Sandy Clay Loam
Btg2	28-42	0.1	0.9	1.6	55.9	7.3	65.7	14.2	20.1	Sandy Clay Loam
BCg	42-62	0.7	7.0	5.5	62.1	7.6	82.9	5.2	11.9	Loamy Fine Sand
2Cg1	62-68	0.1	0.7	2.6	54.9	3.1	61.3	15.7	23.0	Sandy Clay Loam
2Cg2	68-70	0.1	0.6	1.3	50.3	8.3	60.5	15.5	24.0	Sandy Clay Loam

HORIZON	DEPTH in.	Ca (EXTRACTABLE BASES)	Mg	K	Na	EXTRACT ACIDITY	CEC SUM CATIONS	CEC NH4OAc pH 7.0	BASE SAT SUM CATIONS --%--	EXTR Al -meq/100g-	Al SAT SUM BASES + Al --%--	ECEC BASES + Al -meq/100g-	pH	ORG C --%--
		meq/100g SOIL												
A	0-6	0.18	0.72	0.14	0.13	23.56	24.23	8.13	2.77	2.55	79.19	3.22	3.90	3.72
E1	6-9	0.04	0.03	0.03	0.07	9.88	10.05	2.74	1.69	1.33	88.67	1.50	4.40	0.93
E2	9-20	0.05	0.02	0.01	0.06	6.46	6.60	0.95	2.12	0.56	60.00	0.70	4.60	0.14
Btg1	20-28	0.05	0.48	0.04	0.20	6.36	9.16	4.83	8.73	3.00	78.95	3.80	4.50	0.12
Btg2	42-62	0.07	1.05	0.08	0.22	13.68	15.13	5.82	9.56	4.73	76.54	6.16	4.50	0.17
BCg	42-62	0.20	0.75	0.05	0.17	9.50	10.67	5.72	10.97	2.97	71.74	4.14	4.70	0.09
2Cg1	62-68	0.85	1.40	0.06	0.18	16.20	12.30	5.55	16.59	1.69	46.09	3.93	4.80	0.06
2Cg2	68-70	1.35	1.91	0.59	0.19	7.60	11.14	7.71	31.76	1.76	33.46	5.32	5.20	0.07

Clay mineralogy: Btg1 70 kaolinite 20 smectite
Btg2 60 kaolinite 30 smectite

Series: Chipley
Classification: Thermic, coated Aquic Quartzipsamments.
Geographic Setting: Nearly level and gently sloping uplands
Parent Materials: Sandy marine sediments
Drainage: Moderately well and somewhat poorly drained;very slow runoff; rapid and very rapid permeability
Pedon Number: S96SC019-5

TYPICAL PEOON

Chiptey fine sand; about 12.9 miles southwest of Hollywood; 10.2 miles west on primary state highway 162; 1.9 miles southwest on secondary state highway 346; 1100 feet southwest on farm road; 2100 feet south on unmarked farm road; site is 200 feet south of road.

A – 0 to 6 inches; very dark grayish brown (10YR 3/2) fine sand: weak fine granular structure; very friable; strongly acid; abrupt smooth boundary.

Cl - 8 to 19 inches; yellowish brown (10YR 5/6) fine sand; single grained; loose; strongly acid; gradual wavy boundary

C2 - 19 to 39 inches; brownish yellow (10YR 6/6) fine sand; common medium distinct very pale brown (10YR 7/3) mottles; single grained; loose; very strongly acid; gradual wavy boundary.

C3 - 39 to 55 inches; brownish yellow (10YR 6/6) fine sand; common medium distinct very pale brown (10YR 7/3) and common medium distinct strong brown (7.5YR 5/8) mottles; single grained; loose; strongly acid; gradual wavy boundary.

C4 - 55 to 65 inches; very pale brown (10YR 7/3) fine sand; few weak distinct yellowish brown (10YR 5/8) mottles; single grained; loose; moderately acid; gradual wavy boundary.

SERIES Chipley

SAMPLE NUMBER S96SC019-5

COUNTY: Charleston

HORIZON	DEPTH	V COARSE (% SAND)	COARSE (% SAND)	MED. (% SAND)	FINE (% SAND)	V.FINE (% SAND)	TOTAL (% SAND)	% SILT	% CLAY	TEXTURE
Ap	0-8	0.1	0.2	3.9	85.3	1.9	91.3	6.6	2.1	Fine Sand
C1	8-19	0.7	1.2	7.6	80.4	2.1	91.9	5.3	2.8	Fine Sand
C2	19-39	0.1	0.2	3.0	86.5	2.6	92.3	3.5	4.2	Fine Sand
C3	39-55	0.1	0.1	2.6	89.4	3.0	95.2	0.9	3.9	Fine Sand
C4	55-65	0.0	0.0	2.3	94.1	1.7	98.3	0.1	1.6	Fine Sand

HORIZON	DEPTH in.	Ca	Mg	K	Na	EXTRACT ACIDITY	CEC SUM CATIONS	CEC NH4OAc pH 7.0	BASE SAT SUM CATIONS --%--	EXTR Al -meq/100g-	Al SAT SUM BASES + Al --%--	ECEC BASES + Al -meq/100g-	pH	ORG C -%-
		------EXTRACTABLE BASES------												
		-----	-----	-----	meq/100g	SOIL-----	-----	-----						
Ap	0-8	0.70	0.08	0.10	0.07	21.28	22.23	3.12	4.27	0.56	37.09	1.51	5.30	1.63
C1	8-19	0.21	0.02	0.04	0.06	14.82	15.15	0.82	2.18	0.22	40.00	0.55	5.10	0.12
C2	19-39	0.16	0.02	0.02	0.06	14.06	14.32	0.94	1.82	0.33	55.93	0.59	5.00	0.07
C3	39-55	0.05	0.01	0.01	0.08	4.18	4.33	0.70	3.46	0.11	42.31	0.26	5.20	0.02
C4	55-65	0.06	0.01	0.01	0.10	3.64	3.22	0.31	5.59	0.00	0.00	0.18	5.70	0.0.

Series: Centenary
Classification: Sandy, siliceous, thermic Grossarenic Entic Alorthods.
Geographic Setting: Nearly level and gently sloping broad flats
Parent Materials: Sandy marine sediments
Drainage: Well and somewhat excessively drained; slow runoff; moderately rapid permeability
Pedon Number: S96SC019-6

TYPICAL PEDON

Centenary fine sand; about 1.0 mile west of Ravenel; 0.7 mile northwest on US 17; 860 feet southwest on New Road; site is on the roadbank.

A -- 0 to 7 inches; dark gray (10YR 4/1); tine sand; single grained; loose; extremely acid; gradual smooth boundary.

El - 7 to 18 inches; dark yellowish brown (10YR 4/4) fine sand; single grained; loose; very strongly acid; gradual wavy boundary.

E2 - 18 to 24 inches; brownish yellow (10YR 6/6) fine sand; few weak distinct yellowish brown (IOYR 5/8) and few weak distinct very pale brown (10YR 7/3) mottles; single grained; loose; very strongly acid; gradual wavy boundary.

E3 - 24 to 36 inches: brownish yellow (10YR 6/8) fine sand; common medium distinct light yellowish red (5YR 5/8) and few medium distinct very pale brown (10YR [illegible]

SERIES: Centenary

SAMPLE NUMBER: S96SC019-6

COUNTY: Charleston

HORIZON	DEPTH	V.COARSE	COARSE	MED.	FINE	V FINE	TOTAL	% SILT	% CLAY	TEXTURE
		% SAND								
A	0-7	0.9	1.8	5.5	81.9	2.1	92.2	3.5	4.3	Fine Sand
E1	7-18	0.3	0.8	4.5	82.4	2.4	90.3	5.3	4.4	Fine Sand
E2	18-24	0.1	0.4	4.0	83.9	3.0	91.2	4.0	4.8	Fine Sand
E3	24-36	0.2	0.2	3.7	83.4	1.8	89.3	5.5	5.2	Fine Sand
E4	36-51	0.1	0.4	3.6	92.3	2.2	98.5	0.3	1.2	Fine Sand
Bh	51+	0.1	0.5	8.4	84.8	1.5	95.3	0.8	3.9	Fine Sand

HORIZON	DEPTH in.	Ca	Mg	K	Na	EXTRACT ACIDITY	CEC SUM CATIONS	CEC NH4OAc pH 7.0	BASE SAT SUM CATIONS	EXTR Al	Al SAT SUM BASES + Al	ECEC BASES + Al	pH	ORG C	D.C. EXTR Fe
		------EXTRACTABLE BASES------													
		----------------------meq/100g SOIL----------------------							--%--	-meq/100g-	--%--	-meq/100g-		-%-	-%-
A	0-7	0.10	0.02	0.03	0.08	17.86	18.09	5.31	1.27	1.67	87.89	1.90	4.40	3.09	0.1
E1	7-18	0.03	0.01	0.02	0.06	14.06	14.18	1.51	0.85	0.44	78.57	0.56	5.00	0.76	0.1
E2	18-24	0.04	0.01	0.02	0.06	12.54	12.67	0.88	1.03	0.44	77.19	0.57	4.90	0.22	0.1
E3	24-36	0.11	0.04	0.04	0.06	11.78	12.03	1.45	2.06	0.33	56.90	0.58	5.10	0.15	0.1
E4	36-51	0.03	0.01	0.01	0.04	10.26	10.35	0.05	0.87	0.00	0.00	0.09	5.40	0.04	TR.
Bh	51+	0.06	0.01	0.04	0.06	12.54	12.71	3.79	1.34	0.44	72.13	0.61	5.20	0.63	TR.

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Series: Leon
Classification: Sandy, siliceous, thermic Aeric Haptaquods.
Geographic Setting: Nearly level and gently sloping broad flats and slight depressions
Parent Materials: Sandv marine sediments
Drainage: Poorly and very poorly drained; slow runoff or ponded; moderately rapid or moderate permeability
Pedon Number: S96SCO18-6

TYPICAL PEDON

Leon fine sand; about 1.0 mile west of Ravenel; 0.7 mile northwest on U.S. 17; 2.6 miles southwest on New Road; site is on the roadbank.

A -- 0 to 8 inches; black (10YR 2/1) fine sand; weak fine granular structure; very friable; ultra acid; gradual wavy boundary.

E -- 8 to 16 inches; gray (10YR 6/1) fine sand; weak fine granular structure; very friable; extremely acid; gradual wavy boundary.

Bhl- 16 to 24 inches; black (10YR 2/1) fine sand; weak fine granular structure; very friable; extremely acid; gradual wavy boundary.

Bh2- 24+ inches; dark reddish brown

SERIES. Leon

SAMPLE NUMBER 896SC019 8

COUNTY Charleston

HORIZON	DEPTH	V.COARSE	COARSE	MED	% SAND FINE	V.FINE	TOTAL	% SILT	% CLAY	TEXTURE
A	0-8	2.1	1.7	10.2	77.9	1.3	93.2	6.0	0.8	Fine Sand
E	8-16	0.5	0.3	4.6	87.7	1.6	94.8	4.5	0.7	Fine Sand
Bh1	16-24	0.2	0.6	7.5	81.1	1.2	90.6	6.0	1.4	Fine Sand
Bh2	24+	0.5	0.5	13.5	76.5	1.1	92.0	6.3	1.7	Fine Sand

HORIZON	DEPTH in.	EXTRACTABLE BASES Ca	Mg	K	Na	EXTRACT ACIDITY	CEC SUM CATIONS	CEC NH4OAc pH 7.0	BASE SAT SUM CATIONS	EXTR Al	Al SAT SUM BASES + Al	ECEC BASES + Al	pH	ORG C	D.C. EXTR Fe
		meq/100g SOIL							--%--	-meq/100g-	--%--	-meq/100g-		-%-	-%-
A	0-8	0.05	0.12	0.10	0.18	47.12	47.57	9.36	0.95	2.66	85.53	3.11	3.20	6.18	TR.
E	8-16	0.03	0.04	0.01	0.05	6.46	6.59	1.11	1.97	0.22	62.86	0.35	4.30	0.34	TR.
Bh1	16-24	0.02	0.07	0.04	0.09	40.66	40.88	19.21	0.54	5.00	95.79	5.22	3.60	4.96	TR.
Bh2	24+	0.04	0.03	0.02	0.13	45.60	45.82	23.40	0.48	3.66	94.33	3.88	4.40	5.08	TR.

National Soil Information System (NASIS)

Presented by

Dennis J. Lytle
at the
South Regional NCSS Work Planning Conference
April

NATIONAL SOIL INFORMATION SYSTEM (NASIS)
IMPLEMENTATION PLAN
FEBRUARY 23, 1996

The Soil Survey Division has developed and maintained a NASIS Transition Action Plan through the Soil Business Area Analysis Group (SBAAG). This implementation plan is an update and expansion of the work SBAAG has done. The creation of the MLRA Offices (MO) has added another level resulting in this implementation plan to address the software and hardware environment as well as policy, cultural, training, support, and communication issues. In addition to MOs, this plan does address implementation of NASIS at Soil Survey Project Offices and State Offices.

Why NASIS

Starting in about 1985 the Soils Division of NRCS began an effort to reevaluate the soil database. Our current system of building and maintaining the soil databases lacked some important capabilities. Some of those missing capabilities that were identified are listed below:

- No capability to handle MLRA soil surveys
- Inadequate security scheme
- Did not directly support ecosystem based models i.e. representative values
- Uncontrolled environment which created a data quality issue
- lack of coordinated data between the State Soil Survey Database (SSSD) and the database at Iowa State University (ISU)
- Lack of coordination of soil survey symbols between published soil surveys and electronic soil databases (including FOCS)

The issues identified above plus others led to the development of NASIS. The basic premise behind NASIS was to develop a system that would provide for the collection, storage, manipulation, and dissemination of soil survey information. This system was to be flexible enough to withstand changes in how we collect, manage, and maintain soils data and not require retooling. The reorganization of NRCS provided a significant test of the flexibility of NASIS. No reprogramming of NASIS was required to accommodate the creation of the MOs. We fully expect the flexibility of NASIS to be tested many more times in the coming years and we are confident that it will pass those tests also. The work done on this project since 1985. way before any actual software development began, has provided us with that level of confidence.

NASIS 1.0 was released October, 1994 and NASIS 2.0 was released October, 1995. These releases and future releases, planned on a yearly basis, provide the Soil Survey Program many new and enhanced capabilities. Some of those capabilities are as follows:

- Build and manage the soil database at the field level
- Quickly and easily revise and maintain soil properties and interpretations
- Provide needed flexibility to add new national or unique local data elements and generate appropriate interpretations
- Incorporate digitized spatial data to create SSURGO. STATSGO, NATSGO, and other products
- Provide for quick and easy evaluation and coordination of soil properties and interpretations
- Meet soil data needs of ecosystem based modes
- Provide the framework for enhanced levels of data validation and data quality

An added advantage with the NASIS software has been the realization that ii can be used by other natural resource disciplines for their database development and maintenance. Currently a prototype of the Plants database in the NASIS software. is being developed. No reprogramming of NASIS will be required to achieve this goal.

Impacts of not having NASIS

If NASIS were not implemented nationwide in all MOs, State Offices. and Project Offices the impact, especially financially, would be large. Some of these impacts are as follows:

- Costs for maintaining the current agreements with ISU at a cost of $675,000 vs. $500,000 with NASIS implementation
- Costs to reprogram existing mainframe soils data at ISU to the new ISU mini system (estimate 2-3 yeas time frame with total cost about $1.5 million)
- Major changes required to State Soil Survey Database (SSSD) to meet soil data needs of ecosystem based models (basically add NASIS capability to SSSD at greater cost and less functionality than NASIS provides)

ISU mainframe going off-line

We have developed a detailed transition plan of ISU mainframe going off-line and it is being implement& The data (SOI-6 and SOI-5) and corresponding programs we have on the mainframe computer at ISU will be going off-line effective June 1, 1996. The impacts from the state and agency Perspective is large. From the perspective of many states the mainframe shutdown is the elimination of the way we have done things for 25 years. NASIS is new and different to them. The training on NASIS. that will continue this year and into the future, is designed to smooth the transition.

From the perspective of the agency the financial commitment we have with ISU will be reduced. This savings will be realized beginning in FY97. The Soils Division will, after June 1, still be maintaining the Official Series Descriptions at ISU. ISU has also been the site of a prototype of a National Soil Data Access Facility (NSDAF). This prototype has been used for things such as the National Hydric Soils list The work on NSDAF will continue. but using the NASIS environment.

Extent of NASIS implementation

As stated earlier NASIS needs to be implemented in all MOs, State Offices, and Project Offices. Details of how we intend to fulfill that goal is in the implementation plan. We have chosen to pattern our plan after the FOCS implementation plan.

NASIS needs to be fully implemented i.e. software installed, data converted, and each soil scientist trained in 50 State Offices plus Puerto Rico and Guam, 17 MOs, and 210 Project Offices. The following table lists the number of Project Offices by MO.

MO#	MO Location	# of Project Offices	MO#	MO Location	# of Project Offices
1	Portland, OR	9	11	Indianapolis, IN	15
2	Davis, CA	6	12	Amherst, MA	17
3	Reno, NV	4	13	Morgantown, WV	23
4	Bozeman, MT	12	14	Raleigh, NC	23
5	Salina, KS	7	15	Auburn. AL	14
6	Lakewood, CO	12	16	Little Rock, AR	16
7	Bismarck, ND	9	17	Anchorage, AK	4
8	Phoenix, AZ	7			
9	Temple, TX	12			
10	St. Paul, MN	20			

NASIS INFORMATION SHEET

Advantages of Having NASIS

- Build and manage the soil database at the field level
- Quickly and easily revise and maintain soil properties and interpretations
- Provide needed flexibility to add new national or unique local data elements and generate appropriate interpretations
- Incorporate digitized spatial data to create SSURGO, STATSGO, NATSGO and other products
- Provide for quick and easy evaluation and coordination of soil properties and interpretations
- Meet soil data needs of ecosystem based models (representative values, algorithms built into data dictionary)
- Provide framework for enhanced levels of data validation and data quality

Impacts of Not Having NASIS

- Costs for maintaining agreements with ISU at $675,000 per year
- Costs to reprogram existing mainframe soils data to the new ISU mini system (estimate 2-3 year time frame with total cost about $1.5 million)
- Major changes required to SSSD to meet soil data needs of ecosystem based models (basically add NASIS capability to SSSD at greater cost and less functionality than NASIS provides)

How to Defend Big Ticket Spending

- Track record - NASIS 1.0 and 2.0 delivered on time (Oct. 1991 and Oct. 199.5)
- Transition NRCS for the future with information highway technology and client/server technology in alignment with InfoShare
- Better capability to respond to customer needs
- Increased use of technology to enable more work with less resources
- Multiple use software - ability to use NASIS to manage other natural resource databases (e.g., plants, NRI data)

Why SSSD Will Not Suffice

- No capability to handle MLRAs
- Inadequate security scheme
- Does not Directly Support Ecosystem based models (representative values)
- Uncontrolled environment (data quality issue)
- Lack of coordinated data between SSSD and database at ISU
- Lack of coordination of soil survey symbols between published soil surveys and electronic soil databases (including FOCS)

What Products Does NASIS Provide We Cannot Get Anywhere Else

- Management of MLRAs
- Enhanced security of data
- Generation of interpretations tailored to local conditions
- Data dictionary driven interface allows addition of new tables and data elements without having to reprogram any modules
- Coordination of soil survey data between published soils surveys, electronic soil databases. and end users (includes FOCS)
- Soil Survey database (information system) for the National Cooperation Soil Survey

NCSS Southern Region Soil Survey Conference
Charleston, South Carolina
April 15-19, 1996

Report for Committee 2 - Research Needs

CONTENTS

Part 1. Background prior to Conference

Charges to committee from Ben Stucky and Bill Smith

Letter and questionnaire to members of Committee 2

NCSS Southern Work Planning Conference
Charleston, South Carolina
April 15-19, 1996

Committee 2
Research Needs

To:

Bob Ahrens
Tom Ammons
Frederick Beinroth
Steve Coleman
Milton Cortez
Everett Emino
R.W. Griffen
C.T. Hallmark
G. Wade Hurt
John Kimble
Dewayne Mays
W. Frank Miller
Dan Neary
J.M. Soileau
Clyde Stahnke
Allan Tiarks
M.J. Vepraskas
Doug Wysocki

Page **3** is the information sent to me by Ben Stuckey for Committee 2. I am sending this communication to each of the NCSS Cooperators and asking for their contributions, with emphasis on charge 2.

Please have your replies to Warren Lynn by **5 April 1996** at NRCS - Soil Survey Lab, Federal Building, Room 152, Mail Stop 41, Lincoln, NE 68508. Fax 402-437-5760

Would you do the following relative to the charges brought before the committee:

Charge 1. Inventory existing research.

Please indicate what you think a useful and workable inventory would comprise. The following questions come to my mind:

- a list of publications?
- organized by selected topics?
- paper copy included with report of conference?
- to be accessed and updated?

Charge 2. Identify current research that supports the NCSS.

Please list briefly (but in enough detail so the reader will get the idea) research being actively conducted in your state or area. I think this could be a most useful exercise and it is the major effort I will ask of you.

Charge 3. Determine research needs to support the NCSS.

Please indicate 2 or 3 most pressing needs or concerns that are evident to you. Please give them a priority ranking. From this we might do two things: 1) Pick out two to four priority needs that are identified commonly through the region, and 2) compare this with the information gathered for Charge 2, to identify matches and holes.

Charge 4. Recommend method for disseminating data throughout the region.

My assumption is the charge pertains to factual descriptive and analytical data, rather than to generalized data (series, interpretation records). To set up a method is a large and time-consuming task. Would it be done by each state and/or analytical laboratory? Would it be done from a common data base?

Any comments you have are welcome. However, please include suggestions on who and how the should be done, and how that effort could be funded.

Letter to Cooperators in 1862 Land Grant Universities in the Region

NCSS Southern Work Planning Conference
Charleston, South Carolina
April 15-19, 1996

Committee 2
Research Needs

To: NCSS Cooperators in Land Grant Universities in the South Region (who are not members of Committee 2

Stan Buol
Brian Carter
Mary Collins
Ben Hajek
Wayne Hudnall
A. D. Karathanasis
David Pettry
Moye Rutledge
Bill Smith
Larry West
Larry Wilding

I am writing you on behalf of Committee 2 - Research Needs for the Work Planning Conference in Charleston. Your input is important for the committee to discharge its responsibilities.

Attached is a communication sent to committee members plus the information sent to me by Ben Stuckey, one of the coordinators of the conference.

We would like your input especially on Charge 2 - Identify current research that supports the NCSS. Of course your comments on any of the other charges are welcome and would be appreciated.

Please **have your replies to me by 5 April 1996.**

Sincerely,

Warren Lynn

Letter to Cooperators in 1890 Land Grant Universities.

NCSS Southern Work Planning Conference
Charleston, South Carolina
April 15-19, 1996

Committee 2
Research Needs

To: NCSS Cooperators in 1890 Land Grant Institutions and Tuskegee University (who are not members of Committee 2.

James W. Shuford	Alabama A&M University
Samuel Donald	Alcom State University
U.S. Washington, Jr.	Delaware State College
Robert Bradford	Florida A&M University
Fred Harrison, Jr.	Fort Valley State College
Harold R. Benson	Kentucky State University
Ocleris Simpson	Langston University
John Warren	Lincoln University
Godfrey A. Uzochukwu	North Carolina A&T State University
Leon G. Chavous	South Carolina State College
Bobby R. Phills	Southern University
Troy Waketield, Jr.	Tennessee State University
Leslie Glover	University of Arkansas-Pine Bluff
Mortimer Neufville	University of Maryland - Eastern Shore
B. B. Archer	Virginia State University
Audry Trottman	Tuskegee University

I am writing you on behalf of Committee 2 - Research Needs for the Work Planning Conference in Charleston. Your input is important for the committee to discharge its responsibilities. Attached is a communication sent to committee members plus the information sent to me by Ben Stuckey, one of the coordinators of the conference.

We would like your input especially on Charge 2 - Identify current research that supports the NCSS. Of course your comments on any of the other charges are welcome and would be appreciated.

Please have your replies to me by 5 April 1996.
My apologies if this does not reach the right person; my list is a bit out of date.

Sincerely,

Warren Lynn

Part 2. Replies to questionnaire received prior to the Conference.

Charge 1. Inventory existing research.

From: Allan Tiarks - USFS, Southern Research Station, LA

1. Past attempts at cataloging important research, especially long term (>20 years), have not proved useful. People working in the area are aware of 95% of past research. A broad base is desired, but it is overwhelming to include all near-relevant publications.

2. One possibility is to develop a list of completed or nearly completed field studies that have never been published. If someone wants to do a similar project. They could at least look at the existing data and methodology. This would allow new and old measurements to be correlated and possibly combined.

From: Richard Griffin - Prairie View A&M, TS

1. Useful for developing literature reviews. Needs to be updated to evaluate current trends and for comparison.

From: Bob Ahrens - NSSC, NE

1. A list of publications, theses, dissertations, organized, by key words or accessible by key words would be useful. It should be updated every 2 years when regional work planning conferences are held.

Charge 2. Identify current research that supports the NCSS.

From Larry West - University of Georgia

1. Monitoring water table depths at selected sites in the Georgia Coastal Plain.
2. Distribution and genesis of bi-sequal Spodosols in SE Georgia (Ware County).
3. Hydraulic properties of Plinthic and Typic Kandiudults in Coastal Plain of Georgia.
4. Use of GPS to produce large scale soil survey.
5. Identification and distribution of marine sediment cover on Piedmont on Georgia.
6. Inventory native concentration of heavy metals in major soils of Georgia.

From Allan Tiarks - USFS - Southern Research Station, LA

1. Growth measurements on trees of 3 southern pine species planted in the mid 50's at 80 sites in LA and MS used to find soil properties that control performance of the different species.

2. Long term (60+ years) soil productivity testing compaction and organic residue removal on sites in NC, MS, LA, and TX. Effects of harvesting and soil compaction on soil temperature and water regimes.

Prom: Richard Griffin - Prairie View A&M, TX

1. Water table monitoring (piezometers, tensiometers, redox potential, Fc by dipyridyl; intensive and generalized sites.
2. Aquatic ecosystem restoration (marsh soil characterization and assessment of accretion or loss of sediment.
3. Morphological relationships between landscape positions with redoximorphic features as markers.
4. Organic carbon - microbial interactions in flooded soils.

From: Stan Buol - North Carolina State Univ. - NC

1. Soil temperature regime verification (thermic, mesic, frigid) by NCSS personnel.
2. Subsoil changes resulting from intensive crop management (Ultisol → Alfisol). Test results at NCSU show greatly improved base saturation in subsoils to 1.5 m (Buol).
3. Mineralogical alterations within the saprolite (Cr) horizons below soils in the Piedmont (Buol).
4. Redoximorphic features (Hydric soil criteria) in soils. (Vepraskas)
5. Wetland restoration (Brooke) and buffer zone research (Gilliam).

From: Dave Pettry - Mississippi State Univ., MS

1. Conduct soil characterization analyses of representative soils to support progressive soil surveys.
2. Conduct hydrologic, morphological, physical, chemical, and mineralogical studies of selected soils for proper classification and interpretation
3. Conduct groundwater studies on selected soils to determine temporal water table levels,
4. Conduct field and laboratory studies of selected soils classed hydric.
5. Determine waste assimilation capacities of selected soils and effects on water quality.
6. Determine heavy metal contents of representative soils.
7. Conduct field and laboratory studies of soils containing fragipans and plinthite.
8. Conduct field and laboratory studies of selected paleosols and prairie soils.

From: Vernon L. Jones - Langston University, OK

1. Movement of nitrates from commercial fertilizers is a public concern; the nitrates pose a threat to groundwater supplies. Legumes are used by many producers as nitrogen sources for subsequent crops in hopes of reducing nitrate leaching from fertilizers. However, more information is needed on the extent of nitrate leaching from nitrogen fixed biologically by legumes. A project was initiated this spring at Langston University to examine nitrate leaching in the profile under selected summer legumes.

From: Wade Hurt - NRCS with US Fish & Wildlife Service, St. Petersburg, FL

1. I assisted Dr. Stephen Faulkner install wetland monitoring instruments in Mississippi, Alabama, and Florida. Dr. Faulkner leads a nation-wide effort to obtain data that will either validate of improve the current three-parameter approach to wetland identification. The approach is to obtain temporal and long-term data that will provide a correlation among soils, hydrology, and vegetation; sites will be monitored biweekly

or more often during periods of high rainfall. After two years of data collection the computer model DRAINMOD will be utilized to model long term hydrology.

Piezometers were installed at depths of 30, 60, and 90 cm; an observation well installed at 90 cm; and platinum electrodes installed at 15, 30, and 60 cm. Sites arc located at:

- Mississippi Sandhill

1. It would be nice if all analytical data were available form a central location, such as the NSSC. That way, anyone could access the data.

From: Stan Buol - North Carolina State Univ. - NC

1, Data should be organized as a national data base by the NRCS with cooperation by Universities and other sources.

Part 3. Notes gathered in committee sessions at the Conference

Warren Lynn and Richard Griffin co-chaired the sessions

Charge 1. **Existing research**

Existing compilations of existing research could be queried and collected if the appropriate key words could be entered. The Soil Survey Lab or NSSC could distribute a list of publications available and where they can be obtained, particularly Keys to Soil Taxonomy, SSIR 42, SSIR45, as well as listing of other SSIR's. A list of publications by Cooperators that directly apply to the NCSS would be useful to the NRCS and to each other. The NSSC, principally the Soil Survey Investigations people, have developed a list of publications they have generated for 1991 to present that support the soil survey. A similar list combining the work of Cooperators and others in the NCSS in this Conference might be appropriate and useful.

CRIS research projects at Land Grant schools have to be registered; might check with the National Ag library. Might be able to obtain a list of theses from university libraries. Soils library in Temple, TX has a bibliography available on spreadsheet or Microsoft Word.

Charge 2. Current research

Oklahoma - Dr. Sharpley at the ARS Research Station at Durant, Oklahoma, is conducting research on phosphate contamination from chicken and swine waste.

Heavy metal studies: Florida - Willie Harris at University of Florida plans to determine heavy metals on 500 surface samples from the sample library of the soil characterization laboratory.

Waste applications to soil; septic systems; sewage sludge is hauled out of Washington, DC. into Virginia. What is effect on soil quality?

Temperature studies in Virginia; Study on nitrate leaching at Virginia State, similar to study described at Langston University in Oklahoma.

California has measured soil temperature on a number of places on April I5 and September 15 each year (prompted by Otto Baumer to take advantage of the crossover point in the warming and cooling curve, respectively, when the soil temperature at all depths is about the same temperature.

Proposal to study the rusting of buried fuel storage tanks and the effect on the adjacent soil.

Need to be asking: What questions do we need to be solving? Why would I spend the public's money on this research?

Organic carbon sequestration! global change projects -publication is available

Charge 3. Needed research

Water tables and predicting water movement through soils. Current water table studies should be expanded into new areas. If water table monitored by survey party, monitoring could be continued by resource soil scientists after survey party leaves. Effect of cultivation and plow pan formation on water movement - new phase of same soil? Need to verify the apparent vs perched water tables identified for soil series; NASIS has entries for high and low water table as well as kind of water table.

Irrigation, pesticides on sugar cane land in Florida have caused problems in the Everglades, including phosphate and nitrate, including release of green house gases via reduction of nitrates.

Water quality - nitrate/phosphate from agriculture. Are there funding possibilities for such research?

Waste applications: Site evaluations for waste disposal. Kinds of waste application include chicken manure, swine waste, wetland cells for tertiary treatment of municipal waste. Loading effect from additions of wastes of various kinds (municipal, chicken litter, feed yards, canneries). One approach is to develop a waste loading potential, a standard waste loading method and apply to a broad number of soils that could be selected from the Soil Survey Lab soil library.

Mobile irrigation laboratories to test soil physical properties and water movement. For purpose of ground truthing water release curves that have been run on samples in the lab (University of Florida).

Run tests on hydraulic conductivity and/or the Amoozemeter / Guelph Permeameter type of field percolation type tests.

Hydric soils and redoxymorphic features.

Heavy metals in soils, impact on soil quality. Test also for lead, cadmium. Check with the Oak Ridge National Laboratory on testing they have done on heavy metals, with neutron activation analysis (H.Y. Lee).

Research needed on temporal needs such as impacts of human activity on organic matter and bulk density of surface layers for woodland interpretations.

In the southern Great Plains and westward, growing seasons by predicted frost-free dates are markedly restricted compared to observation.

Human (agricultural) influence on soils that affect classification of soils in Soil Taxonomy (reference to pre-meeting response from Buol) - sandy soils in Louisiana alter from Ultisol to Alfisol in a rather short time. How can we handle those in Soil Taxonomy. Soils on High Plains of Texas become acid with continued cropping, even when nitrogen applied as anhydrous ammonia (which causes acidity problems in eastern Nebraska)

Phosphorus study on Bosque (Texas, Golden) involves Terry Sobecki and Jerry Lamonion.

Research on Genesis and morphology.

GLOBE - Program (contact - James Lawless) to work with K-12 teachers and students to teach children how to collect data, with the twin purpose of teaching children the scientific method and to produce data to be used in scientific research intended for publication in refereed journals. After test trials a conclusion was that middle school was the age group that produced the most usable data and had the greatest interest in the project. Supporting agencies include NASA, NOAA, EPA, DOD. Think that soil measurements are a useful means of carrying out the project. Some 800 to 900 schools in the USA and 200 schools in other countries have been targeted. Funded with $15 million. Elissa Levine at NASA is part of the project. They developed soil color charts by selecting appropriate crayons.

There are kits for measuring microbial activity.

Study on MLRA 150 south Texas sand sheet. Bisequal placement of aeolian sediment of the Lissie Formation, including monitoring of wet soils that could be installed to take advantage of catena sequences.

Take advantage of Geology studies by universities applicable to soil survey areas - has been useful in Virgina - Ed Ealey.

Charge 4. Disseminating data

World Wide Web sites; national/international data base set up. Sites need to be georeferenced and US sites need to carry MLRA designation. This committee should recommend that the National Work Planning Conference establish a national - international data base from which data can be disseminated. NRCS Soil Survey Lab data base on CD rom.

Need for a common data base with standard NRCS Soil Survey Lab methods or equivalents. Is there any interest in putting money into this effort?

Program planned for Ed White (NRCS employee) to compare Penn State lab Data program and NSSC data program.

Conclusions drawn by the chair.

1. Lynn distribute the list of publications for 1991 to present compiled by the NSSC to university Cooperators, MO Leaders, State Soil Scientists with a query if they would like to contribute a similar list. I would be willing to compile the lists if they were sent to me on disk (Word for Windows preferred)

2. Pass along deliberations of this committee to parallel chairs of parallel committees in the other three work planning conferences scheduled this year.

3. Ask the national work planning conference to establish a national research committee, to include one university Cooperator and one NRCS person from each of the regional work planning conferences meeting this year.

4. Ask the national committee to consider 3 topics for priority placement on an NCSS research agenda
   A. Water table studies to include some landforms with hydric soils and associated measurements to determine redox regimes.
   B. Gathering baseline data on heavy metals, with due consideration given to utilizing soils in sample libraries for which soil characterization data are available.
   C. Establish a standard methodology for waste loading of soils for selected kinds of wastes, and use the standard method to gather data on selected soils from existing sample libraries.

5. That recommendation 4 above be conveyed to the co chairs of each of the other work planning conferences and to the chair of the research needs committee for each conference.

6. National NCSS data bases be established for:
   A. Pedon characterization data from the NRCS Soil Survey Laboratory and NCSS Cooperators in Land Grant Universities.
   B. Pedon descriptions corresponding to pedons in A.
   C. Data from the Wet Soils Monitoring projects and other water table studies by the NCSS.

7. Funding and time be alotted to accomplish tasks in item 6.

1996 South National Cooperative Soil Survey Work Planning Conference
Charleston, South Carolina

Committee 3 Final Report

Future Interpretation Needs

DISCUSSION: The results from the 1994 committee focused on water quality issues, regional criteria, and the need for interpretations on materials deeper in the soil than we presently consider. This 1996 conference report carries over the majority of these items with emphasis on key areas, as well as some recommended actions. The responses from both years are combined:

Charge 1. Identify new interpretations needed to meet future demands.

* Interpretations for groundwater vulnerability to pesticide or nitrate contamination.
* Phosphorus loading with applications of chicken litter and hog manure. Concerns of residence time vs. loading.
* Interpretations for depths greater than 2 meters. Develop methods to describe, classify, and interpret the deep materials, Take into account fracture of bedrock, dip and strike of strata, and presence of hard rock below Cr. There is a section of lithosphere between realms of geologists and soils that is not addressed. The soils discipline is best suited to assess, categorize, and classify the non-soil regolith.
* The need to better describe materials below the solum and provide interpretations that include these.
* Incorporate fuzzy logic - a continuously sliding scale: an example is that the interpretation for roads would slide as depth to bedrock is more critical at steeper slopes.
* We need the ability to predict development of a temporal properties such as traffic pans in agricultural and forestry interpretations.
* New data elements for yields on soils using nutrient management systems.
* Drained and undrained phases of soils need different interpretations for woodland, cropland and urban uses.

Charge 2. Identify present interpretations that need improvements or modifications to meet current demands and outline corrections.

* Predictions on depths and duration of water tables need improvement. Identification of water tables at depths more than 2 meters desirable for predicting response on deep-rooted species.
* Woodland site index data needs improvement. University research needs to be incorporated. Data may be available on hardwoods but needed for pines, or the inverse. Literature and research are available for converting data from one species to another. Additionally, the NRCS plants lists need revision.
* Provide more reasonable ratings for septic tank absorption fields. Soils rated severe may be quite different in their ability to perform with minor design modifications. Regional criteria are more desirable than the national "slight/moderate/severe" ratings.
* Incorporate soil criteria such as the kandic horizon into interpretations that involve CEC.
* Pesticides leaching and runoff potentials need to be reworked. As more soil properties are identified with NASIS, more sophisticated interpretations could be generated.
* We need to regionalize the national interpretation guides. The opportunity exists for accomplishing this in MLRA updates.
* Distinguish between perched and apparent water tables: concern is connection to aquifer. Need information on soil water tables, rates of water movement, and relation of morphology to water tables.
* Animal and municipal waste disposal interpretations need refinement.

Charge 3. Identify new research and investigations needed to support new interpretations.

* NASIS will require water table by month: maximum and minimum depth for upper water table; depth of bottom of water table for perched water. Also, inundation by ponding and flooding needs additional study for wetland identification and classification. MLRA updates need to include these types of studies.
* Research on permeability of various horizons, especially at greater depths, for determining effects of chemical solutes on the groundwater.
* Determine the effect of anion exchange capacity on Ultisols and soils with kandic horizons, and implications on water quality.
* Interpretations need to be on the leading edge, with an organizational structure and people to support research of existing data and get new interpretations on line. Interpretations should lead the way for mapping.
* Determine background levels of heavy metals, etc.

RECOMMENDATIONS:

1. NASIS gives the user the ability to set local criteria for interpretations.
2. There is a great need for data and research on water states and water tables and ponding, perched and apparent water tables in relation to relate to water quality, especially in MLRA update projects. NASIS requires this information. Data gathering can come from: experiment stations, technical services soil scientists, soil survey projects, local health departments, ARS, NRCS field offices.
3. All materials to a depth of at least 2 meters need to be interpreted. Develop methods to describe, classify, and interpret the deep materials. Take into account fracture of bedrock, tilt of strata, and presence of hard rock below Cr within 2 meters.
4. Develop sliding scale for interpretations. Allow capability to regionalize interpretations. These efforts should be a coordinated effort in MLRA updates.
5. Work with NCSS cooperators in improving woodland site index data and plant lists. Plants list is presently frozen. Make contacts with persons at the national level responsible for these items.
6. Select work group from pool on NCSS cooperators to draft soil criteria for needed interpretations.
7. Present rating systems of good, fair and poor, has its advantages for large scale generalizations.
8. The NASIS interpretations generator handles many of the concerns expressed here. Data gathering is a primary necessity. Coordination is needed with NCSS cooperators in accomplishing this task. Work groups will have to be organized. It was recommended that this committee should not be continued.

SOUTHERN REGIONAL COOPERATIVE
SOIL SURVEY CONFERENCE
Charleston, South Carolina
April 15 - 19, 1996

Committee #5 - Future of the South Regional Work Planning Conference.

Background: Many of the NCSS Cooperating Partners have undergone major restructuring and reorganization over the past few years that may impact the future of the conference. This restructuring and reorganization has created a need for the cooperators to address the following charges.

Charges:
1) Recommend functions of future conferences.
2) Recommend makeup of Steering Committee.
3) Recommend conference participants.
4) Recommend conference framework and follow up.
5) Revise by-laws.

Committee Membership:

Chairman: Craig Ditzler

Charge number 1, "functions of future conferences", is addressed in so much as it is incorporated into Article II, Section 1 .0 (Purpose) of the by-laws. The language of this section, along with other sections pertaining to organization and management (Article IV) and conference committees (Article VI), is sufficiently broad as to allow the Steering Committee, in any given year, to establish and charge committees to address issues of current importance and to establish an agenda to meet the needs of the region.

Charges 2, 3, and 4 are explicitly addressed within the revised by-laws.

A summary of the changes recommended by this committee to the current by-laws follows.

SUMMARY OF BY-LAWS REVISIONS

Article I

Section 1 .0 - Name revised to "Southern Regional Cooperative Soil Survey Conference". This change implies a broadening of our purpose by deleting "technical work planning". It also patterns our name after the national conference.

Section 2.0 - New section defining "southern region" as corresponding to the Agricultural Experiment Station Southern Region.

Article II

Section 1 .O - First sentence revised to reflect the revised name of the conference and to add "and other general questions and issues of importance to the Cooperative Soil Survey Program." This is intended to provide wide latitude to the conference to address soil survey issues.

Article III

Section 1.3 - New section adding representatives from 1890 Land Grant Universities and Tuskegee University.

Section 1.4 - Replaces SNTC Soil Scientist with those from the South-Central and Southeast NRCS Regional Offices.

Section 1.7 - Adds representative from the Information Technology Center (NRCS - Ft. Collins, CO).

Section 1.10 - Adds representative from the National Society of Consulting Soil Scientists, Inc.

Article IV

Section 1 .0 - Added the phrase "and organizing the program of the conference" to the end of the section.

Section 1.1 - Added reference to appendix I. Also, the membership of the Steering Committee is revised to include one NRCS Regional Office Soil Scientist and one MLRA Team Leader. The Steering Committee is increased from four to five members. The Regional Office Soil Scientist is designated as Steering Committee Chair.

Section 1.3.4 - Added item 3, NRCS Regional Conservationists. Also added "and private individuals" to item 8.

Section 1.4.3 - Deleted requirement that only NRCS or Experiment Station representatives can contact their respective members.

Section 2.0 - New discussion of conference chair and vice-chair.

Section 2.1.11 - New section making it the Conference Chairs responsibility to appoint a recording secretary to keep meeting minutes.

Article V

Section 1.0 - Added reference to appendix I.

Article VI

Section 4.0 - Moved from old position as last section of article V.

Section 5.1.5 - Revised to Regional Office Soil Scientists.

Article VII

No Changes

Article VIII

Section 1 .O - Revised membership to include Lead Scientist, Soil Taxonomy (NSSC) as permanent Chair; five MLRA Team Leaders as permanent members, and three state representatives as rotating members.

Section 2.0 - Sets 3 year terms and method to elect state representatives.

Appendix I

Recommendations for future conference locations; Conference Chair and Vice-Chair; Steering Committee Chair; and MLRA Office representative to the Steering Committee.

Special Note: Much of the work in revising the by-laws was accomplished prior to the establishment of this committee by an ad-hoc committee consisting of Talbert Gerald, John Meetze, Larry West, and Ben Hajek. This ad-hoc committee was established after the 1994 conference in Little Rock, Arkansas. The members of Committee # 5 thank this ad-hoc committee for the work they did.

BY-LAWS FOR THE SOUTHERN REGIONAL COOPERATIVE SOIL SURVEY CONFERENCE

ARTICLE I NAME

Section 1.0 The name of the Conference shall be the Southern Regional Cooperative Soil Survey Conference.

Section 2.0 The Southern Region corresponds to the Agricultural Experiment Station Southern Region and includes the states of Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and the Caribbean Area.

ARTICLE II PURPOSE

Section 1.0 The purpose of the Southern Regional Cooperative Soil Survey Conference is to bring together representatives of the National Cooperative Soil Survey in the southern states for discussion of technical, scientific, and other general questions and issues of importance to the Cooperative Soil Survey Program. Through the actions of committees and conference discussions, experience is summarized and clarified for the benefit of all; new areas are explored; procedures are synthesized; and ideas are exchanged and disseminated. The conference also functions as a clearing house for recommendations and proposals received from individual members and state conferences for transmittal to the National Cooperative Soil Survey Conference.

ARTICLE III PARTICIPANTS

Section 1.0 Permanent participants of the conference are the following:

Section 1.1 The NRCS State Soil Scientist, Staff Soil Scientists, and the MLRA Office Soil Scientists responsible for each of the states and U.S. Territories assigned to the South Region.

section 1.2

The Steering Committee consists of five members. Appendix I contains a schedule which can be used to determine the appropriate rotations of assignments.

1. The conference chair.
2. The conference vice-chair.
3. Soil Scientist assigned to either the Southeast or South Central Regional Office of NRCS.
4. One MLRA Team Leader.
5. The past conference chair.

The Steering Committee is chaired by the Soil Scientist serving under item 3 above.

The Steering Committee may designate a conference chair and vice-chair if the persons designated in Section 2.0 are unable to fulfill their obligations.

Section 1.2 Meetings and Communications

A planning meeting will be held about 1 year prior to the conference. Additional meetings may be scheduled by the chair if the need arises.

Most of the steering committee's communications will be in writing.

Section 1.3.3 Conference Policies

The Steering Committee is responsible for the formulation of statements of conference policy. Final approval of such statements is by consensus of the conference participants.

Section 1.3.4 Liaison

The Steering Committee is responsible for maintaining liaison between the regional conference and:

1. The Experiment Station Directors within the Southern Region.
2. The State Conservationists, NRCS, for the states within the Southern Region.
3. The Regional Conservationists for the Southeast and South Central NRCS regions.
4. Director, Soils Division, NRCS.
5. Regional and national offices of the U.S.Forest Service.
6. The National Cooperative Soil Survey Conference.
7. Southern Forest Soils Research Council.
8. Other cooperating and participating agencies and private individuals.

Section 1.4 Responsibilities of the Steering Committee Chair are:

Section 1.4.1 Call a planning meeting of the Steering Committee about 1 year in advance of the conference to plan the agenda, and if possible, at the scheduled location of the conference.

Section 1.4.2 Develop with the Steering Committee the conference's committees and their charges.

Section 1.4.3 Send committee assignments to committee members. The committee assignments will be determined by the Steering Committee at the planning meeting. The proposed chair and vice-chair of each committee will be contacted personally by a member of the conference steering committee and asked if they will serve prior to final assignments.

Section 1.4.4 Compile and maintain a conference mailing list (can be copies on mailing labels).

Section 2.0 Conference Chair and Vice-Chair

The conference chair and vice-chair are the State Soil Scientist and Experiment Station Soil Survey Leader from the state where the next conference is to be held. These officers serve a two year term from close of conference to close of conference. The chair position, for each two year period, alternates between the state soil scientist and experiment station representative. This sequence may be altered by the Steering Committee for special situations.

Section 2.1 Responsibilities of the conference chair:

Section 2.1.1 Functions as chair of the biennial conference.

Section 2.1.2 Planning and management of the biennial conference.

Section 2.1.3 Serve as a member of the Steering Committee.

Section 2.1.4 Send out a first announcement of the conference about 9 months prior to the conference.

Section 2.1.5 Send out written invitations to all speakers or panel members and representatives from other regions. These people will be contacted beforehand by phone or in person by various members of the steering committee.

Section 2.1.6 Send out written requests to Experiment Station representatives to find out if they will be presenting a report at the conference.

Section 2.1.7 Notify all speakers, panel members, and Experiment Station representatives in writing that a brief written summary of their presentation will be requested after the conference is over. This material will be included in the conference's proceedings.

Section 2.1.8 Preside over the conference.

Section 2.1.9 Provide for appropriate publicity for the conference.

Section 2.1.10 Preside at the business meeting of the conference.

Section 2.1.11 Appoint a recording secretary to take minutes of the business meeting and prepare minutes for inclusion in the proceedings of the conference.

Section 2.2 Responsibilities of conference vice-chair:

Section 2.2.1 Serve as Program Chair of the biennial conference.

Section 2.2.2 Serve as a member of the Steering Committee.

Section 2.2.3 Act for the chair in the chair's absence or disability.

Section 2.2.4 Develop the program agenda of the conference. Time is to be provided on the conference agenda for separate state and federal meetings.

Section 2.2.5 Make the necessary arrangements for lodging accommodations for conference members, for food or social functions, for meeting rooms, including committee rooms, and for local transport for official functions. Notify all persons attending the conference of the arrangement for the conference (rooms, etc.). Included in the last mailing will be a copy of the agenda.

Section 2.2.6 Compile and distribute the proceedings of the conference. If these by-laws are ammended, the proceedings shall contain a copy of the new by-laws.

Section 3.0 Past Conference Chair

The primary responsibility of the past conference chair is to provide continuity from conference to conference. Additional responsibilities include the following:

Section 3.1 Serve as a member of the Steering committee.

Section 3.2 Assist in planning the conference.

Section 4.0 Administrative Advisors

Administrative advisors to the conference consist of a NRCS State Conservationist (usually, but not necessarily, from the state where the conference is held) and an Experiment Station Director (usually, but not necessarily from the state where the conference is held). In addition, other advisors may be selected by the steering committee or the conference.

ARTICLE V TIME AND PLACE OF CONFERENCE

Section 1.0 The conference convenes every two years, in even-numbered years. During the biennial business meeting, invitations from the various states are considered, discussed and voted upon. A simple majority vote decides the location of the next conference. Appendix I can be used as a guide for determining meeting locations. The date and specific location will be determined by the Steering Committee.

ARTICLE VI CONFERENCE COMMITTEES

Section 1.0 Most of the work of the conference is accomplished by duly constituted committees.

Section 2.0 Each committee has a chair and vice-chair. A secretary or recorder may be selected by the chair, if necessary. The committee chair and vice-chair are selected by the Steering Committee.

Section 3.0 The kinds of committees and their members are determined by the Steering Committee. In making their selections, the Steering Committee makes use of expressions of interest filed by the conference participants.

Section 4 .0 Much of the work of committees will of necessity be conducted by correspondence between the times of biennial conferences. Committee chairs are charged with the responsibility for initiating and carrying forward this work.

Section 5.0 Each committee shall make an official report at the designated time at each biennial conference. Chair of committees are responsible for submitting the required number of committee reports promptly to the vice-chair of the conference.

Section 5.1 Suggested distribution is:

Section 5.1.1 One copy to each participant on the mailing list.

Section 5.1.2 One copy to each State Conservationist, NRCS, and Experiment Station Director in the Southern Region

Section 5.1.3 Five copies to the Director of Soils, NRCS, for distribution to National Office staff.

Section 5.1.4 Ten copies to the National Soil Survey Center NSSC) for distribution to staff in the Center.

Section 5.1.5 Three copies to the Soil Scientists representing the Southeast and South Central NRCS regions for distribution and circulation to both the NRCS and cooperators within their regions.

Section 5.1.6 Five copies to the Forest Service Regiona1 Soil Scientist.

ARTICLE VII REPRESENTATIVES TO THE NATIONAL AND REGIONAL SOIL SURVEY CONFERENCES

Section 1.0 At least one state and one federal member will represent this conference at the National Cooperative Soil Survey Conference. Selections are to be made by the appropriate administrators. Representatives will report back to their respective state or federal group.

Section 2.0 One member of the Steering Committee will represent the Southern Region at the Northeast, North Central and West Regional Soil Survey Conference. If none of the members of the Steering Committee can attend a particular conference, a member of the conference will be selected by the Steering Committee for this duty.

ARTICLE VIII SOUTHERN REGIONAL SOIL TAXONOMY COMMITTEE

Section 1.0 Membership of the standing committee is as follows:

1. Lead Scientist, Soil Taxonomy (permanent chair).
2. MLRA Team Leaders representing MLRA Regions 9, 13, 14, 15, and 16 (permanant members).
3. Three experiment station representatives (rotating members).

Section 2.0 At their respective business meetings, the experiment station representatives will be elected to serve on this committee. The term of membership is three years, with two members elected at each biennial conference. One member's term will begin immediately and the other will begin one year later.

ARTICLE IX AMENDMENTS

Section 1.0 Any part of this statement of By-Laws may be amended any time by majority agreement of the conference participants.

By-Laws Adopted June 9, 1990
By-Laws Amended July 11, 1968
By-Laws Amended May 7, 1970
By-Laws Amended May 25, 1984
By-Laws Amended June 22, 1990
By-Laws Amended April 19, 1996

APPENDIX I RECOMMENDATIONS FOR FUTURE CONFERENCE LOCATIONS; CONFERENCE CHAIR AND VICE CHAIR; STEERING COMMITTEE CHAIR; AND MLRA OFFICE REPRESENTATIVE TO STEERING COMMITTEE.

YEAR	HOST STATE	CONFERENCE CHAIR	CONFERENCE VICE CHAIR	STEERING CHAIR	STEERING MLRA REP.
1998	LA	SSS - LA	EXP STA - LA	SOUTH CENTRAL	RALEIGH
2000	VA	EXP STA - VA	SSS - VA	SOUTHEAST	TEMPLE
2002	AL	SSS - AL	EXP STA - AL	SOUTH CENTRAL	MORGANTOWN
2004	MS	EXP STA - MS	SSS - MS	SOUTHEAST	LITTLE ROCK
2006	GA	SSS - GA	EXP STA - GA	SOUTH CENTRAL	AUBURN
2008	OK	EXP STA - OK	SSS - OK	SOUTHEAST	TEMPLE
2010	FL	SSS - FL	EXP STA - FL	SOUTH CENTRAL	RALEIGH
2012	TX	EXP STA - TX	SSS - TX	SOUTHEAST	LITTLE ROCK
2014	KY	SSS - KY	EXP STA - KY	SOUTH CENTRAL	AUBURN
2016	TN	EXP STA - TN	SSS - TN	SOUTHEAST	TEMPLE
2018	PR	SSS - PR	EXP STA - PR	SOUTH CENTRAL	MORGANTOWN
2020	NC	EXP STA - NC	SSS - NC	SOUTHEAST	LITTLE ROCK
2022	AR	SSS - AR	EXP STA - AR	SOUTH CENTRAL	RALEIGH
2024	SC	EXP STA - SC	SSS - SC	SOUTHEAST	TEMPLE

In addition to the above, the past conference chair also serves on the steering committee.

MINUTES OF THE BUSINESS MEETING OF THE SOUTHERN REGIONAL SOIL SURVEY WORK PLANNING CONFERENCE

April 19, 1996

The meeting was called to order by Bill Smith.

Warren Lynn moved that Technical Soil Scientists be included in all future meetings of the SRSSWPC.

Motion was seconded,

Discussion followed. Gist of the discussion was that Technical Soil Scientists had never been excluded from the meeting and that they should be Included. Budgets, travel restrictions, and other factors must be considered when sending any Soil Scientist to these meetings. Suggestion was made to prepare a mailing list of all potential participants so they can be invited.

Motion passed.

Ben Stuckey moved that the amended By-Laws as circulated at the meeting be adopted.

Motion was seconded.

Motion passed.

Jerry Daigle invited the group to meet in 1998 In Baton Rouge.

Ben Stuckey moved we accept this invitation. Motion seconded. Motion passed.

Dick Arnold addressad the group indicating his intention to step down as head of Soil Survey.

He then presented a slide show.

Meeting adjourned.

DR. RICHARD ARNOLD
Natural Resources Conservation Service
Director of the Soils Division
Washington, DC

Dr. Richard W. Arnold is currently the Director of the Soils Division, Natural Resources Conservation Service, Department of Agriculture, Washington, D.C. He is a native of Creston, Iowa. He holds a BS degree from Iowa State University, and MS degree from Cornell University. He started his career as a Soil Scientist with the Soil Conservation Service in Iowa. Dr. Arnold has held Assistant and Associate Professor positions at the University of Guelph, Ontario, Canada and Associate Professor and Professor positions at Cornell University, Ithaca, New York. In 1979, Dick returned to SCS as Staff Leader, Soil Survey and Classification, Washington, D.C. In 1980, he was appointed Director of the Soil Survey Division, SCS, Washington, D.C. He also holds Adjunct Professorship6 at the University of Florida, Gainesville and Mississippi State University, Starkville. Dr. Arnold is an internationally known Soil Scientist who has served as chairman of Commission V in the International Society of Soil Science (1982-1986), is a member of the World Reference Base and International Programs Working Groups of ISSS, and serves on the Board of Trustees of IBSRAM, the International Board for Soil Research and Management, Bangkok.

MS. PBDITA **BELK**
Natural **Resources** Conservation **Service**
Publio Affairs
Columbia, South Carolina

Pedita Belk is the state public affairs specialist for the USDA/Natural Resources Conservation Service in Columbia, South Carolina. A native of Virginia, Hs. Belk has extensive experience in writing, media and public relations, and marketing. She began her career with NRCS in 1993 as a public affairs specialist in Raleigh, North Carolina. She earned a Bachelor of Arts degree in English from Hampton University (VA) in 1991. Her professional affiliations include the Soil and Water Conservation Society, the American Business Women's Association, the Carolinas Association of Business Communicators and the National Association of Female Executives. She and her husband reside in Columbia, South Carolina.

MARK BERKLAND
Natural Resources Conservation Service
State Conservationist
Columbia, South Carolina

Mark Berkland has been state conservationist for the U.S. Natural Resources Conservation Service in South Carolina since September 1994. A native of Iowa, Mr. Berkland began his career in the NRCS as a student trainee, working in several locations in Iowa. He has an extensive background in natural resources conservation, having served as an area conservationist in Missouri, state resource conservationist in Iowa, and deputy state conservationist in Illinois. Nr. Berkland earned a Bachelor of Science degree in Agronomy from Iowa State University in 1970. He is a member of the Soil and Water Conservation Society and the National Association of Conservation Districts. He and his wife Carol have three children and reside in Columbia, South Carolina.

DR. STANLEY BUOL
North Carolina State University
Raleigh, North Carolina

Stan Buol has a B.S., M.S. and PhD from University of Wisconsin-Madison. Stan mapped soil in Southern Wisconsin for USDA/SCS in 1956, state soil survey leader and faculty member at the University of Arizona for 6 years, 30 years as state soil survey leader and faculty member at North Carolina State University. Presently William Neal Reynolds Professor of Soil Science and Alumni Distinguished Graduate Professor at North Carolina State University, Raleigh, North Carolina.

GLEN CHERVENKA
Natural Resouroes Conservation Service
Bryan, Texas

Glen Chervenka is a resource soil scientist headquartered in the Bryan Texas Zone Office. A native of Texas, Glen has an extensive background in cotton and grain farming in the central Blacklands of Texas. He received his Bachelor of Science degree in Agronomy in 1964 from Texas A & M University. Glen began his career with SCS as a soil scientist in early 1965. He has worked several counties throughout Texas. He is presently the Resource Soil Scientist for a 23 county area. Glen serves central and southeast Texas. His expertise is mainly Blackland Prairies, Claypans, East Texas Timberland and Gulf Coast Prairie. This involves Udic-ustic and thermic-hyper-thermic lines, major areas of hydric soils as well as the Houston urban area.

DR. NARY COLLINS
Professor of Environmental Pedology,
Soil and Water Science Department
University of Florida
Gainesville, Florida

Mary Collins is a native of New Jersey. She holds a BS degree from Cornell University, and MS and PhD degrees from Iowa State University. She started her career as a Soil Scientist Student Trainee with the SCS in Orange County, New York, and later worked as a soil scientist in Iowa. Nary has been on the faculty of the Soil and Water Science Department at the University of Florida since 1981. Her responsibilities include teaching undergraduate and graduate classes in Environmental Pedology as well as Wetlands and Water Quality, and directs research of graduate students in this area of soil science. Her research emphasizes the use of the ground-penetrating radar to study subsurface soil properties, research on hydric soils and soil-water-landscape relationships, and the development of multimedia software to provide training to students and other users in the study of hydric soils and pedology. She is also Curator of the Florida Museum of Natural History.

DR. B. ALLEN DUNN
Direotor, Sohool of Natural Reeouroee
Clemson University
Clemson, South Carolina

Allen Dunn is a native of Etowah, Tennessee. He received his B.S.F., M.F., and PhD from the School of Forest Resources, University of Georgia. After he graduated with his B.S.F. in 1965, Allen served as Platoon Leader/Executive Officer (NACV, Republic of Vietnam) and Forester (Corps of Engineers, Fort Jackson, SC) for the United States Army. Upon completion of his tour of duty he returned to the University of Georgia as a Teaching/Research Assistant for the School of Forest Resources. Allen continued his education at the University of Georgia and after receiving his PhD in forestry in 1971 he went to work as a Biologist/Environmental Scientist for the Tennessee Valley Authority, Knoxville, Tennessee. In 1993, Allen became a Professor for the Department of Forest Resources at Clemson University. He has since moved from Department Head to his current position as Director, School of Natural Resources, which includes the Departments of Aquaculture, Fisheries and Wildlife, Forest Resources, Soils, and Environmental Toxicology. Allen and his wife Joyce have three children.

DR. EVERETT EMINO
University of Florida
Gainesville, Florida

Everett Eminc was born in Mildford, Massachuetts. He holds a BS degree from the University of Massachusetts and MS and PhD degrees from Michigan State University. Everett's work experience includes Instructor, Department of Horticulture, Michigan State University; and Professor, University of Connecticut. In 1987, Bverett was appointed Professor, Department of Environmental Horticulture, and Assistant Dean of Research, Institute of Food and Agricultural Science, Florida Agricultural Experiment Station, University of Florida. He also serves as Administrative Advisor to the South Regional Soil Survey Work Group.

BOB EPPINETTE
Natural Resources Conservation Service
Walterboro, South Carolina

Bob is a native of Ncnrce, Louisiana. He is a graduate of Clemson University where he received his BS degree in Agronomy. Bob has worked as a Soil Survey Party Leader in Dorchester, Hampton, Allendale, and Bamberg counties. He is currently working as a Resource Soil Scientist assigned to a 18 county area including the Savannah River Site in South Carolina. MLRA regions include the Tidewater area, Atlantic Coast Flatwccds, Southern Coastal Plain, and Carolina and Georgia Sand Hills. Bob and his wife Gail have two children.

JIMMY FORD
State Soil Scientist
Natural Resources Conservation Service
Stillwater, Oklahoma

Jimmy Ford is a native of Butler, Oklahoma. He received his BS degree in Agronomy in 1970 and MS of Agronomy (Soils) in 1972 from Oklahoma State University. He began his career in Natural Resources Conservation Service as a soil scientist in Grenada, Mississippi. After working in Mississippi for three years, he returned to Oklahoma. He then became a Supervisor, Soil Scientist in three soil survey areas in Beckham, Harmon, and Woods counties in Oklahoma. In 1991 he moved to Stillwater, Oklahoma, to serve as Aesietant State Soil Scientist. Jim served in that position until 1994. He is currently the State Soil Scientist He is a member and past president of the Professional Soil Scientist Association of Oklahoma. He and his wife, Donna, have one child, and reside in Stillwater.

RR. CHARLES FULTZ
Natural Resources Conservation Service
Little Roak, Arkansan

Charles Fultz is a native of Huskogee, Oklahoma. He received a BS degree from Oklahoma State University. Charles began his career with Soil Conservation Service in 1966 as s Soil Scientist at Warren, AR, and made soil surveys in several counties in south Arkansas. He worked for two years on a detail to Arkansas State Department of Planning. Charles has held positions in Arkansas as Soil Interpretation Specialist and Assistant State Soil Scientist before being promoted in 1979 to his the position of State Soil Scientist. He is now the M.O. Leader/State Soil Scientist.

DONALD GOHMERT
Natural Resouraes Conservation Service
Louisiana

Donald Gohmert is a native of south central Texas. In 1967, he received his BS degree in agriculture from Sam Houston State University. Shortly after graduation he was drafted into the military, serving from 1967 to 1969 in the U.S. Army. After his tour of duty, Don returned to college to do post graduate work. He joined the Soil Conservation Service in 1970 as a soil conservationist in Alexandria, Louisiana. He worked various locations and positions in Louisiana from 1970 to 1977. Don received his MS degree in 1977 from Syracuse University in New York state. He then accepted the state resource conservationist position in Phoenix, Arizona. Don returned to Louisiana in 1983 as the Assistant State Conservationist for Programs. In 1986 he was selected as the Deputy State Conservationist for Louisiana and served in that position until 1990 and then transferred to Texas as Deputy State Conservationist. In January 1990 Don was transferred to Arizona as the State Conservationist. He returned to Louisiana as the State Conservationist in 1993. Don and his wife Jo have two children.

DR. RICHARD GRIFFIN

Texas

Richard Griffin is a Research Scientist/Lecturer Graduate and Undergraduate Faculty at PVAMU. He received his BS degree in soil science and his MS degree in soil science with a minor in public administration from North Carolina State University. Richard received his PhD in Pedology/Soil Science in 1991 from Texas A&M University. He began his career with the USDA/Soil Conservation Service in 1986 as a soil scientist. In 1987 he returned to school to continue his education while also working as a Laboratory Instructor at Texas A&M University. He also served as the Director/Educator for Studies in Environmental Education Program (SEEP) for minority youths in Bryan, Texas. Richard currently serves as the Research Coordinator: Environmental Quality Program, Coop. Agricultural Resources Center, Lecturer/Research Scientist, Academic and Research Advisor: Undergraduate and Graduate students, and Academic Coordinator, Agronomy and Soil Science.

DAVID HOWELL
Natural Resources Conservation Service
Lake City, Florida

David Howell is a native of Jennings, Florida. He has a BS degree in Soil Science from Florida A&M University in Tallahassee. He has also served a short tour of duty while in the U.S. Army and is a former Horticulture Teacher of sixth graders in public school. David Howell's 26 year career with USDA/NRCS began as a student trainee in 1967. First permanent assignment as a Soil Scientist located in Broward County, Florida in 1970. Other locations worked mapping soils include Columbia, Duval, Lake, and St. Johns counties in Florida. He served as Soil Scientist Party Leader in Columbia, Hamilton, and Madison counties. David also mapped soils while on detail to Hancock County, Maine in the summer of 1983. He is currently the Resource Soil Scientist, Technical Team II, Lake City, Florida.

DR. **MAURICE MAUSBACH**
Boil **Survey** Division
Natural Resources Conservation **Service**
Washington, D.C.

Maurice Mausbach is a native of Worthing, South Dakota. He holds a BS degree from South Dakota State University, and MS and PhD degrees from Iowa State University. He started his career as a Student Trainee in soil Science with SCS in South Dakota. Maury has held positions as Project Leader for McCook County, South Dakota; Research Soil Scientist at the National Soil Survey Laboratory; Soil Scientist for databases in Washington, DC; and National Leader for Soil Survey Interpretations. He served as Assistant Director and part of the Steering Team of the Soil Survey Division. He is currently Head of the Soil Quality Institute.

RUSSELL PRINGLE
Louisiana Btate University
Baton Rouge, Louisiana

Russ Pringle is a native of New York and an Alumni of California State Polytechnic University, San Luis Obispo, California. He began his professional career in 1966 as a soil survey party member and party leader in Washington state where he is the author of three soil survey reports. In 1978 he was promoted to Area Soil Scientist for Western Washington state. In 1992 he went on a detail to the U.S. Army Corps of Engineers at the Waterways Experiment Station in Vicksburg, Mississippi. Russ has since served from June of 1994 to October 1995 on the National Wetlands Team in Washington, DC. He is presently assigned to the NRCS Wetland Science Institute, located at Louisiana State University, Baton Rouge, Louisiana. Russ and his wife Roberta have two children and two grandchildren.

MR. JERRY RAGUS
U.8. Forest Service
Atlanta, Georgia

Jerry grew up on a farm in northeast Louisiana. He received his BS degree from Northeast Louisiana in Monroe. After three years in the Army, Jerry began his professional career with the Soil Conservation Service in 1972 on the Otero County Soil Survey in Alamogordo, New Mexico. In 1976, he transferred to the Forest Service in Laurel, Mississippi. In 1978 he moved to Pineville, Louisiana, where he was responsible for the soil surveys being conducted on the Kisatchie National Forest. In 1980, Jerry moved to Ogden, Utah as the Assistant Regional Soil Scientist for the Intermountain Region. Jerry moved into his current position as Regional Soil Scientist for the Southern Region in 1986.

WILLIAM SIMPSON
Charleston 8011 and Water
Conservation District
Charleston, South Carolina

Bill Simpson is a native of South Carolina. A graduate of Clemson University, he has been a Commissioner since 1978. Bill has been with Sanders Brothers Construction Company of Charleston *since 1973* and is now Vice-President and General Manager. Among his many conservation activities, he was recently appointed Chairman of the Land Resources and Conservation Districts Advisory Committee. Currently Chairman of the State Erosion and Sediment Reduction Advisory Council, he was instrumental in passing South Carolina's first statewide Stormwater Management and Sediment Reduction Law. He is also a member of the Governor's Wetlands Task Force and is a trustee of the South Carolina Conservation Districts Foundation. He is also a Board member of the Charleston Interfaith Crisis Ministry and the Board of Visitors of Charleston Southern University. Bill is married with two children and resides on James Island.

DR. JAMES A. TIMMERMAN, JR., PhD
Director
SC Department of Natural Resources
Columbia, south Carolina

James Timmerman in a native of Pelzer, South Carolina. Be received his BS and MS degrees in Zoology from Clemson University. James received his PhD in Zoology from Auburn University in 1963. He joined the faculty at The Citadel in Charleston, South Carolina in 1961 and was later appointed to head the new biology department which was formed at the military college in July 1967. He was the youngest department head ever to serve at The Citadel. Dr. Timmerman served as Acting Director of the Marine Resources Division of the South Carolina Wildlife and Marine Resources Department from March 1970 to December 1970. In January 1971, he was appointed Director of the Marine Resources Division. He was appointed Deputy Director of the South Carolina Wildlife and Marine Resources Department in 1974. Later that same year he was named Executive Director of the South Carolina Wildlife and Marine Resources Department, which developed into one of the premiere wildlife departments in the nation. During the 1993 South Carolina Legislative session, the South Carolina Restructuring Act was passed and a new agency formed to meet the needs of the public in a more efficient and responsive manner. Effective July 1, 1994, a new agency, the South Carolina Department of Natural Resources was formed. During a transition phase, Dr. Timmerman was named Director-Designee and on July 15, 1994 the board voted unanimously to name Dr. Timmerman agency Director, the position which he currently holds. James and his wife, Jo Anne, have three daughters and one son.

SHARON WHITMOYER WALTMAN
Natural Resources Conservation Service
Lincoln, Nebraska

Sharon Whitmoyer Waltman received her BA and BS degrees from Pennsylvania State University. She began her career with USDA/NRCS in 1981 as a soil scientist. Sharon returned to Pennsylvania State University as a Graduate Assistant in 1981 and received her MS degree in 1988 in Soil Genesis & Morphology. During her graduate work she returned to USDA/NRCS in Syracuse, New York as a soil scientist. In 1989, worked at Cornell University, Department of Soil, Crop, and Atmospheric Sciences as a soil scientist, soil information systems laboratory. Sharon currently works as a Soil Scientist, Soil Geography Section in Lincoln, Nebraska.

DR. LARRY T. WEST
University of Georgia
Athens, Georgia

Larry West is a native of Arkansas. He received his BS degree in Agronomy and MS degree in Soil Science from the University of Arkansas. Larry acquired his PhD in Soil Science from Texas A&M University in 1986. He began his professional career as a Research Assistant at the University of Arkansas in 1973. Larry then went on to become a soil scientist for USDA in Gatesville, Texas. In 1980, he returned to Texas A&M University as a Graduate Assistant and later as a Research Associate, Larry then went on to work as a Soil Scientist and Adjunct Assistant Professor, USDA-ARS and Agronomy Department, Purdue University, West Lafayete, Indiana. In 1988, he became Assistant Professor, Department of Crop & Soil Sciences, University of Georgia in Athens. Larry currently serves as Associate Professor, Department of Crop & Soil Sciences, University of Georgia in Athens. He current research areas are Morphological indicators of season water tables, hydric soils, and morphological effects on water movement across landscapes.

DAVID WILSON
U.S. Forest service
Columbia, South Carolina

Dave Wilson is a native of Virginia. He began his 26-year career with USDA Forest Service after earning a BS degree in Forest Resource Management, with majors in wildlife management and forestry, from the University of Tennessee. Dave has served in various capacities with the Agency in several southeastern states, including Louisiana, Georgia, Tennessee and Arkansas. His career stints include District Ranger, Regional Wildlife Program Manager, and five years as the Deputy Forest Supervisor of the Quachita National Forest in Arkansas. Dave is currently the Forest Supervisor for South Carolina. He has managed the Francis Marion and Sumter National Forests since 1991 and oversees the management of 612,000 acres of national forest lands in 13 South Carolina counties. In addition to his career duties, Dave serves as a member of the Society of American Foresters and The Wildlife Society.

JOHN H. THORP
WESTVACO

NATIONAL COOPERATIVE SOIL SURVEY

Southern Regional Conference Proceedings

North Little Rock, Arkansas
June 20-24, 1994

[redacted]

Work Planning Conference of the National Cooperative Soil Survey

Riverfront Hilton Inn
North Little Rock, Arkansas
June 20-24, 1994

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CONFERENCE AGENDA

SOUTHERN REGIONAL SOIL SURVEY WORK PLANNING CONFERENCE
OF THE
NATIONAL COOPERATIVE SOIL SURVEY
RIVERFRONT HILTON INN
NORTH LITTLE ROCK, ARKANSAS
JUNE 20-24, 1994

SUNDAY AFTERNOON, JUNE 19

3:00-6:00 PM — **Registration**
Hotel Lobby

MONDAY MORNING, JUNE 20

8:00-12:00 Noon — **Registration**
Hotel Lobby

MONDAY AFTERNOON, JUNE 20 — **Session Chair-Richard T. Fielder**

1:00 PM — **Introductions end Announcements**
Charles L. Fultz
State Soil Scientist
SCS, Little Rock, AR

1:15 PM — Welcome
Tomas M. Dominguez
Asst. State Conservationist
SCS, Little Rock, AR

1:30 PM — **Purpose and Objectives**
DeWayne Williams
Soil Scientist
SNTC, SCS, Ft. Worth, TX

1:45 PM — **Opening Remarks**
Dr. L. B. (Bernie) Daniels
Associate Director
Arkansas Agriculture Experiment Station
University of Arkansas, Fayetteville, AR

Jesse James III
Ranger
St. Francis National Forest
FS, Marianna, AR

Charles R. Adams
Associate Director
SNTC, SCS, Ft. Worth, TX

2:30 **PM**	**Break**
2:45 **PM**	The Spirit **of Arkansae** (slide presentation) Larry B. Ward Asst. State Soil Scientist SCS, Little Rock, AR
3:05 **PM**	**National Cooperative Soil Survey** **SCS National Perspective** Steve Holzhey Assistant Director Soil Survey Division NSSC, SCS, Lincoln, NE
3:25 **PM**	National **Cooperative Soil Survey** **University Perspective** **Dr. Everett Emino** **Professor** University of Florida, Gainesville, FL
3:45 **PM**	**Break**
4:00 PM	**National Cooperative Soil** Survey **Forest Service Perspective** **Jerry Ragus** Regional Soil Scientist FS, Atlanta, GA
4:20 PM	Training Charles R. Adams Associate Director **SNTC, SCS, Ft. Worth, TX**
4:40 **PM**	**Open Discussion-Current Issues** **Darwin Newton** State Soil Scientist SCS, Nashville, TN
5:00-6:30 PM	Mixer-Hunterville Room

TUESDAY MORNING, JUNE 21 — **Session Chair-Robert** A. **Eigel**

8:00 AM	**Soil Survey Quality Assurance Activities** Larry Ratliff Lead Soil Scientist NSSC, SCS, Lincoln, NE
8:20 **AM**	**National Soil Survey** **Laboratory Activities** **Warren Lynn** **Research Soil Scientist** **NSSL, SCS, Lincoln, NE**

8:40 AM	**Cartographic Support To The NCSS** **Lee** Sikes **Branch** Chief NCG, SCS, Ft. Worth, TX
9:00 **AM**	**Report form 1890 Universities** Dr. Leslie J. Glover Acting Chair Department of Agriculture University of Arkansas, Pine Bluff, AR
9:20 **AM**	**Break**
9:40 **AM**	**Report From The National Society For Consulting Soil Scientists** Dave Lietzke President Rutledge, TN
10:00 **AM**	**Soil Map** Development Vivian Owens Soil Scientist NCG, SCS, Ft. Worth, TX
10:20 AM	**Technical Soil Services** Maurice Mausbach Assistant Director Soil Survey Division SCS, Washington, D.C.
10:40 **AM**	**Experiment Station-Agency Breakout Session**
12:OO Noon	**Lunch**

TUESDAY AFTERNOON, JUNE 21 — Session **Chair-George Martin**

1:00 PM	**Loess In Arkansas-An Overview** **Dr. Moye Rutledge** **Professor** **University of Arkansas, Fayetteville, AR**
1:20 PM	**Phillips Bayou Loeee Section** **Douglas Wysocki** **Research Soil Scientist** **NSSIV, SCS, Lincoln, NE**
2:00 PM	**Break**
2:15 PM	**Committee Breakout Sessions**
4:15 PM	**Break**

4:30 PM — Open Discussion-Current Issues
Instructions For Field trip
Charles L. Fultz
State Soil Scientist
SCS, Little Rock, AR

5:00-6:30 PM — Mixer-Hunterville Room

WEDNESDAY, JUNE 22

8:00-5:00 PM — Field Trip
Phillips Bayou Loess Section
Anderson's Bait Fish Farm

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David Jones
State Soil Scientist
SCS, Jackson, MS

Ben Stuckey, Jr.
State Soil Scientist
SCS, Columbia, SC

11:00 AM — Experiment Station-Agency **Breakout Sessions**

12:00 Noon — Lunch

THURSDAY AFTERNOON, JUNE 23 — **Session Chair-Qaylon L. Lane**

1:00 PM — **NASIS**
David Jones
State Soil Scientist
SCS, Jackson, MS

1:20 PM — Data **base Attribute8 and Relationship to Water Quality**
Jennifer Brookover
Soil Scientist
SNTC, SCS, Ft. **Worth, TX**

1:40 **PM** — **Method8 and Instrumentation for Measuring Aquic Condition8**
Dr. Wayne Hudnall
Professor
Louisiana State University, Baton Rouge, LA

2:10 PM — **Break**

2:30 PM — **Committee Breakout Sessions**

4:30 PM — **Open Discussion and Instructions for Evening** Activities
Charles L. Fultz
State Soil Scientist
SCS, Little Rock, AR

6:30-9:00 PM — **Fish Fry-Burn8 Park**

FRIDAY MORNING, **JUNE** 24 — **Session Chair-Talbert Gerald**

8:00 AM — **Committee Reports**
Committee Chairs

9:15 **AM** — **Break**

9:45 AM	Business Meeting DeWayne Williams Soil Scientist SNTC, SCS, Ft. Worth, TX
10:45 AM	Closing Remarks Charles L. Fultz State Soil Scientist SCS, Little Rock
11:oo AM	Adjourn

Southern Regional Soil Survey
Work Planning 'Conference

Introductions and Announcements
Charles L. Fultz
State Soil Scientist

I believe the excellent attendance at this 1994 Southern Regional Soil Survey Work Planning Conference demonstrates a strong commitment by the southern states' NCSS partners. At last count, we had 75 conference participants registered and we are very pleased that you are here.

The 1994 Work planning steering Committee consisted of myself, Dr. Moye Rutledge, University of Arkansas at Fayetteville, and DeWayne Williams, SCS, South National Technical Center. We are sorry that Dr. Rutledge will not be able to participate in all of the conference because his mother is critically ill. Dr. Rutledge is hopeful that he will be able to make his scheduled presentation tomorrow afternoon. DeWayne Williams is here and I would like for him to stand and be recognized.

The Steering Committee appreciates very much the Arkansas Association of Professional Soil Classifiers for sponsoring this conference. The association has handled all of the registration fees for the conference and is sponsoring the social that begins this evening at 5:00. I would like for Jeff Olson, president of the Arkansas Association of Soil Classifiers to stand and be recognized.

Those of you that have had the honor of hosting this conference in the past are aware of the tremendous time and effort that is required. I would like to recognize some of my staff that have worked very hard, especially the last few weeks and days, to make sure all of the details have been taken care of.

Larry Ward, please stand. Larry has carried the burden of the planning, organizing and getting things done for the conference. By noon Friday, Larry is going to be ready for some well deserved rest and relaxation.

Anna Smith, please stand. Anna is our secretary and she has worked diligently on hotel and meeting room arrangements, and has handled the paper work related to the conference.

Marcella Callahan, please stand. Marcella is our GIS and Remote Sensing Specialist and she has followed up behind all of us to make sure we haven't allowed anything to fall through the cracks. Marcella has assisted with organizing

SOUTHERN REGIONAL SOIL SURVEY WORK PLANNING CONFERENCE

JUNE 20-24, 1994

Good afternoon.

It gives me great pleasure to welcome the South Region Soil Survey Conference to Little Rock, Arkansas, the home of our current President and First Lady. Later on in the program you will be viewing a slide program that will give you a closer look at our great state. As Charles mentioned, I am Tomas Dominguez, Assistant State Conservationist for Operations in Arkansas. I was the one available that Charles Fultz landed as I was walking down the hall. Due to conflicts, Ronnie Murphy nor Ced Bradford could not be here to open the session.

What Charles doesn't know is that he got the best of the lot in the corner office anyway. You see, I use to map soils with our soil scientist in south Texas, and still have the chigger, tick, and mosquito scars to prove it. Those were hot, steamy days and in most instances windshield mapping of soils was virtually impossible. I think Charles Adams can relate to those conditions specifically since he was working down there at the same time.

Welcome by Tomas M. Dominguez, Asst. State Conservationist presented to the Southern Regional Work Planning Conference, Little Rock, Arkansas, June 20, 1994.

But even then, in my young career as a Range Conservationist, I realized the importance of the soil survey not only in my discipline but in others such as Agronomy, biology, even economics. It touches all the work we do in SCS.
I was telling Charles Fultz something that all of you already know and that is, that the soil survey is the critical foundation to all that we do in the Soil Conservation Service. The need started in the old dust bowl days, it survived FSA and has not deterred even today as we face reorganization and reinvention. The need will continue as we implement technology such as GIS, Ecosystem Based Assistance, and global positioning, and as we provide service to ALL the public we serve that deal with conserving and preserving our natural resources.

The fact that the effort is federal, state, and local governments working together in a National Cooperative Soil Survey is a compliment in itself. Not many endeavors have been as successful as the effort you carry out. I commend you for this effort and for having conferences like this every even numbered year.

So with that, let me reiterate that it is so good to have all of you here. An outstanding program has been planned for you this week. If there is anything we can do for you during your stay, please do not hesitate to ask anyone from Arkansas for assistance. Thank you and I hope to see and meet some of you personally on Thursday evening. Have a great week.

SOIL SURVEY WORK
AS IT RELATES TO AGRICULTURAL RESEARCH IN ARKANSAS

On behalf of the University of Arkansas and its Division of Agriculture, I would like to extend to you a cordial welcome to Arkansas, the "Natural State" and the "Land of Opportunity." We are extremely happy that you chose to meet in Arkansas.

Soil survey work has been extremely important to the State. For example, we have soils in agricultural production today that were swamps 40-50 years ago. These soils are very productive. Thus, I would like to spend a few moments with you relative to Arkansas' agriculture and the importance of soil survey work to agriculture.

The economy of Arkansas is very dependent on agriculture. Sales of agricultural commodities are over $5 billion annually, ranking Arkansas 12th among all states. This accounts for over 25-percent of the State's gross revenue. Further processing or "value added" of the State's raw agricultural commodities yield gross total sales of nearly $15 billion dollars annually and provides a substantial number of jobs (over 15 percent of total employment).

Agriculture in Arkansas is very diverse, ensuring a stable farmgate income. However, Arkansas' agriculture has changed drastically during the past 20-30 years. It has gone from predominantly a row crop agriculture to a poultry and livestock agriculture. Poultry and livestock sales account for 62-percent of the farmgate revenue, whereas agronomic crops, fruits and vegetables provide 38-percent. Poultry accounts for 43-percent of the farmgate revenues. This change in agriculture in the State has created many problems. Animal waste is being disposed of on a variety of soils. Most of these soils are on steep slopes lending to erosion and runoff. Build-up of phosphorus is occurring on many soils. Thus, we must study the characteristics of these soils and develop strategies to best utilize the animal waste without polluting our water and environment. This is a challenge for soil scientists.

Opening Remarks by Dr. B. L. (Bernie) Daniels, Associate Director, Arkansas Agricultural Experiment Station at the Southern Region Soil Survey Planning Conference, Riverfront Hilton Inn - North Little Rock, Arkansas, June 19-20, 1994.

Arkansas ranks within the top 10 among states for several agricultural commodities. The State of Arkansas ranks first in poultry, broilers and rice; 2nd in catfish: 3rd in turkeys; 4th in cotton; 5th in grain sorghum; 6th in eggs; and 7th in grapes and soybean production. In addition, the State has over one million head of beef cows, produces a million acres of soft red winter wheat and has a large fruit, vegetable, and forestry industry.

There are 46,000 farms in Arkansas with an average size of 337 acres. The State has 15.5 million acres in farmland and harvests 8.1 million acres of cropland. These crops are produced on a large variety of soils, ranging from silt to clayey loams in the Delta to limestone-based soils in the hills.

Soil survey work is very important to our agricultural research programs and helps in keeping with the mission of the Agricultural Experiment Station. This mission is to generate, interpret and communicate new knowledge and technology to enhance the economic and social well-being of Arkansas. Thus, it is extremely important that we know the characteristics of the soils in the State in order to plan and conduct our research program.

The contribution of the Arkansas Agricultural Experiment Station to the National Cooperative Soil Survey is through the activities of Moye Rutledge who is the Station representative on the program. Dr. Rutledge directs the soil characterization laboratory which provides data for the proper classification of soils as well as serving as a basis for decisions regarding proper soil and land use. He also participates in soil survey reviews regarding the design and classification of soil survey map units and the regional correlation of soils. The SCS and Dr. Rutledge have done many field studies throughout Arkansas. They have been especially active in investigating loess, the windblown silty soil parent materials. Two such studies are ongoing in Eastern Arkansas, one in the Marianna-Helena area and one in Arkansas County (Stuttgart).

Again, I appreciate the invitation to visit with you. Enjoy the hospitality of Arkansas.

Opening Remarks by Charles Adams at the South Regional Soil Survey Work Planning Conference of the National Cooperative Soil Survey, June 20-24, 1994, Little Rock, Arkansas

-Hello. I'm pleased to be here in Little Rock with you. It feels good to attend any conference with the word *cooperative' in the title. And times being what they are, its particularly good to be at this conference -where scientists from the federal and state agencies and universities can bring together the best in ideas and technology for your mutual benefit and for the benefit of your customers.

-Unless you've been abroad for the fast two years, you know that government business and focus is shifting: we are increasing our customer population, while we narrow how we target customers: we are broadening our view of natural resources, while we more strictly define the resource problems we address. These aren't paradoxes; they are wise marketing and planning decisions. What they will require to succeed is better access to more reliable information--and soils information is at the top of the list of resources that impact the entire spectrum. Across the board, all resources and all audiences have a survival stake in soils.

-At SCS's South National Technical Center, there are some new focuses with soils since you iast met. These include:

+soil interpretations by Major Land Resource Area or MLRA--which allows a more smoothing and correlating process compared to county-by-county interpretations;

+progress in soils data-base development;

+classifying hydric soils for the benefit of identifying wetlands;

+advances in soil support for Geographic Information Systems (or GIS);

+ **soils support** for **SCS's** Field Office Computing System (or FOCUS);

+ **increased** support for water quality initiatives through soil modeling;

+ **increased** support to identify wetlands and highly erodible lands to meet requirements of the **conservation** provisions of the Farm Bill;

+ **and, an** increased emphasis to interpret soil survey information into activities of other disciplines

-Your training, networking and committee work here this week is an effort to help accomplish all that I have listed and more. I encourage you to approach this week with the question "**what** can I share and learn that not only benefits me and my job, but also benefits other resource specialists, the agency, and ultimately the mission.

Southern Regional Soil Survey Work Planning Conference
Little Rock, Arkansas
June

Some key committees continue their work for NCSS at the national level.

Documenting our SOP.

Change in national SCS soil survey staff structure.

Discussion

We are justifiably proud of the quality of work produced by NCSS over the past 40 years, Quality was in the forefront for decades of work by dedicated and hard working people. Nevertheless, reasons for wanting soil surveys have changed dramatically in many places. Hence, in many places the requirements changed for designs of map units and intensities of investigations during the mapping process. As a result, we have more county line and state line seams among our soil surveys than present customers can afford. Future work that stops at a county or state line, must be part of a process that erases undesirable discontinuities, and meets standards that are defined by long range plans each overall area. In some cases, it will be possible to trace quality of old work across large stretches of a physiographically uniform area or feature, independent of artificial boundaries. Whether artificial or natural, joins that are part of an overall plan, made in accordance with uniform standards for the area will assure that our activities continue to improve the seamlessness of soil surveys. To this end, a number of states have joined efforts to create MLRA-wide soil survey plans and efforts. Others are discussing basic organizations of personnel to more efficiently provide the technical support to customers, while effectively performing updates and maintenance of soil surveys,

The SCS in the Northeast Region is considering ways to organize soil survey production and maintenance independently of state boundaries to produce regionally seamless soil surveys and to conserve personnel.

Interstate organization of soil surveys along MLRA boundaries also continues in a growing number of places, independently of changes in SCS structure.

A few years ago, Richard Arnold specified that development of the National Soil Information System (NASIS), and modernization of our documentation for soil survey as a whole, should have special emphasis. Phase 1 of NASIS will be released this fall, and SCS will be heavily involved in conversion of information to the new system. This phase allows conversion from SSSD to Informix-based system. User information for the conversion is scheduled for distribution with Phase 1 in October. Some state participation in preparation of user information might be requested. Phase 2, the step that implements use of the converted information, is scheduled for implementation in the autumn of 1995.

Much of the completed new documentation for the soil survey is in the following publications.

-- The new Soil Survey Manual was published this year.

-- The new revision of the National Soil Survey Handbook of SCS has just been released.

-- The newest keys to Soil Taxonomy should be out within weeks. Included will be the new Aridisol classes.

-- A new Guide to Authors of Soil Survey Manuscripts was delivered to states last winter.

-- The Guide to Soil Surveys by Geographic Areas was recently distributed.

-- The SCS Soil Survey Laboratory Manual, Soil Survey Investigations Report No. 42, is now a couple of years old and due for small additions of procedures.

Initiatives for interagency purchase of orthophotos, and for accelerated digitizing of SSURGO continue to be forwarded, but Congressional action is limited, as lawmakers attempt to hold the line on total expenditures. USDA agencies have attempted to join forces to maximize efficiency of purchases, but we haven't yet seen results.

SCS has the soil lead in developing the Federal metadata standards for data transfer. USFS is collaborating. Other agencies have the lead for development of the metadata standards for other natural resources. **These Federal Data Transfer Standards** will be followed by Federal agencies, and will control Federal agency options even if in contradiction to NCSS standards. Hence, we are very glad that the soil lead is within the NCSS part of the Federal community. The Soil Survey lead recently shifted from Dennis Lytle to Tommy Calhoun.

Some notable committees that have been functioning in recent years, to make the soil survey effort still more effective and better coordinated, are as follows:

-- A National Soil Survey Center Advisory Committee of state conservationists consisting of one from each NTC area **has** been very helpful in providing advice from their perspective, and was instrumental in getting us started on the soil survey strategic plan. Current members are Niles Glasgow, FL; Duane Johnson, CO; Dawn Genes, NH; Earl Cosby, WI, augmented by the Director, West NTC, Tommy George.

-- A NCSS Technical Advisory committee to the National Soil Survey Center composed of one Agr. Exp. Sta. representative from each region, plus one representative each, was initiated by action of the National Soil Survey Conference of 1991. This group has brought up a number of issues from the perspective of active NCSS participants outside SCS. Members are **Mary Collins, Univ. Fla.; David Lewis, Univ. Nebr.; Robert Rourke, Univ. Maine; and Eugene Kelly, Colo. St. Univ.; Peter Avers, USFS; and Glen Bessinger, BLM.**

-- The NCSS Standards Committee, of **Ed Ciolcosz, Penn. St., Univ.: Mickey Ransom, Kans. St. Univ.; Janis Boettinger, Utah St. Univ.; Tom Ammons, Univ. Tenn.; Peter Avers, USFS; Scott Davis, BLM; Gary Muckel, SCS; and Steve Holzhey, SCS, Chair. The committee has begun identifying those standards that** are NCSS. Gary Muckel is poised to take a larger role, and has created a list of standards that will come under committee scrutiny in July.

represent about 1/3 of the soil scientist time at the NSSC, with sizeable contributions from SCS in NHQ, NTCs, and states, plus contributions from others in NCSS.

Soil Survey National Structure in SCS

About two years and a half years ago we began studying currently popular concepts of leadership and management. We also began serious discussions about how to adjust processes at the national level in response to advice from within SCS and NCSS.

We agreed that the national soil survey staffs were too mutually dependent to function as separate entities. We also responded to the NCSS Technical Advisory Committee, that had said our national structure made our SCS soil survey leadership seem too diffuse, and to a committee of SCS state conservationists who also expressed related concerns. We also agreed that our staff structure limited reaction time to new priorities, Employees tend to view shifts of people from one staff to another as gains and losses instead of ways to best serve.

We further agreed that the National Leader concept was a weakness in the structure, because those positions were expected to wear too many hats: (1) supervisory, (2) administrative/operational, (3) technical, and (4) long range think tank. Critics complained of a lack of strategic leadership.

We set out to shore up the perceived weaknesses, and to empower individuals more. The general idea was to eliminate much of the old structure! and rebuild a staff in which the steering team has time to orchestrate our strategic processes, do some think tank work, and strengthen contacts with a variety of customers and collaborators. Others would do much of the technical work formerly done by national leaders. The net result at the NSSC and NHQ would be more time spent leading the program, and a little less, but more effective time for technical staff work.

In January of this year, we eliminated all internal staffs except those producing data and publications at the NSSC, and all but the World Soil Resources Staff at NHQ. The leadership of the two locations was merged into a single steering team and charged with the overall management of the SCS soil survey by Dr. Richard Arnold, Director, Soil Survey Division, SCS. National Leaders that did not become part of the steering team retained technical responsibilities.

The new steering team is known as the Soil Survey Division Steering Team, and is under the direction of Dr. Arnold. The new organization centers around a team concept, customer service, and flat administrative structure.

Basically, the Steering Team is responsible for (1) supervision, overall management and supervision of the Soil Survey Division in NHQ and NSSC, (2) overall strategies, plans, and operations for the SCS soil survey effort, and (3) liaison with SCS leadership, other customers, and cooperators.

The SCS Soil Survey Division Steering Team consists of James Culver, Maurice Mausbach, Steven Holzhey, Tommy Calhoun, Dennis Lytle, and William Roth. Roth will transfer to the National Soil Survey Center about August 1, 1994.

Harf Eswaran, the National Leader for our international effort continues in his old role, unchanged.

Ellis Knox, continues his lead role as the National Leader for Research, focusing more (1) on the research agenda to implement soil survey strategies, and (2) on liaison to the Agricultural Experiment Station Cooperators of the National Cooperative Soil Survey to facilitate that process.

For each relatively short term team there is a Steering Team sponsor who helps with project management. The sponsor works with the team leader, who is like a hard working technical committee chairman. The team leader, and not the sponsor is the contact person for people interested in work of the team. Readers are again referred to the end of this report for a list of the formal teams of the SCS Soil Survey Division.

For the larger, long term efforts, there are lead scientists instead of steering team sponsors. The lead scientists have many of the technical responsibilities formerly held by National Leaders, but are freer to concentrate on the technical program. They serve as the senior technical experts in a subject area, for the Soil Survey Division. They facilitate and arbitrate technical decisions in a designated subject area. Although their duties vary somewhat, they have in common:

1. Liaison responsibilities to customers in the subject area,

2. Team responsibilities with other lead scientists to assure competence and continuity among technical products of the SSD,

3. Responsibilities to initiate, facilitate, and encourage technical discussions and interactions among the other scientists in the specific subject areas (natural work groups), other lead scientists, and others,

4. They track activities and direction in the subject area, and

5. They maintain files and technical records of R & D and rationale for their specified subject areas,

We are still defining responsibilities, but to date have named Larry Ratliff as a lead scientist for quality, Raymond Sinclair as the lead scientist for applications, Gary Muckel as the lead scientist for the documentation of standards and procedures, including the National Soil Survey Handbook, and other definitive documents. Robert Ahrens is the Lead Scientist for soil classification, and Carolyn Olson for soil landscape investigations.

Several other long term responsibilities are assigned to individuals. Two to note at this time are Earl Lockridge for the training program, and Ricky Bigler for the soil survey data dictionary.

General Comments

We are taking a more proactive role within SCS and in outreach to customers. Some examples follow:

General Comments

We are taking a more proactive role within SCS and in outreach to customers. Some examples follow:

-- Steering-Team meetings were held with SCS State Conservationists in each of the four NTC areas of the USA last year. The session in the NE also included SCS state soil scientists. One day was devoted soil surve

Soil Survey Division Teams
FY-94

Team	Sponsor	Lead
Soil Health/Quality 8 Sustainability	M. Mausbach	G. Muckel
Pedon	S. Holzhey	E. Benham
Official Soil Series Team	J. Culver	L. Brockmann
NASIS Teams:		
Model Interface	W. Roth	R. Nielsen
Reports Generator	J. Culver	
Nat'l Standard Implementation	J. Culver	
Interpretation Generator Module	W. Roth	R. Nielsen
National Data Access Facility	D. Lytle	S. Waltman
Soil Survey Schedule Module	W. Roth	C. Loerch
Lab Data Integration & Conversion	D. Lytle	E. Benham
Soil Characterization Data Reliability	S. Holzhey	E. Knox
Data Validation/Population	S. Hohhey	R. Bigler
Global Change Teams:		
Global Change	D. Arnold	J. Kimble
GCPP Soil Temperature and	T. Calhoun	R. Yeck
Soil Survey Publication:		
Streamlining Quality Improvement	D. Lytle	R. McLeese (IL)
Operation Quality Improvement	J. Culver	H. Smith (NC)

National **Cooperative** Soil Survey: **University**

As I thought about the University perspective on the soil survey I identified four areas to discuss. They are: Resources, education, cooperation, and research.

1. __Resources__ - People and Dollars

OBSERVATIONS

a. Pedology is a rather young field of science and practiced by a relatively small number of scientists (Yaalon).

b. Universities are now at or below a critical mass in terms of personnel involved in NCSS and related activities.

c. Pedologists in soils programs are concerned about their numbers, available budgets, and lack of active surveys nearby.

d. Pedologists are excited and optimistic about new opportunities utilizing new technology and new areas for pedology research.

At the University of Florida during the mid 80's state funding was among the best in the nation, if not the best for the NCSS with the SCS involved in the mapping and the Experiment Station involved in sampling and research. Now we are at zero funding with three counties to be mapped.

The literature points out real concern over the resource base.

2. <u>Education</u> - Soil science faculty involved with research and teaching in Agricultural Experiment Stations and Colleges of Agriculture are essential to teach the next generation of soil scientists. Other disciplines such as environmental engineering geology, although important in soil science education, in themselves do not train soil scientists. Thus, I submit a major role of Experiment Station Scientists who are pedologists and are essential for generating the new soil scientists for the soil survey.

3. <u>Cooperation</u> - The National Cooperative Soil Survey. The literature is clear that since the beginning the soil survey has been a cooperative effort. Cline writing in the <u>Soil Science Society of America</u> (Vol. 41) states that "morphology, genesis, and classification of soils in America have been inextricably intertwined with the Soil Survey since its inception. This cooperation is probably best illustrated historically by the 1935 joint meeting of the soils section of the American Society of Agronomy, the American Soil Survey Association from the Soil Science Society of America. The contemporary illustrations is the overwhelming overall success of the soil survey effort. The cooperation between universities and USDA and other in the survey allowed its success.

Such cooperation also appears to be the key to the future with cooperators contributing in the area of their strengths.

4. Research - There is a delightful paper by Richard Arnold in the summer 1992 Soil Survev Horizons on becoming a pedologists. Arnold states "Pedology is the heart, soul, and artistry of soil science." Soil is not static but dynamic. The need for research on soils is necessary to widen the conceptual principles and to improve the understanding of the multitudes of processes operating in soils over time. I see the University with its Experiment Station scientist's central to that task.

Although much of the early soil science research was related to farming to devise better means to manage soils for increased and sustainable production. I sense from the literature that we have evolve to a much broader agricultural agenda including non-farm soils, fundamental aspect of landscape evolution and variability, biochemical cycling of nutrients and other elements , archeology, understanding historical past environments to predict to some degree future environments, and certainly urban considerations.

Early in this talk I spoke about a personal experience of gardening which addresses the concept of soil as a growth medium. The several times I have made opening remarks to you at these meeting s I urged that we think of soil in a broader sense as an essential natural resource. Again the literature reinforced this concept. Emil Truog's writing in the Soil Science Societv of Proceed- (1949) stated, "I like to keep in mind the fact that currently the annual market value of all the gold mines in the whole world is only about three-fourths of the annual market value of the crops produced on the soils of Wisconsin."

In summary, the University Perspective on the NCSS is that much has been done with great success and as the concept of soil evolves much needs to be done. The University or Experiment Station scientists provide human resources or expertise to the soil, cooperate with other agencies in a big job, are involved in educating the next generation of soil science and central to the research agenda of peaology.

3 hope these comments were useful to you and I look forward to another successful conference. As Administrative Advisor to the Southern Regional Soil Survey Work Planning Conference representing the Southern Association of Agricultural Experiment Station Directors, I would like to add my welcome and wish for continued success of the National Cooperative Soil Survey.

NCSS, FOREST SERVICE PERSPECTIVE

JERRY RAGUS

Southern Regional
Soil Survey
Work Planning Conference

Little Rock, Arkansas
June 20-24, 1994

I am glad to be here today representing the Forest Service. Thank you for the opportunity to share with you some information on our agencies participation in the NCSS.

Most of you know that the Forest Service is in the process of making some major changes in our organization. The Reinvention efforts of the Department will lay out the changes, but the Buyout our agency just went through will have a tremendous effect on our workforce. I know that the scs facing the same situation. We lost over 2,000 positions Nationally and about 230 in the Southern Region. In the Forest Service, Soil Scientists and Hydrologists were exempted from the buyout. This was primarily because the budgets for the Soil and Water programs are expanding due to our shift to Ecosystem Management, the Clean Water Act, Wetlands and Riparian Area regulations, the Clean Air Act and other environmental issues.

We are rapidly moving into Ecosystem Management in this Region as well as the other Regions. We have a Regional Ecological Classification, Mapping & Inventory team which is developing a classification system and the criteria and process for mapping ecological units. I will talk more about the ECS we are developing in our Region later in the week.

We are continuing to complete Order 2 soil surveys on National Forest lands. We are about 85% completed with current surveys. One of the required layers in our GIS is the soil survey.

During FY 94, we have reimbursable agreements for SRI with 8 states in the Region. These agreements total about $215,000 for about 170,000 acres.

We have 21 Soil Scientists at the Forest level and 2 in the Regional Office who are involved in the soil inventory program.

While we are **continuing** to complete the Order 2 surveys, we are also integrating these inventories into ecological inventories.

Several **of** the speakers today have talked about cooperation. We plan to continue our cooperation with the NCSS and also in developing the ecological maps we and other agencies are working on.

Most of you know Pete Avers, our National Soil Program Leader in Washington. Pete will be retiring on June 29.

Again, I am glad to be here this week. I would like to thank Charles and his staff for the program they have put together. It looks like we will have a real good meeting this week.

TRAINING IN SCS

Presentation by Charles Adams to the South Regional Soil Survey Work Planning Conference of the National Cooperative Soil Survey, June 20-24, 1994, Little Rock, Arkansas

What's new in training:

* States are canceling training due to budget constraints [the states don't want their employees to travel anywhere for training unless the training is within driving distance].

* This year formal courses were cut from 160 to 111 due to lack of funds--formal classroom training is becoming too costly.

* Our employees still need the same (if not more) training as in the past--especially on new programs and initiatives such as wetland delineation, ecobased assistance, and TQM.

* This impresses upon us the need to use alternate means of delivering training to our customers--training that can be delivered effectively and efficiently and to more people than we have in the past.

* Because our agency is now involved, more than ever, with MOU's with sister agencies, we want to include our partners in training opportunities and avoid duplications among government agencies. Using technology such as satellite delivery and computer based training will allow us to involve more people in receiving necessary training. It also gives us the opportunity to share in more training available through sources other than SCS.

* As James Lyons suggested in his January 26, satellite conference with the Forest Service and SCS, the NRE agencies need to work together in common goals such as GIS and Water Quality.

* An SCS-GIS Instructor Cadre will be put together in the near future. Funds have been made available and descriptions have been drawn up. We need to involve our partners in this effort.

* SCS has created a cadre of instructors who deliver management and technical training in a professional manner. This professionalism provides more efficient use of training dollars and facilitates a consistent learning experience for all employees throughout the agency.

* Charles Adams and Ken Cookson are developing an SCS national training proposal recommending that facilitator skills be taught as a stand-alone course. An additional course combining conflict management, effective listening skills, "people" skills, negotiating, team building, and group dynamics will also be developed. Other topics such as measurement, bench marking, and self-directed teams are also being considered. These courses will be delivered in FY '95.

- SCS is supportive of the graduate studies program for the education of its employees in areas of specific interest to SCS. An ad hoc review team will be established to provide recommendations on the announcement and applicant rating process. This team will be an inter- and intra-agency group.

- SCS will also be reemphasizing the career enhancement program to provide employees in grades l-l 0 opportunities for career growth, development, and retraining. This program will contribute to the diversity of SCS employees through self-motivation and agency support.

- SCS, Office of Personnel Management, US Extension Service, USDA, and Office of Communications have created an on-line data base of satellite down link sites and facilitators. The data base is located on the OPM Express bulletin board system and is available to all states for locating sites close to their offices to reduce travel costs.

- Our agency is developing an on-line system for easier tracking of training. It will provide us with an opportunity to marry IDP's and Proficiency Models to further career development. It will also allow states to define their own core courses and find alternative means for training their employees other than SCS formal courses. Phase 1 of this new system has just been implemented by Rhode Island and Connecticut. These 2 states are one of four sites that will be testing this new program.

- As a partner in INFOSHARE, we are developing a plan and capacity for delivery of INFOSHARE courses. Currently, there are four independent sites with Computer Based Training and Interactive Video. We plan to expand into Distance Learning via satellite and a nation-wide Computer Based Training network which will be available to INFOSHARE agencies and through MAP, other USDA agencies.

Within the next few months:

- A FOCS-EBA Interactive Satellite broadcast will take place March 8, 1994 for 2 1/2 hours. It can be viewed by all SCS employees and partners. Broadcast is expected to be down linked to at least 300 locations nationwide. Paul Johnson will introduce the program and give his philosophy about eco-based management. Wes Oneth will moderate and Pearlie Reed will wrap-up the program.

- A 24-hour Interactive Satellite course on Water Duality computer modules is under production. The course is targeted to take place early summer '94 with an audience of Water Quality Specialists located at the NTCs and states. This course is being developed jointly with ARS.

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* Because **of** the support that the **NTC's,** States, and NHQ are giving to training, our products are improving every year. You have given us your best people for course design teams and have allowed them to spend time to help develop these courses. Through this internal partnership, we can continue to deliver quality training in a timely, efficient, and effective method.

Thank you.

SOIL SURVEY QUALITY ASSURANCE ACTIVITIES
South Region Soil Survey Work Planning Conference
Larry F. Ratliff
June 1994

For the-last six years we have conducted soil survey quality assurance activities along major land resource area (MLRA) lines and as a Quality Assurance (QA) staff. This staff was composed of four groups of people. Three groups, the East, Central, and West, were composed of soil scientists who provided direct assistance to states in the conduct of field reviews, vorkshops, and the review of soil survey products. The fourth group consisted of editors who provided editorial reviews and produced page ready copy of soil survey manuscripts. In fiscal year 1993 we participated in about 65 field reviews, 40 state or MLRA workshops, reviewed and processed over 4000 series and processed about 50 soil survey manuscripts.

At the beginning of fiscal year 1994 the decision was made to dissolve staffs and move to more of a team style operation. We had already developed our schedule for the year and planned to continue our operation much as we had always done as we transitioned into the new style of operations.

However, several things were happening. To begin, Jim Culver became a member of the "Steering Team" and was effectively removed from QA activities. Berman Hudson was selected as a liaison to the Environmental Protection Agency and reassigned to North Carolina. Carol Franks was named the State Soil Scientist of Arizona. Concurrent with this several people were assigned to various team activities which required differing amounts of their time. We regrouped, adjusted our schedules, and then along came the buy out. Roger Haberman, Dick Base, Beverly Shanks, and Rex Mapes accepted. To shorten the story, since the first of the fiscal year we physically lost one/third of our soil scientists. We, like you, are struggling to keep up but will try to meet as many of our commitments to you as possible.

What about the future?

In February 1994, Roger Haberman, Ellis Knox, Ronald Yeck, and I were directed to begin a formal process to: a) Define what services the National Soil Survey Center (NSSC) should provide to states considering our reorganization and possible budget constraints; b) Define how those services should be provided. The process was to be completed in time to schedule assistance to states by fiscal year 1995.

We were provided a list of names of persons available to provide either full or part-time assistance to states. This list included most soil scientists, data base persons, end editors at the NSSC.

The four of us chose to invite Robert Ahrens, Gary Muckel, Carolyn Olson, and Raymond Sinclair to participate in developing a strategy for providing services to states. They accepted.

In March we had a meeting of the persons identified to us. We presented a preliminary list of products or services currently provided to states. Our strategy was that through input of the group we would add to the list and collectively prioritize the work activities as essential, not needed, and some intermediate ratings. The meeting was not a rousing success. We were successful getting products and services added to the list but there was a reluctance to prioritize. Many suggested that a priority vote would not be useful because the list was too detailed, not organized into meaningful categories, and perhaps not progressive. We were asked to rethink our position and to group the long list of products and services into broader categories.

Following the meeting we attempted to organize all that we do in relation to several different schema. We finally

4. Geographic areas of responsibility for the teams will be by land resource region (LRR) or groups of LRR's such as proposal A, or proposal B, or some alternative. (Proposal "A" divided the U.S. into four regions. The boundaries of the regions were close to the NTC boundaries except they are along LRR's rather than state lines. It was proposed that a team be assigned to each region. The make-up of the team would depend on priority and need of the area but the team members would come from both the NSSC and NTC's. Proposal "B" was similar except that the country was divided into 6 regions and 6 teams were proposed.)

5. Priority of services provided to the states will be determined on an ongoing basis by regionally assigned teams in consultation with states and cooperators.

6. Team assignments will be made by the committee conducting these meetings.

At each of the five meetings we presented background information much as described in this paper. Each attendee had an opportunity to express his/her views in group and individual discussion. A vote was then taken.

All five groups gave a YES consensus (with minor proviso) for items 1, 2, 3, 4, and 5. Item 6 received yes consensus from only three of the five groups and only with proviso.

The proposal for four regions received 20 votes and the proposal for six regions received 24 votes.

Having received consensus of the involved NSSC personnel we asked the steering team to begin the initiative for fostering a closer partnership with the NTC's. We also roughed out a core team structure (in terms of kind of expertise and anticipated workload) for each of the six regions and asked for expressions of interest in being on one or more of the teams. Teams have been formed as shown on the attachment. The team leaders will be the contact persons and work with the states and NTC's to identify priorities and assistance needs for fiscal year 95.

We are asking each of you to give serious thought as to how we can best assist to ensure we have quality soil survey products. What things are we doing that can be dropped? What things are we not doing that we should be doing? How can we be more efficient?

South Regional Work Planning Conference
Little Rock, Arkansas
June 20-24, 1994

National- Soil Survey Laboratory Activities
Warren Lynn
Tuesday, June 21: 8:20-8:40 AM

We have been and still are experiencing re-invention of government and reorganization activity. The analytical function of the Laboratory, including sample processing and preparation are a separate entity under a newly formed Analytical Management Team:

DeWayne Maya, Leader
Richard Pullman
Lea Ann Pytlik
Tom Reinsch
Susan Samson-Liebig

DeWayne Ways, the Read of the Soil Survey Laboratory, Dennis Lytle of the Soil Survey Division Steering Team.

Three persons in the Laboratory accepted the recent buy-out proposal for retirement: Benny Brasher, Leo Klameth, and Sue Legeros.

I am sure we will all miss Benny's participation and counsel in this and future South *Region* Work Planning conferences. Leo was the soil scientist in charge of mineralogy production in the laboratory. Benny and Leo both moved from Riverside to Lincoln when the National Lab was established in 1975. Sue was lead technician in the Mineralogy Section of the lab. Staffing of the analytical lab has not been affected except in mineralogy. We also lost a full time technician who was a whiz at grain counts to another job in his profession. Those of us remaining, including Mike Wilson and me, are putting in extra time to keep up. Leo has been putting in volunteer time to help out.

The laboratory facility will be undergoing renovation in the next year, including major overhaul of the air-handling system and installation of labs in some additional apace. This will entail down time, the major part anticipated from November through March. We have developed a plan to work with contractors to minimize loss of work.

With all that has/is happening, we are still turning out work. In FY93 we received 8771 samples in 239 projects and turned out 297,342 analyses. A copy of the workload for the past three fiscal years is attached to my report to the conference.

NATIONAL SOIL SURVEY LABORATORY
SOIL CONSERVATION PROJECTS
WORKLOAD ANALYSES

TOTALS FOR YEAR: 91

AREA	PROJECT CP	PROJECT RP	PROJECT RZ	PROJECT TOTAL	PEDONS CP	PEDONS RP	PEDONS TOTAL	SAMPLE CP	SAMPLE RP	SAMPLE RZ	SAMPLE TOTAL
F	3	1	4	8	19	2	21	134	12	58	204
M	24	42	13	79	211	248	459	958	1580	392	3930
N	8	6	3	17	63	35	98	83	174	76	733
S	19	10	14	43	122	39	161	876	183	469	1528
W	29	44	31	104	243	203	446	677	820	636	3133
X	0	7	12	19	0	18	18	0	91	92	183
TOTALS	83	110	77	270	658	545	1203	5128	2860	1723	9711

TOTALS FOR YEAR: 92

AREA	PROJECT CP	PROJECT RP	PROJECT RZ	PROJECT TOTAL	PEDONS CP	PEDONS RP	PEDONS TOTAL	SAMPLE CP	SAMPLE RP	SAMPLE RZ	SAMPLE TOTAL
F	6	0	1	7	56	0	56	393	0	14	407
M	35	25	31	91	213	90	303	1890	512	1395	3716
N	6	3	4	13	45	34	79	306	94	105	505
S	16	5	18	39	67	7	74	588	37	1061	1686
W	63	43	19	125	358	207	565	2055	1051	588	3694
X	2	3	19	24	10	16	26	81	60	470	611
TOTALS	128	79	92	299	749	354	1103	5232	1754	3633	10619

TOTALS FOR YEAR: 93

AREA	PROJECT CP	PROJECT RP	PROJECT RZ	PROJECT TOTAL	PEDONS CP	PEDONS RP	PEDONS TOTAL	SAMPLE CP	SAMPLE RP	SAMPLE RZ	SAMPLE TOTAL
F	5	0	4	9	51	0	51	366	0	39	405
M	19	24	17	60	125	145	270	1348	1044	676	3068
N	21	7	16	44	119	18	137	850	90	628	1568
S	14	9	4	27	77	19	96	505	211	115	831
W	25	22	31	78	175	109	284	1063	401	958	2422
X	1	2	19	22	6	6	12	51	52	374	477
TOTALS	85	64	91	240	553	297	850	4183	1798	2790	8771

CARTOGRAPHIC SUPPORT
TO THE
NATIONAL COOPERATIVE SOIL SURVEY (NCSS)
by

Lee Sikea, Branch Chief, National Cartography & GIS Center

During the past year, the National Cartography and GIS Center (NCG) has supported the NCSS by preparing materials, providing training at NCG, and providing direct assistance to several states.

The Aerial Surveys/Photobase

set of B&W photographic prints is made by compositing the line negatives with the halftone negatives for each atlas sheet. This dummy is given one final check for registration, tonal quality of theimage, legibility of symbols and lettering, and gross errors.

The Negative Prep Section communicates regularly with the soil survey text editors at the national Soil Survey Center (NSSC) in Lincoln, Nebraska, to coordinate maps and text for surveys being published. They also coordinate with the Publications Branch at NHQ in order to ensure proper quantities of publications are printed and distributed.

At any given time, NCG has approximately 150 sets of map negatives waiting for publication. They may wait in NCG from 3 months to 5+ years, depending on the overall schedule.

The Contract Map Finishing/Digitizing Section has been in place since 1966 to assist states in obtaining map finishing of map overlays and, also, obtaining digital soils data. This is to help states that do not have the staff to do their own map finishing or digitizing. NCG will cost-share with states in order to obtain this work through contractors.

In the past 2 years, it has become evident that many of the jobs digitized by the states and by contracting did not meet SSURGO standards. As a result, Hof Owen and Fred Minzenmeyer have been developing new standards and procedures for soil map compilation.

A General Soil and Index (GS&I) map team prepares these maps for publication. Approximately 3 staff years are dedicated to this. We also have one person dedicated to making block diagrams.

The total budget (CO-02) supporting soil surveys is nearly $3 million at NCG. Approximately 27 staff years are dedicated to preparing materials or providing training in support of NCSS. We feel the Soils Division (NCSS) is our biggest customer and strongest ally.

A Report From 1890 Universities
By
Leslie J. Glover, Ph.D.

The seventeen 1890 universities end collages end their location are: Alabama A&M University, Normal, AL; Tuskegee University, Tuskegee, AL; University of Arkansas at Pine Bluff, Pine Bluff, AR; Delaware State College, Dover, DE; Florida A&M University, Tallahassee, FL; Fort Valley State Collage, Fort Valley, GA; Kentucky State University, Frankfort, KY; Southern University and A&M Collage, Baton Rouge, LA; Maryland Eastern Shore, Princess Anne, MD; Lincoln University, Jefferson City, MO; Alcorn State University, Lorman, MS; Langston University, Lsngston, OK; North Carolina A&T State University, Greensboro. NC; South Carolina State University. Orangeburg. SC; Tennessee State University, Nashville, TN; Prairie View A&M University, Prairie View, TX; and, Virginia State University, Petersburg, VA.

Although they era officially called 1890 collages and universities, many of these schools ware formed before 1890. For example, Lincoln University was opened in 1869, Alcorn in 1871, South Carolina State in 1872 end University of Arkansas et Pine Bluff in 1873. Most of these schools ware formed after the emancipation of slaves in 1865. This unleashed a potential workforce of 4 million Blacks who were illiterate and in need of education to prepare themselves for survival end prosperity in American Society. Then, there were no higher education opportunities for Blacks, and usually, primary and secondary education ware nonexistent.

For more than 100 years, these schools have stood the test of time and in 1990 they celebrated their centennial year. Today, the 1890's can point with pride to both the private and public sectors of society at the vast number of professionals that they have produced. For example, if we look at en agency such as the Soil Conservation Service. It could easily be shown that most of the Afro Americans in this agency have at least one degree from an 1890 university. And, if one looks at the USDA, I dare say that the same trend will hold true. The 1890's have accomplished this feat with an ethnically diverse faculty and student body. For example, the University of Arkansas at Pine Bluff has a faculty that is approximately 33 percent nonAfro American and the student body is about 19 percent nonAfro American.

History will show that these institutions have done exceptionally well in meeting the challenges that faced them. This was done by dedicated faculty, staff and administrators because the schools were not provided sufficient financial or fiscal resources to accomplish their goals. In spite of these shortcomings, these schools can point with pride to their record of human capital development. Also, they have done many worthwhile public services for their local communities, their states and the nation.

Formal research activities began at most of these schools in 1967. This was the result of concerted efforts by members of the 1890 community (presidents, also deans and chairpersons of agriculture) and federal research administrators. These groups made a recommendation to the Secretary of Agriculture, who funded grant proposals using discretionary funds provided by Public Law 8 9 106. During the past 27 years, these schools have conducted research that is relevant to the clientele groups that they serve. By doing this, they have made many positive contributions to the nations food & fiber system.

Currently, the 1890 Institutions participate in various research activities in biotechnology, animal and plant systems, food science and human nutrition, natural resources, small scale sustainable agriculture as well as socioeconomic studies of youth and elderly. These activities are carried out in cooperation with the Cooperative State Research Service of the USDA. Research programs at 1890 Universities also provide opportunities for minority students to continue to move into the national research mainstream. This enables the 1890 Institutions to continue a tradition of being our nation's greatest asset in the development of minority expertise in the food and agricultural sciences.

The role of research in the food and agricultural sciences et the 1890 Lend Grant Colleges end Universities is to conduct basic end applied research to ensure e safe, economical and adequate food supply, promote a sustainable environment, conserve the natural resource base, end contribute to the improvement of the sociowellbeing and overall quality of life of diverse rural end urban populations.

Additionally, research et the 1990 Institutions contributes to the development of professional expertise in the food end agricultural sciences through focused research end laboratory experiences for undergraduate end graduate students. This is possible because 1890 Institutions are smell enough to facilitate pairing of undergraduate end graduate students with research scientists, thereby enhancing special research end training opportunities for students pursuing careers in the food end agricultural sciences.

Research programs at the 1890 Institutions have traditionally addressed pertinent problems end concerns of smell scale farmers end limited resource families. Future research will continue to focus on the needs of these clientele and others. Mechanisms to accomplish this goal include: 1) establishing centers of excellence in several food end agricultural science in various areas (this will be done in conjunction with USDA agencies whenever possible); end 2) initiating collaborative research programs between 1890 Institutions end various state, regional end federal agencies.

The Association of Research Directors (ARD) is one of the organizations that work to promote the 1890 campuses. It does this by providing an avenue for linking end coordinating research initiatives in the food end agricultural sciences among member 1890

Institutions, and federal, state and private partners. ARD also cooperates with appropriate regional and national committees and organizations in developing legislation that effect research in the food and agricultural sciences at the 1890 Institutions.

The research areas at 1890's are consistent with national priorities set forth by the Experiment Station Committee on Organization and Policy and the U. S. Department of Agriculture. Specifically, the Institutions are focusing on the following research areas:

(1) Improved plant production systems

(2) Improved animal production systems

(3) Small scale sustainable agriculture systems

(4) Protection and improvement of water quality

(5) Improved human nutrition and health

(6) New crops and new uses for agricultural products

(7) improved aquaculture production systems

(8) Socio economic studies of youth end elderly.

Scientists at UAPB conduct research in Poultry Science, Aquaculture/Fisheries, Entomology, Horticulture, Agronomy. Agriculture Economics, Clothing and Textiles, Housing, Nutrition and Gerontology. There are 18 scientists working on Evans Allen Projects. However, the scientists are not content to rely on Evans/Allen formula funds; they are seeking funds from external sources. The 1890 community of schools would welcome the opportunity to work with members of this group on projects that may be mutually beneficial to all concerned.

Scientists are working on diverse topics such as: (1) the adaptation of new and/or minor crops to the growing conditions of Arkansas, (2) Fish health and nutrition, pond & hatchery management, water quality, fish ecology, and marketing of aquaculture projects,

(3) Quality of well-being of the rural elderly, (4) Comfortable and affordable housing, (5) Marketing strategies that are suitable for limited resource farmers, (6) Poultry nutrition and management, and (7) Assessing the coronary risk factors of college youth. Research findings ara published in local, state, national and international publications; workshops are conducted and a presentations are made to novices and technical personnel, as well as members of the scientific community.

Future trends for research will be driven by the clientele that we serve. As the late S. J. Parker said, we are still committed to working on the "Master Research Plan for Improving the Living Conditions of Disadvantaged Rural People in Arkansas." This is inclusive in our efforts to improve the overall economy of the state. Also, agricultural research at UAPB is committed to being working partner with the University System in it's effort to solve problems.

Let me conclude by saying that over the years, the 1690 Land Grant Colleges and Universities (1890 Institutions) have shown their capacities to do much with little and to train those who might otherwise have been denied the opportunity. These institutions are prepared to work with you as we strive to meet future challenges and to continue to prepare future scholars with necessary scientific expertise for the twenty first century.

June 15, 1994

Address to the South Region Soil Survey Work Planning Conference

It has been a great personal pleasure after more than 8 years to see so many familiar faces and to renew acquaintances and to meet younger soil scientists.

1 would like to spend a few minutes, from my perspective, discussing how the National Society of Consulting Soil Scientists came into existence, where the NCSS is currently, and where I think its future lies. For a long time, soil science was composed of two parts, the university sector: research, teaching and extension, and the government sector: mapping and interpretations, (Figure 1). I can remember, as a SCS soil scientist, when soil interpretation sheets were actually developed. Bruce Watson started this process in Michigan nearly 30 years ago, and I suspect there were others doing the same elsewhere. There were very few requests for on-site evaluations or for site specific interpretations back then. Virginia was an early leader in the development of site specific interpretations,

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Address to the Southern Regional Work Planning Conference, June 21, 1994, Little Rock, Arkansas by David A. Lietzke, President, National Society For Consulting Soil Scientists.

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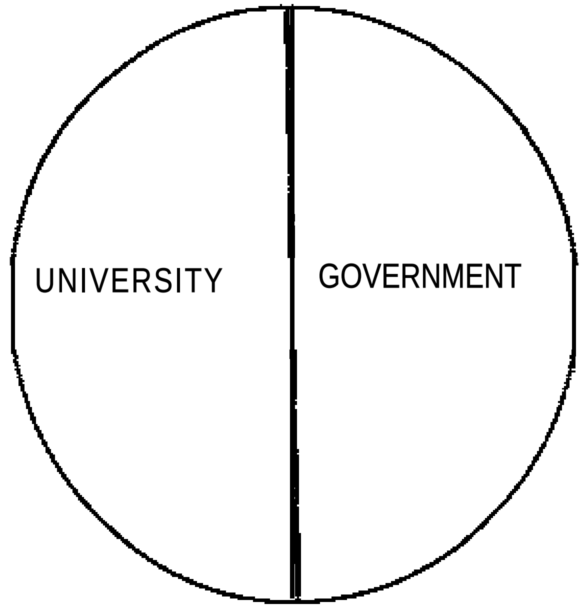
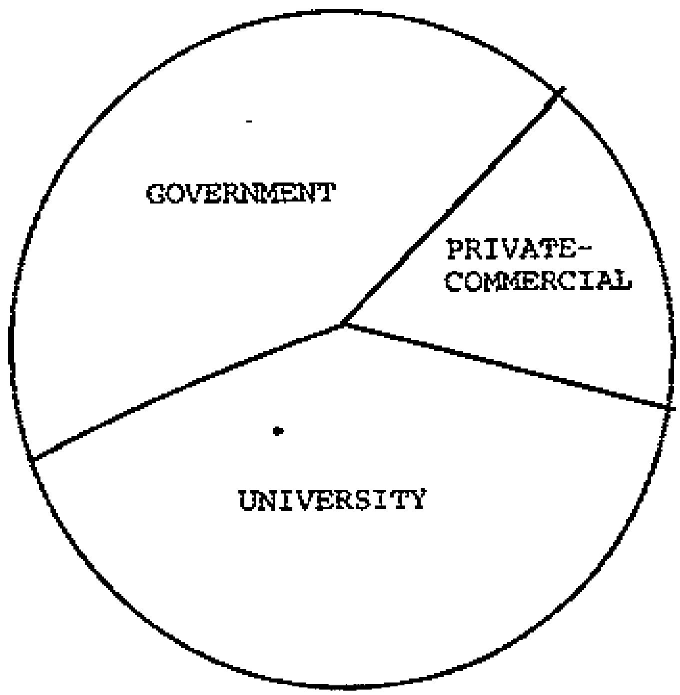


Before 1987



Present

Fig 1

especially in locating soil scientists in rapidly urbanizing areas (Fairfax County). Back in the 1960's, demand for interpretations was very low, and as the private-commercial sector of soil science aid not yet exist. The Soil Conservation Service and Land Grant Universities filled requests for information. The 1970's produced an increasing demand for on-site evaluations and site specific interpretations. Sections on soil interpretations began to occupy increasing numbers of pages in published soil survey reports. Throughout the remaining years of the 1970's and into the early 1980's, requests for on-site evaluations increased dramatically. This development produced a vacuum as there was excess demand and only a few hardy pioneers who were trying to make a living doing soil science consulting. As a result of this demand, several changes occurred. First, the SCS moved in to partially fill the demand, and second, retired soil scientists and a few younger soil scientists saw a growing potential in the consulting business. For example, the Tennessee Dept. of Health, through the efforts of Charles Powers, Joe Elder and others, adopted a "high intensity" soil mapping program to determine site suitability for subsurface sewage disposal. This program replaced the previous perc testing program. However, the demand for high intensity soil mapping could not be handled by the Health Dept.'s soil scientist staff plus the few private consultants then in business. The SCS was asked to provide soil scientists, for fee, to try to catch up as the Health Dept. was very much concerned about political problems with retaining the mapping program if developers did not receive assistance within a reasonable amount of time. This was an early example of what is now called "Work for Others" program in some government agencies. At this same time in the University sector, there was an explosion of research in effluent movement in soils and alternative types of disposal systems. The second major event that occurred in the late 1970's and early 1980's was the birth of the private-commercial sector of soil science and the slowly increasing numbers of soil consultants, either sole proprietorships or soil scientists employed by larger consulting firms. In the early and mid 1980's, essentially from about 1981 to 1987, as more soil scientists entered the private-commercial sector, consultants started to realize that both government and university sector soil scientists were doing essentially gratis work, or work at very low fees, and were in direct competition with private enterprise. This lead to a lawsuit and an injunction against the SCS. This was a major event in that it greatly enlarged the scope of potential work in the private-commercial sector and the soil science pie definitely now had three pieces. I started my consulting business in 1986 and initially had a very hard time earning money because clients had been receiving services at no cost or very little cost to them. It was also a struggle to build a reputation as a business delivering a quality product on time or ahead of time. Tennessee Dept. of Health soil scientists were charging for making high intensity soil maps, but the fees were very low and taxpayer subsidized.

In 1987, James Brown began an attempt to organize consultants, and a meeting was held in Atlanta to determine if there was sufficient interest in forming an organization of consulting businesses. In 1988, the NSCSS was formally organized. How refreshing it was to get together with other consultants, to talk about common problems and concerns. I have been involved with the NSCSS since its inception, its birthing pains and early growth.

The primary objectives of the NSCSS, as I see them are: (1) To promote conditions in the private-commercial sector of soil science so that consultants can earn a livelihood. I want to emphasize that the NSCSS is an organization of small businesses, not a soil scientist professional organization. Those kinds of professional soil science organizations already exist. (2) To provide a means of communication between widely scattered consultants. (3) To lobby and be politically involved at the state level in the promotion and use of qualified soil scientists to do soils work. In this arena, soil scientists are in direct conflict with engineers and geologists who have been organized longer and have already moved into doing work that is better done by soil scientists. (4) To provide a means of determining who is qualified by the creation of a Registry, the adoption of a very strict code of ethics and the means of enforcing the code. The NSCSS Registry currently requires 5 years of work experience and there is some thought for requiring some of this work experience to be in the private-commercial sector, and finally (5) To promote and **foster** the needed business skills required to be a successful small business.

There have been some recent problems between the SCS and the NSCSS regarding the boundaries between the government sector and the private-commercial sector. This boundary will never be straight and sharply defined. I strongly feel that the time is at hand to promote the building **of** ties and bridges and to get beyond the past even though the past colors the present.

Soil consultants are probably the best, most informed users of SCS generated information. Indeed, many consultants earn most of their living mapping soils at higher degrees **of** resolution **or** in the delineation of wetlands. However, it is extremely difficult for private-commercial sector soil scientists to keep up to date. For this reason, the NSCSS would like to sign a Memorandum of Understanding with the SCS-NCSS so that each party has a better idea of how we can and should interact. The SCS is mandated to perform certain tasks for the betterment of society and to train soil scientists to carry out these tasks. The technical training and up dating of consultants falls largely in the Government and University sectors. If advanced training or continuing education courses are suitable, consultants will pay fees, provided the training will enhance their earning potential or will expand the consultant's expertise. The NSCSS will provide training and continuing education courses in the business aspects **of** consulting. Consultants, in return, have developed a great store of knowledge of'how soils occur and are resolved at scales of 100 feet per inch. I would be happy to give copies of high resolution soil maps, where there would be no conflict with ownership, to SCS party leaders in active counties so that they can rapidly gain a feel for how complicated soil patterns are over certain kinds of geologic formations and relatively less complicated over other formations.

As there are several University sector soil scientists present, I want to say a little about interactions that I feel are needed between the University and private-commercial sectors of soil science. Personally or professionally, I do not have a problem with University sector soil scientists consulting for a fee as long as there is no direct competition and that fees charged are high enough. However, there is one state where the private consultants have been complaining about a university soil scientist doing routine consulting jobs and what they perceive to be excessive competition. What I am saying is that the potential for conflict with private enterprise exists. Most University soil scientists, with a Ph.D degree, can become involved in consulting activities where an advanced degree end knowledge is required. The other reason I am not too concerned about the consulting activities of University sector soil scientists is that this is a means whereby these soil scientists can acquire real world experience. The private-commercial sector will look to the university sector for needed research in issues that may occur largely in the private sector.

The private commercial sector needs university educated soils students who will have some knowledge of business methods and practices. The NSCSS recognizes each year, a university that has a soils curriculum that will graduate soil scientists who can function in a business environment. The private-commercial sector of soil science is not an area where someone fresh out of the University can hang out their shingle. This sector requires a fairly lengthy period of apprenticeship. Since the bulk of income in the private-commercial sector is generated from soil mapping, potential consulting soil scientists must learn how to do this. In Tennessee, for example, a new soil scientist, by virtue of a four year education in soil science, must work with a licensed soil scientist for a minimum period of two years, then take a qualifying test and then submit their first several subdivision soil maps and reports before they will be licensed by the state agency. Another way to gain work experience in Tennessee is to work with the SCS on a soil survey crew for a period of two years. Let me insert a strong word of caution about learning how to map soils. High resolution soil mapping requires "splitters": Lumpers will have trouble.

In conclusion, the private-commercial sector is now rapidly growing and will continue to rapidly grow. This sector needs young dedicated soil scientists in the consulting business. Established soil consultants will have to take the responsibility of providing the additional needed training and experience required for them to become successful. Having worked in all three sectors of soil science, I can surely tell you that in order to be successful in the private-commercial sector, a soil scientist must acquire a mind set. Each sector has its own perspective, problems and outlook. As you can see, the private-commercial sector of soil science is very young but actively growing. We must cooperate when and where we can, and, if necessary, fight and lobby to promote an atmosphere where private enterprise can flourish. I realize that there are probably some areas around the country where sufficient numbers of consultants may be lacking to satisfy the demand. The Department of Energy (DOE) for example, has a "work for others" program. If the SCS were to have a similar program, here is a possible way it could operate. First, there needs to be an understanding of what is work for the betterment of Society and site specific work for individuals. The SCS will continue making and updating soil surveys and interpretations. I think it is the publics business for SCS soil scientists to interpret existing information, but it is in the private-commercial sector when individuals want specific on-site information that requires an on-site visit and additional field work over and above the making of a second order soil survey.

1. State soil scientists should have a list of qualified soil consultants in their state. This list can be provided by the state soil scientist association or consultants association. 2. As requests for providing information that requires field work in the nonagricultural sector, the person requesting assistance is

provided with a list of consultants. If no consultants are available, the "work for others" program would be activated. 3. SCS soil scientists time (hourly rate plus overhead and fringes plus transportation) is made available for specific on-site work. Society should not be paying or subsidizing on-site work for individuals in the non-agricultural area. I strongly feel that the mandate of the SCS is to provide assistance to the betterment of the general society and to specific kinds of individuals through cooperator agreements in the interpretation of existing information. On site assistance requests by land developers and others for the making of high resolution soil maps or for specific kinds of on-site investigations should go to consultants if they are available.

Because NSCSS soil scientists are making high resolution maps, Officers of the Society have began to discuss standards for the making of various kinds of high resolution soil maps. Table 1 is a first draft of such proposed standards. This table does not say what should be mapped. What is to be mapped at various degrees of resolution depends on how the map is to be interpreted. The proposed standards specify the map scales and ground controls that are required to make these kinds of higher resolution soil maps.

I would also like to invite soil scientists who are contemplating making a move into the private-commercial sector to come to the

Degree of resolution	Map scale	Ground control
LOW	100 to 400 ft/in.	2 to 5 foot topo contours (not smoothed)
MEDIUM	100 to 200 ft/in.	grid stakes at 100 to 200 foot intervals or 1 acre or larger lots with corner stakes
HIGH	50 to 100 ft/in.	grid stakes at 100 foot intervals or lots less than 1 acre in size with corner stakes
VERY HIGH	25 to 50 ft/in.	grid stakes at 25 to 50 foot intervals

next NSCSS annual meeting which will be in Coeur **d'Alene,** Idaho January 25-29, 1995. Please call l-800 535-7148 for details or to be placed on the NSCSS mailing list.

TECHNICAL **SOIL** SERVICES

Presentation for the South Regional Work Planning Conference
June **20-24,** 1994
Little Rock, Arkansas
by
Maurice J. Mausbach

INTRODUCTION

It is a pleasure for me to speak with you about technical soil services and some issues related to technical soil services. In the reorganization **of** the national staff, my title changed from National Leader for Technical Soil Services to **Assistant** Director and with it a came a change in duties. In this respect, Lawson Spivey and Ben Smallwood have had to assume some of the leadership in TSS. I will discuss some of the activities in technical soil services in Washington, our activities in **soil** quality/soil health, and follow-up activities from the technical soil services brainstorming session last year in California.

TECHNICAL SOIL SERVICES ACTIVITIES- **NHQ**

I will briefly cover some of our activities at the national level in Technical Soil Services. The interpretations team have been working for a number of years with the Forest Service on forestry related interpretations. We recently held a workshop with the State and Private Forestry people from the Forest Service and from selected states. Out of that work shop a recommendation was to initialize a test program where representatives from the forestry community become involved in developing forest soil interpretations ***on*** multi County/State resource areas. We are in the process selecting 3 **MLRAs** as pilots for the forestry community involvement. They are MLRA 105 which encompasses 37 counties along the Mississippi River, MLRA 126 which includes areas in West Virginia and Pennsylvania, and MLRA 136 which includes the southern portion **of** the Piedmont. The purpose is to bring together people with expertise in forest soil interpretations with people who use forest soil information in the development **of** regionally adapted soil interpretations.

The agency has accepted the ecosystem based assistance approach to managing natural resources and is now developing policy and procedures to implement the system. The leadership approach. wipr a mÃrglvazaginr a number os teres ty hpow develin the(poli,st)Tj 0.7729 Tc 905726 Tw 0.4

agriculture on global change. Lawson **Spivey** is coordinating this activity. We are now in the process of addressing the status and trends with respect to the effects of agriculture on global change. To address status and trends, we are summarizing the organic carbon levels of the upper meter of the soil and the changes that have taken place as a result of agriculture. We have taken-two approaches, (1) using the laboratory data, we summarized the organic carbon contents by soil class and then calculated the carbon stored in soils, and (2) using organic matter in the soil interpretations record to calculate present levels of carbon in the soil. We have done an extensive literature review of the change in carbon with cultivation and will use general relationships from the literature to assess the trends. The difficult part is assessing the effect of residue management on organic carbon levels. We hope to use the next iteration of global models to assess the effect of climate change on agriculture.

My activities with the Scientific Assessment and Strategy Team (SAST) amounted to a 10 week assignment at the EROS Data Center in Sioux Falls, South Dakota. We were tasked to build a database from which to assessed the effects of the 1993 flood and the structural and non structural practices that would help mitigate flood damages. The **STATSGO** database was extremely valuable in are activities and was the geographic data that we used to draw many of our interpretative maps. As an example hydric soils were used to used to indicate presettlement distribution of wetlands in the drainage basin, ponding was used to show the pothole or closed drainage landscapes of the area and to estimate surface storage potential, slope was used to develop a terrain classification system of the basin, and available water capacity was used to estimate potential subsurface storage of water. We have just finished our technical report which will be published along with a policy report. These reports will be used by the administration to formulate policy for reducing damages from floods.

SOIL QUALITY/SOIL HEALTH

Paul Johnson, Chief of the SCS, is committed to soil quality and soil health as it relates to the mission of the SCS. He is a strong proponent of addressing sustainability issues via soil quality. He was a member of the Board of Agriculture of the National Research Council who published the report "Soil and Water Quality: An agenda for Agriculture." In testimony before the subcommittee on Agriculture Research, Conservation, Forestry, and general Legislation, he stressed the four recommend approaches to prevent soil degradation and water pollution:

1. conserve and enhance soil quality as a first step to environmental improvement.
2. increase nutrient, pesticide, and irrigation use efficiencies in farming operations,
3. increase resistance of farming system to erosion and runoff, and

4. make **greater use** of field and landscape buffer zones.

Our Chief believes the expertise in SCS lies in soil quality, thus we have a tremendous opportunity to address soil quality issues.

In response to this and **needs to more fully define soil quality in the Field Office Technical Guide, the Soil Survey Steering Team charged a team to address soil quality/soil health issues.** The team charges are:

1. Develop a strategy to address soil health or soil quality issues for the Soil Survey Division and SCS. This includes deciding on the appropriate terms and their definitions.
2. Identify and develop indicators and criteria for evaluating and monitoring soil health or sustainability.
3. Develop a final draft **of** the **procedures, guidelines and criteria for evaluating and monitoring soil health.**

The team is chaired by Gary **Muckel and** has as members Bob Grossman, Carl **Glocker,** Ron Bauer, Larry Brown, Berman Hudson, Betty **McQuaid,** and Gary Tebke (conservation agronomist). Berman and Betty are on temporary assignment with the Environmental Protection Agency, Environmental Monitoring and Assessment Program (EMAP) in North Carolina. In response to their charges, the team held an workshop where scientists from other agencies and universities were invited to participate.

In addition to charging a team, **we** have forwarded a budget proposal for the 1996 Fiscal year to establish and fund a project to monitor and evaluate trends of the nation's soil resources. This would be accomplished via the our National Resource Inventory (NRI) sample points. The plan includes:

1. monitoring soil quality in future NRI's,
2. database development and application,
3. models/protocols for using soil-related information in soil quality assessments, and
4. techniques for applying soil quality at different scales (fields, farms, watersheds, regions, nation).

TECHNICAL SOIL SERVICES BRAINSTORMING **SESSION** - FOLLOW-UP

About a year ago we held a brainstorming session with some selected State Soil Scientists, and staff from National Headquarters, the National Technical Centers, and the National Soil Survey Centers. The objectives were to define Technical Soil Services (TSS) responsibilities and activities at each level **of** organization, develop short and long term strategies, discuss marketing with respect to TSS, and discuss funding and program implementation of TSS. We discussed a number of issues, and I will review the progress with respect to the recommended solutions for these issues.

With respect to management support for TSS, the recommended solutions were to expand the scope of the State Conservationists Advisory Committee to all of soil survey including TSS. The scope has been expanded and we will be discussing opportunities and concerns on staffing and funding soil scientists to assist in other programs in SCS with them in July. Another recommendation was to have details of State Staff to NHQ to help draft policy and procedures. We are doing this as much as possible and have included State Staff in teams evaluating the publications process. Bobby Ward is on NHQ implementation team for ecosystem based assistance.

We discussed funding issues related to TSS and suggested that the funding formula needed to be reevaluated. There is a team of State Soil Scientists reevaluating the formula. Another solution was to brief top staff and program staff on needs for TSS and funding by other disciplines. We have and continue to make these briefings. Our issue paper on technical soil services recommends that funding be requested through the programs benefiting. We also suggested that about 100 staff years of soil scientist time is needed for the NRI process, 200 staff years of time is needed for wetland identification and mapping, and 100 staff years to service other programs.

We discussed integration and linkages of soil scientists with other SCS programs. Recommendations included placing soil scientists on other staffs, broaden the paradigm that TSS can only be funded by soil survey funds, train other disciplines in use of soil survey information, and have soil scientists signoff on other programs. We are working on these recommendations. We have had success in placing soil scientists on staffs of other disciplines. We have 3 soil scientists on assignment with other agencies at the expense of these agencies, and recently the National Wetlands Team has included two soil scientists, Ron Yee and Russell Pringle, on their team.

We discussed the future organization of soil survey. The solutions were that NHQ staff develop a briefing paper on the framework of needs for TSS, strengthen TSS in the strategic plan, and reorganize National Staff to become more responsive to change. We have done all of the recommendations and the Steering Team is now redrafting the strategic plan to include a strategy on customer services.

Recommendations for technology needs included developing information networks at all levels, equip staff with latest computer equipment and GIS and attribute data, develop field manuals for onsite evaluations and interpretations of the data, develop interdisciplinary teams at area and local offices, develop mechanisms to facilitate the sharing of information, train soil scientists on TSS, soil landscape relations, organo/pesticide interactions, and other technologies, develop brochures and videos. We are struggling with ways to develop information networks to facilitate the sharing of information among the resource soil scientists. This is complicated by our line and staff organization. We are working with the **NTC's** to develop an action plan. The acceptance of the agency of the ecosystem approach will facilitate the formation of the interdisciplinary teams at the local level. We have also been approved and funded to develop a training course for technical soil services - the resource soil scientists.

We continue to have more than we can do in technical soil services at all levels of the organization. However, this is an indication that our customers realize the value of our product and services in solving their problems. I am excited about the **future** of soil survey and look forward to working with you in the developing the soil survey program of the future.

LOESS DEPOSITS IN ARKANSAS: AN OVERVIEW[1]

E.N. Rutledge*

Eastern Arkansas is located in the Lower Mississippi Valley which extends from southern Illinois to the Gulf of Mexico. This Valley contains some of the world's most widely recognized loess deposits. Most of the loess is on the eastern side of the Valley since the dominant winds which deposited these sediments generally blew from west to east. However, subdominant winds, blowing generally from east to west, also deposited loess which occurs on the western side of the Valley and on many terraces within the Valley.

Much of the Eastern Arkansas portion of the Lower Mississippi Valley (Fig. 1) is a lowland with little relief. On a trip from Little Rock to Memphis, Crowley's Ridge, a Pliocene-Pleistocene terrace with about 30 to 50 m of relief, rises in stark contrast to the adjoining lowlands. The Mississippi River and its ancestors have been both west of Crowley's Ridge and east of the Ridge where it occurs today. It has likely moved back and forth several times. Thus, there have been potential loess source areas on both sides of the Ridge which makes it an interesting area in which to study loess.

HISTORY

Call, in 1891, published an extensive study of Crowley's Ridge. He reported the occurrence of two water-deposited loesses with a paleosol in the top of the second loess. Call also suggested the possibility of a third water-deposited loess on the southern part of the Ridge. Salisbury (1891) identified loesses on Crowley's Ridge. He identified two water-deposited loesses, also noting the presence of a paleosol in the top of the second loess.

Although Crowley's Ridge was not extensively involved, the literature between the turn of the century and the 1950s contains much discussion regarding the nature of loess deposition. Was it deposited by water or by wind? Smith's 1942 article is a classical publication which showed loess to be a wind deposit. He developed relationships between

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1 Presented to the Southern Regional Soils Survey Work-Planning Conference of the National Cooperative Soil Survey, June 21, 1994. Little Rock, AR.
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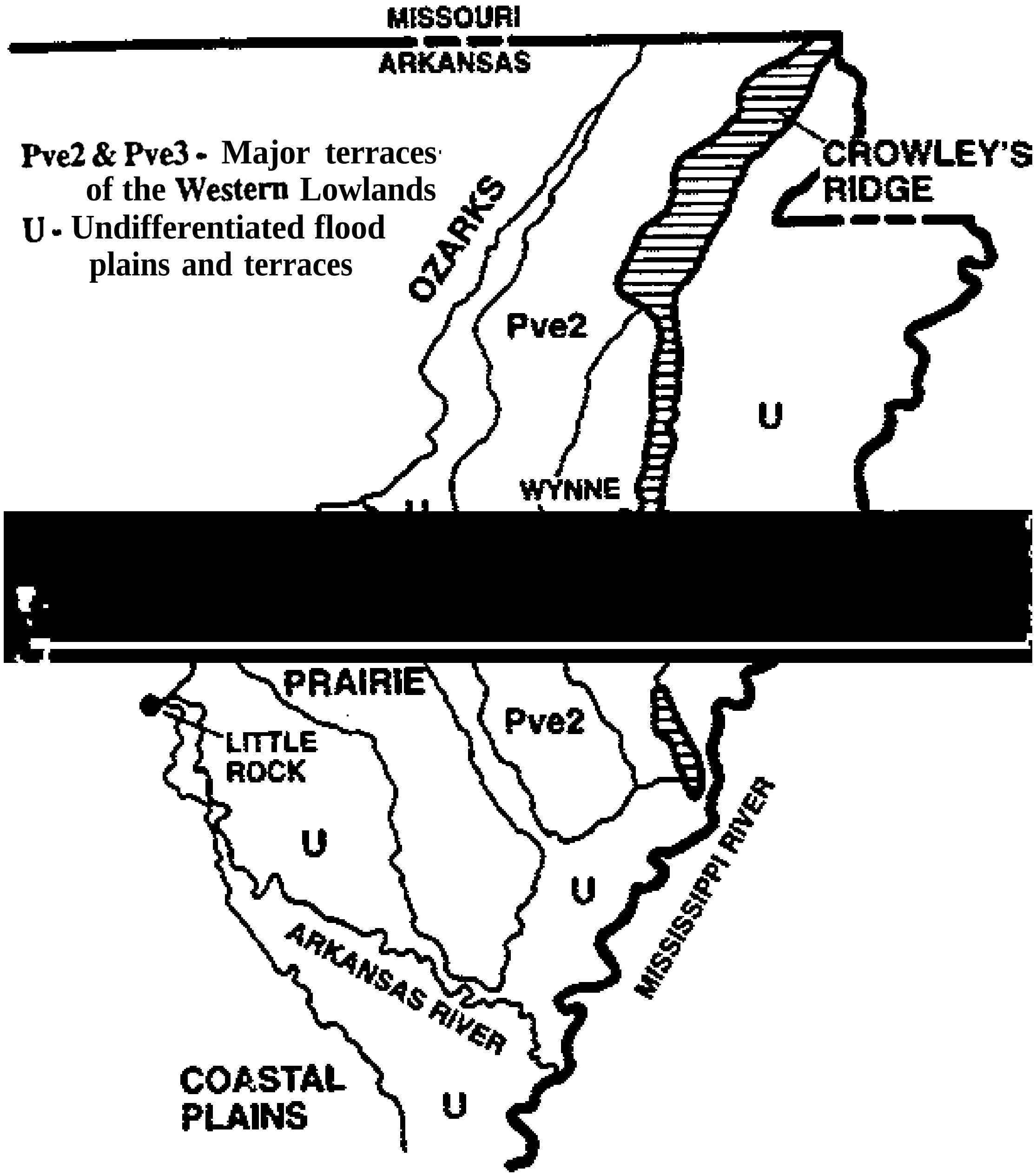

Figure 1. Northern and Central part of the Eastern Arkansas portion of the Lower Mississippi Valley. Adapted from Saucier and Snead, 1989.

the loess deposits and the alluvial valley source areas from which the deposits were blown. Smith showed that the loess thickness decreased with log (base 10) of distance from a source area. He also demonstrated that coarse silt contents decreased and fine silt contents increased with log of distance from a loess source area. An alternative expression of the particle size relationship is that the mean particle size of the loess decreases with log of distance from the source area. These relationships of Smith's are continuous across geomorphic surfaces of differing elevations.

Following Smith's article, Wascher et al. (1947), who accepted loess as a wind deposit and the principles developed in Smith's work, reported on the loesses of the Lower Mississippi Valley including Crowley's Ridge. They reported the occurrence of three loesses throughout the Valley and on the Ridge. They reported little soil development in the second loess, but indicated the third or lowest loess contained a well developed paleosol. These researchers also observed loess on a terrace west of Crowley's Ridge. Leighton and Willman (1950) included numerous observations on Crowley's Ridge in their studies of loesses in the Lower Mississippi Valley. They also accepted loess as a wind deposit. Like Wascher et al. (1947) they reported the consistent observations of three loesses with a well developed paleosol in the lower or third loess. However, Leighton and Willman (1950) also reported limited observations of a fourth loess which contained some soil development in its surface. They reported observing this loess on Crowley's Ridge in the areas of both Wynne and Forrest City, Arkansas.

As with most deposits, various terminology has been utilized for the loess deposits of Crowley's Ridge. The present terminology is, from top to bottom, Peoria Loess, Roxana loess, Loveland loess or Sicily Island loess, Crowley's Ridge Loess and Marianna loess. The lowest loess, Marianna, has been identified at only one location (Rutledge et al., 1990) and there is still question as to whether it is a loess or a water deposit. The Crowley's Ridge Loess (Miller et al., 1986 and Porter and Bishop, 1990) contains a well developed paleosol and has been seen at several locations. The Loveland/Sicily Island loess, which contains a well developed paleosol, has been observed and reported by essentially all researchers who have studied loess on Crowley's Ridge. West et al., (1980) followed the lead of earlier researchers and correlated this loess with the midwestern USA using their terminology of the day, Loveland (Willman and Frye, 1970). However, Miller et al. (1986) who, along with coworkers, had done extensive research on loess in Louisiana, correlated this loess with Sicily Island loess at Vicksburg and in Louisiana. The Loveland term indicates an Illionian or late-middle Pleistocene age and the term Sicily Island indicates an early Wisconsin age loess. We do not feel there is sufficient data to resolve the issue so we are using the term "Loveland/Sicily Island loess." Using the term Peoria Loess for the surface loess and Roxana loess for the next loess seems to be agreed upon by all workers.

INVESTIGATIONS WEAR WYNNE, ARKANSAS

When we started our loess investigations in 1969, the cooperative soil survey in Arkansas was doing a good job of recognizing soils developed in loess. They were recognizing loess on Crowley's Ridge (Fig. 1), on a large terrace west of Crowley's Ridge, on the Grand Prairie, and on the Prairie terrace and Macon Ridge in southeastern Arkansas as well as on a small terrace east of Crowley's Ridge in northeast Arkansas. At that time, the loess covered area west of Crowley's Ridge included all of what is now the Pve3 terrace and parts of the Pve2 terrace near its southern end (Fig. 1). Although we were mapping many areas of soils developed in loessial parent materials, we were not totally satisfied with our delineations, did not know which loess was the soil parent material in many locations and did not know the direction of loess deposition.

Our studies of loess were initiated to determine 1) which loesses were on which geomorphic surfaces and 2) the wind direction that deposited each loess. We felt that if we knew the wind direction that deposited each loess then we could determine the thinning patterns and thus could do a better job of predicting which soils would occur on a given surface. We started with three transects aligned east-west originating on the east side of Crowley's Ridge and ending near the Ozark Escarpement (Fig. 1). In order to build on the research of previous workers (Leighton and Willman, 1950 and Wascher et al., 1947) the transect passed east-west through the Wynne area. The Crovley's Ridge transect was primarily to determine the direction of loess deposition since the various loess sheets had already been identified. Another transect crossed Pve3 west of Wynne (Fig. 1) and was most sensitive to loesses deposited by winds blowing from vest to east. The portion of Pve2 shown in Fig. 1 west of Wynne was mapped with soils developed in alluvium. These soils varied from sandy to clayey and there was no reason to assume that they might be developed in loess. Therefore, no transect was placed in this portion of Pve2. However, a small portion of Pve2 joining the Ozark uplands essentially vest of Wynne and not shown on Fig. 1 was indicated on soil maps as being covered with loess. The soil parent materials on this geomorphic surface were evaluated with a transect most sensitive to loess deposited by east to west winds.

The studies on Crowley's Ridge (West, 1980) showed that in the Peoria Loess the coarse silt (20-50 mm) fraction contents decreased and the medium silt (S-20 mm) fraction as well as the fine silt (2-5 mm) fraction contents increased with the log (base 10) of distance from east to west. The thinning pattern followed the same relationship. These data clearly indicate that the Peoria Loess on Crowley's Ridge had its source in the lowlands east of the Ridge and was deposited by winds blowing generally east to west. These studies also showed that in the Roxana loess the coarse silt contents decreased while the medium and fine silt contents increased with log of distance from east to west across the Ridge. Like the Peoria, the Roxana loess had its source area east of the Ridge and was deposited by winds blowing generally from east to west. The particle size-distance relationship for the Loveland/Sicily Island loess was quite different from that of the Peoria and Roxana deposits. In the Loveland/Sicily Island deposit the coarse silt contents were greater than the medium silt contents throughout the transect and none of the three silt fraction contents showed a good relation with log of distance from the lowlands either east or west of the Ridge. Since the Loveland/Sicily Island loess was coarser on both sides of the Ridge and became finer toward the middle of the Ridge, it was concluded that there was a source area for this loess on both the east and west side of Crowley's Ridge and the loess was deposited by winds blowing from generally east to west and generally west to east.

Data from the transect across Pve3 west of Wynne (Fig. 1) showed that in the Peoria Loess the coarse silt fraction contents decreased and the medium and fine silt fraction contents increased with log of distance westward from the source area east of Crowley's Ridge (Rutledge et al., 1985). The Peoria thickness also decreased with log of distance from east to west across Crowley's Ridge and the Pve3 terrace. These data indicate that Peoria Loess is a continuous deposit across Crowley's Ridge and the Pve3 terrace and that the loess had its source area in the lowlands east of Crowley's Ridge. Roxana loess was not detected on Pve3. It is assumed that Roxana was also deposited on Pve3 by winds blowing from east to west, but the deposit was too thin to identify. As on Crowley's Ridge, the silt fraction contents of the Loveland/Sicily Island loess showed a different relation with distance than did the fractions of the Peoria Loess. In the Loveland/Sicily Island loess the coarse silt contents decreased and the medium and fine silt contents increased with log of distance from west to east starting at the base of the western escarpment of Pve3. These data indicate that the Loveland/Sicily Island loess on Pve3 was deposited by winds blowing generally from west to east and that the source area for this loess was mainly the lowlands west of the Pve3 terrace.

Our studies (West and Rutledge, 1987) on the silty portion of Pve2 adjacent to the Ozark uplands showed the area to be silty alluvium rather than loess. The particle size-log of distance relationships were not appropriate for loess from either immediately east of the terrace or from east of Crowley's Ridge. Thinning data from the Crowley's Ridge and the Pve3 study (Rutledge et al., 1985) also predicted that any Peoria Loess from east of Crowley's Ridge would be too thin to detect on this portion of Pve2. Also, concluding that this portion of the Pve2 terrace was Capped with alluvium was consistent with the designation of the soils in the surface of adjacent portions of Pve2 as having alluvial parent materials.

In conclusion of the studies *of* the three transects in the Wynne area, we found that the lowlands east of Crowley's Ridge were the source area for the Peoria and Roxana loesses. Our investigations also indicated that the Loveland/Sicily Island loess had source areas both east and west of Crowley's Ridge. The Ridge is capped by the Peoria and Roxana loesses which were deposited by winds blowing generally from east to west. These loesses are underlain by the Loveland/Sicily Island loess which was deposited by winds blowing both generally east to west and generally west to east. The Crowley's Ridge Loess is sometimes found on the Ridge and the Marianna loess has once been identified. Two loesses were identified *on* terrace Pve3, the Peoria which was deposited by winds blowing generally from east to west and the Loveland/Sicily Island which was deposited mainly by winds blowing generally west to east. The silty portion of Pve2 which joins the Ozark uplands was found to consist of alluvium.

INVESTIGATIONS ON THE GRAND PRAIRIE

Mersiovsky (1993), with extensive support from Larry B. Ward and others of the Soil Conservation Service, has evaluated the Grand Prairie (Fig. 1) for the occurrences of loess deposits. These researchers have analyzed data from three transects. The first was located on the northern part of the Grand Prairie and was most sensitive to a loess source area in the lowlands between the Grand Prairie and Crowley's Ridge. The second and third transects were located on the southern portion of the Grand Prairie. One was most sensitive to a loess source area to the east, in the Mississippi River lowlands. The other was most sensitive to a loess source area to the west, in the Arkansas River lowlands.

Results of the studies of Wersiovsky (1993) and coworkers presently indicate the silty surfaces of the Grand Prairie are alluvium. In general, these deposits tend to become thinner from east to west and to become coarser from east to west. This is reverse to the relations expected for loess. Loess should fine in the same direction in which it thins.

Two additional approaches are being developed to evaluate the possible presence of loess on the Grand Prairie. Mersiovsky, Ward and coworkers are sampling a transect to test the hypothesis that loess was deposited by winds blowing from the south. Also, since Peoria and Roxana loesses are known to have blown westward from east of Crowley's Ridge the thickness of these loesses is being traced westward across Pve3 and Pve2 in order to project their expected thickness on the Grand Prairie.

identify. The Pve2 terraces west of Wynne are capped by alluvium.

Our investigations to date indicate the Grand Prairie is capped by alluvium. Additional investigations are in progress to test for loess from a southern source area and to trace the thickness of Peoria and Roxana loesses from east of Crowley's Ridge to the Grand Prairie. Very tentative results from this tracing effort suggests the Peoria loess caps the Pve2 terrace in its southern part (Fig. 1). Since Pve2 is capped by alluvium in the area west of Wynne, if it were capped by Peoria Loess in the southern part this would suggest Pve2 was two terraces and that the southern part were older than the part to the north.

REFERENCES

Call, R.E. 1891. The geology of Crowley's Ridge. Annual report for 1889. Vol. II, Geological Survey of Arkansas. Little Rock.

Leighton, M.M., and H.B. Willman. 1950. Loess formations of the Mississippi Valley. J. Geol. 58:599-653.

Mersiovsky, Edgar P. 1993. Silty deposits on the Grand Prairie of Arkansas. M.S. thesis, Univ. of Arkansas, Fayetteville.

Miller, B.J., W.J. Day, and B.A. Schumocher. 1986. Guidebook for soils-geomorphology tour, American Society of Agronomy Annual meetings. Department of Agronomy, Louisiana State University. Baton Rouge.

Porter, Donna and Sam Bishop. 1990. Soil and lithostratigraphy below the Loveland/Sicily Island silt, Crowley's Ridge, Arkansas. Proc. Ark. Academy of Sci. 44:86-90.

Rutledge, E.M., L.T. West, and M.J. Guccione. 1990. Loess deposits of northeast Arkansas. p. 57-98. In Guccione, M.J. and E.M. Rutledge (ea.) Field guide to the Mississippi Alluvial Valley: Northeast Arkansas and Southeast Missouri, Friends of the Pleistocene South-Central Cell. Dept. of Geology, Univ. of Arkansas, Fayetteville.

Rutledge, E.M., L.T. West, and M. Omakupt. 1985. Loess deposits on a Pleistocene age terrace in Eastern Arkansas. Soil Sci. Soc. Am. J. 49:1231-1238.

Salisbury, R.D. 1891. On the relationship of the pre-Pleistocene formations of Crowley's Ridge, and adjacent areas south of the limit of glaciation. In The geology of Crowley's Ridge. Annual report for 1889. Vol. II. Geological Survey of Arkansas. Little Rock.

Saucier, Roger T. and John I. Snead. 1989. Quaternary geology of the Lower Mississippi Valley, plate 6. In Autin, W.J., S.F. Burns, B.J. Miller, R.T. Saucier and J.I. Snead, 1991. Quaternary geology of the Lower Mississippi Valley. In Morrison, R.B. (ed.) Quaternary nonglacial geology; Conterminous U.S.: The geology of North America. Geological Society of America. Bolder, CO.
Smith, Guy D. 1942. Illinois loess: Variations in its properties and distribution. Univ. of Illinois, Agric. Exp. Stn. Bull. 490. Urbana, IL.
Wascher, H.L., R.P. Humbert, and J.G. Cady. 1947. Loess in the southern Mississippi Valley: Identification of the loess sheets. Soil Sci. Soc. Am. Proc. 12:389-399.
West, L.T. and E.M. Rutledge. 1987. Silty deposits of a low, Pleistocene-age terrace in Eastern Arkansas. Soil Sci. Soc. Am. J. 51:709-715.
West, L.T., E.M. Rutledge, and D.M. Barber. 1980. Sources and properties of loess deposits on Crowley's Ridge in Arkansas. Soil Sci. Soc. Am. J. 44:353-358.
Willman, H.B., and J.C. Frye. 1970. Pleistocene stratigraphy of Illinois. Illinois State Geol. Survey Bull. 94. Urbana, IL.

LOESS AND ASSOCIATED PALEOSOL STRATIGRAPHY, MIDDLE MISSISSIPPI RIVER VALLEY 1/

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Data from on-going, cooperative, interdisciplinary studies of Quaternary loess and alluvium in southeastern Missouri, eastern Arkansas, western Tennessee and northwestern Mississippi, are being used to construct regional chronostratigraphic and lithostratigraphic frameworks for the Middle Mississippi River Valley (MMV). In this region, loess is present on the highlands east of the valley, on terraces in the valley, and on Crowleys Ridge, a highland in eastern Arkansas that longitudinal divides the Mississippi River Valley into the Eastern and Western Lowlands (fig. 1). Field observations and core suggest that silt on the terraces includes primary loess (eolian and possibly lacustrine) as well as some secondary (colluvial and (or) alluvial) loess, and that the number of silt units at a site varies by terrace age and by geomorphic position on the terrace. To date, only limited laboratory data are available for these terrace silts.

Loess deposits in the area are the thickest in the Mississippi River Valley. Exposures are few, and where present, are commonly accessible only by rope. We selected one natural exposure at the headwall of a gully (Old River) and one quarry site (Yocona), (each about 30-m high), from exposures on the east valley-wall, and one quarry site (40 m high) on the east side of Crowleys Ridge (Phillips Bayou) to serve as "benchmark" localities for this study. The loess units and associated paleosols at these localities are being described in detail. Samples are taken from each pedogenic horizon, above and below each geologic contact, and at arbitrary intervals where there is no obvious

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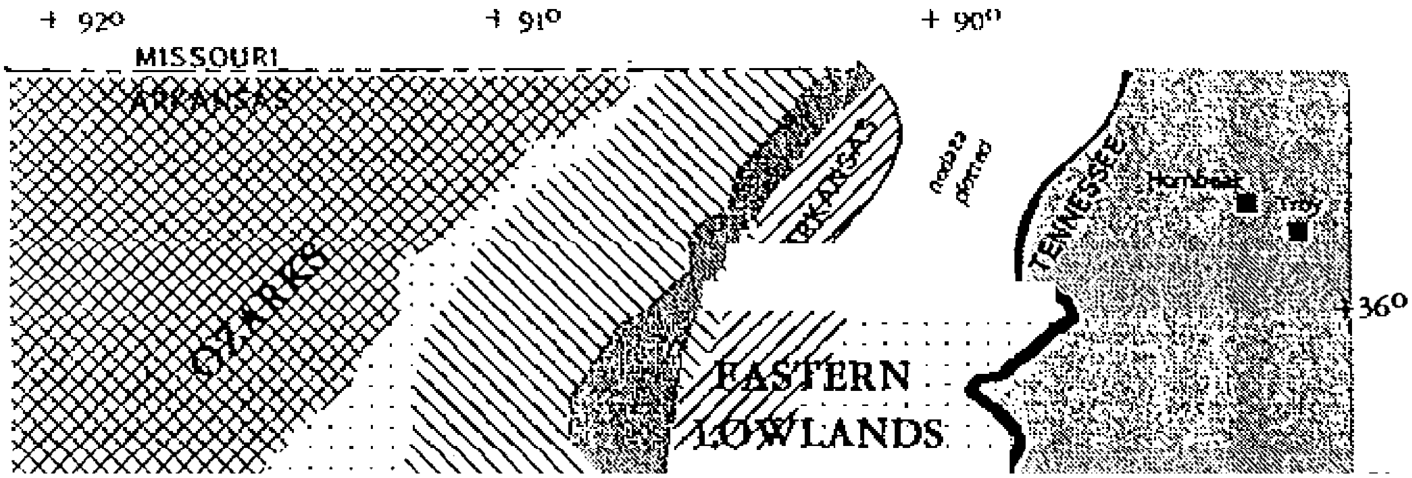
1/ Presentation by Douglas A. Wysocki to the Southern Regional Soil Survey Work Planning Conference, Little Rock, Arkansas, June 21, 1994. Originally, presented as a poster paper at the INQUA Paleopedology Symposium, August 1993.



92°
91°
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MISSOURI
ARKANSAS
OZARKS
ARKANSAS
EASTERN
LOWLANDS
TENNESSEE
Hornbeak
Troy
36°

stratification. Sample splits are sent to the National Soil Survey Laboratories in Lincoln, Nebraska for particle size and characterization analyses, and to the U.S. Geological Survey laboratories in Denver, Colorado and Reston, Virginia for bulk chemical and clay mineral analyses, respectively. Loesses and paleosols exposed at intervening localities are described and sampled less rigorously and correlated to loess units at the benchmark localities.

To date, loesses and paleosols at two "benchmark" localities, Old River and Phillips Bayou, have been described and sampled (fig. 1). Samples have been submitted for analyses. A detailed description of the Phillips Bayou section, x-ray diffractometry data from the Old River section, as well as age and magnetic susceptibility data from both localities are now available, as are some preliminary compositional and age data from exposures at Wittsburg quarry (fig. 1). Initial results suggest a consistent loess stratigraphy for the MMV. The following paragraphs summarize the chronostratigraphy and the lithostratigraphy of the region as compiled from available published and unpublished data.

Four stacked loesses are present on the high bluffs east of the Mississippi River and on Crowleys Ridge. From oldest to youngest the loesses are identified as the Crowley's Ridge Silt, the Loveland loess, the Roxana Silt, and the Peoria Loess. The general morphology of individual loess sheets and their associated paleosols is notably consistent from one locality to another.

At the Old River and Phillips Bayou localities, the 2- to 4-m thick Crowley's Ridge Silt grades from a 10YR 5/4 to 7.5YR 4/6-5/6 sandy loam or fine sandy loam in the basal meter to a 10YR 5/3, 6/4, or 5/4 to 7.5YR 4/4 silt or silt loam in the uppermost meter. At the Phillips Bayou locality, a 10YR 7/2-7/3 fine sand (of fluvial or eolian origin) is either the basal part of, or stratigraphically underlies, the Crowley's Ridge Silt. The sand grades upward into a silt or silt loam. Clay minerals in the Crowley's Ridge Silt are dominantly kaolinite with lesser amounts of illite/smectite.

Commonly, the contact between the Crowley's Ridge paleosol and the overlying Loveland loess is accretionary (the result of loess being deposited at a rate less than the rate of soil formation) with a biologically mixed zone marking the Loveland Silt/Crowley's Ridge paleosol contact. Locally, such as at Wittsburg quarry, the mixed layer, and (or) upper part, of the Crowley's Ridge paleosol has been eroded and the Loveland loess/ Crowley's Ridge paleosol contact is unconformable.

The 6- to 8-m thick Loveland loess commonly grades from a 10YR 5/3-5/4 loam or fine sandy loam in the basal 1 to 2 m to a 10YR 5/4-6/4 silt in its middle section to a 7.5YR 4/6-5/6 silty clay loam in the argillic horizon of the 2- to 3-m thick Sangamon paleosol at the Roxana Silt/Loveland loess contact. At the Phillips Bayou section, the upper part of the argillic horizon of the Sangamon paleosol has a maximum <2 micron content of 32 percent. The Fe and Mn oxyhydroxide (present as part of the <2 micron fraction, along ped faces, as lining in pores, and as concretions) content in the argillic horizon is also high (Fe content of 2 to 3 percent by weight). X-ray data from the Old River section indicate that the <2 micron fraction of the Sangamon paleosol has a higher kaolinite content and lover illite and illite/smectite contents than does the Crowley's Ridge paleosol. Where thicker than 4-5 meters, the Loveland loess is strongly calcareous in the basal part. Locally, the basal 2 m is characterized by hard round carbonate concretions, 5-50 mm in diameter as well as disseminated, thin vein, and filament carbonate. Where observed, the contact between the overlying Roxana Silt and the Loveland loess is an erosional unconformity.

The 1- to 7-m thick Roxana Silt has an unusual pink- to purple-gray color, which when viewed at a distance, stands in contrast to the chalky light pink to gray of the overlying Peoria Loess and the red to orange-red of the underlying Sangamon paleosol. The texture of the Roxana Silt is silt to silt loam throughout. At the Phillips Bayou and Old River localities the Roxana Silt has two associated paleosols. Stratigraphic position and C-14 data suggest that the upper paleosol, at the Peoria Loess/Roxana Silt contact, is equivalent to the Farmdale paleosol of Iowa and Illinois. The lower unnamed paleosol, in the basal 1.0 to 1.5 m of the Roxana Silt, appears to be welded to the underlying Sangamon paleosol. Neither paleosol in the Roxana Silt shows significant structural development.

At Phillips Bayou and Old River localities, the lower paleosol has an overall 10YR 4/3-4/4 color with 7.5YR 4/6-5/6 mottles. The center part of the Roxana Silt is characterized by 10YR 5/3-6/4 colors with 5YR 4/6 clay-lined pores and 7.5YR 4/6 oxidized pore walls. The upper (Farrndale) paleosol is dark gray to black in color (10YR 4/3-3/2) with 7.5YR 4/6 mottles in the darkest horizons. Data indicate that even the darkest (10YR 3/2) horizons have an organic carbon content <0.5 percent. The source(s) of the black to gray to purple colors of the Roxana Silt have not yet been adequately identified. Clay minerals in the Roxana Silt are dominantly illite/smectite with a lesser amount of illite and a very minor amount of kaolinite.

Locally, where the Roxana Silt is >2 m thick and the lower unnamed paleosol is absent, the basal meter is calcareous and contains highly weathered terrestrial gastropod shells. At these localities, irregularly shaped, soft to hard, clay-rich, 2- to 10-mm thick carbonate concretions are common in the basal meter of loess, even where shells are absent. The contact between the top of the Farmdale paleosol and the overlying Peoria loess is generally sharp and easily identified: strongly calcareous above the contact and noncalcareous below.

In the MMV the Peoria Loess is commonly from 6 to 20 m thick, but can be as thin as a meter and still recognizable in outcrop and (or) core. The Alfisol generally associated with the Peoria Loess in this region has a 2 to 3 m thick solum, some fragic properties (slight to moderate brittleness) from 1 to 2 m depth, and an accumulation of Mn oxides along ped faces. Colors in the A and BA horizons are generally 10YR 4/2 and 7.5YR 3/4-4/4. Bt horizons are 7.5YR 4/4-5/4, with the 4/4 being the dominant color of clay films along ped faces. X-ray data from the Old River and Wittsburg quarry localities suggest that clay minerals in the Peoria are dominantly illite/smectite with a very a minor amount of kaolinite.

Generally the Peoria is calcareous to dolomitic. Hard round concretions from 1 to 25 mm in diameter are common in the basal 3-5 m of loess. Terrestrial gastropods are common in the basal third of sections thicker than 5 m. Depth of carbonate dissolution in relatively uneroded topographic positions varies from 3 to 9 m.

Magnetic susceptibility (MS) and other mineral magnetic parameters including isothermal remanent magnetization (IRM) and anhysteretic remanent magnetization (ARM), measured at six exposures in western Tennessee and eastern Arkansas, indicate systematic and widespread variations in the amount, grain size, and type of magnetic minerals in the four loess units. The following trends are present: a) MS generally increases with depth within each of the loess units; b) the contacts between loess units are generally marked by sharp reductions in MS; c) the highest MS in most exposures is found in the basal part of the Peoria Loess and the upper part of the Roxana Silt; d) whereas there appears to be no simple relations between the degree of soil development and MS, the percent of the MS that is dependent on the frequency of the applied field (% FD) closely follows trends in soil development; e) the percentage of MS removed after the citrate-bicarbonate-dithionite (CBD) treatment ranges from about 10 percent in unaltered Peoria Loess to about 60 percent in the Sangamon paleosol; f) the CBD treatment removes nearly all of the percentage FD of samples. Finally, preliminary paleomagnetic results indicate a normal polarity for the Crowley's Ridge Silt.

Data from studies on the ages of individual loesses and on the time represented by the inter-loess unconformities are preliminary. No data are available on the age of the

Crowley's Ridge Silt. Preliminary Be-10 data suggest a residence time of about 10^5 years for the Crowley's Ridge paleosol at the Wittsburg quarry locality. Published amino acid racemization data and TL data from Wittsburg quarry indicate that the Loveland loess is >100,000 years old. Recent TL analyses suggest that the lower 3-5 m of Loveland loess at Wittsburg quarry are greater than 150,000 years old. TL data from Wittsburg quarry and C-14 data from Old River and Phillips Bayou suggest that the upper meter of Roxana Silt was deposited about 28,000 years ago and that the Farmdale paleosol dates from 29,000 to 25,000 years before present. TL and C-14 data for four localities (the Hornbeak, Old River, Wittsburg quarry, and Phillips Bayou localities; fig. 1) suggest that deposition of the Peoria loess in the MMV began about 25,000 years ago and sustained a depositional rate of 1 m/1,000 years from 25,000 to 20,000 years ago. No age data are available for the upper part of the Peoria loess in the MMV.

We can interpret from the age data for the MMV: (1) loess was deposited during glacial and just-post-glacial climatic periods in the late Quaternary; (2) by adding the 100,000 year residence time for the Crowley's Ridge paleosol with the 150,000 year age of the Loveland loess the calculated age of the Crowley's Ridge loess is >250,000 old; and (3) the 150 ka TL age for the Loveland loess suggests that the associated Sangamon paleosol probably represents oxygen-isotope stage 5 (from about 80,000 to 132,000 years ago).

Some climatic interpretation of the data is possible. The accretionary characteristic of the Loveland loess/Crowley's Ridge Silt contact suggests that the initial rate of deposition of the Loveland loess was slower than the rate of pedogenic development. Present data suggest that the Sangamon(?) paleosol associated with the Loveland loess in the MMV is the most strongly developed of the paleosols. The color, structure, texture, chemistry, and mineralogy of the Sangamon paleosol suggest that the climate was warmer, but probably not wetter, that the present climate in the region. The presence of the unnamed paleosol in the basal part of the Roxana Silt, and by the Farmdale paleosol at the Peoria Loess/Roxana Silt boundary, indicates that short periods of nondeposition interrupted the major depositional episode. The gray to black colors, the lack of argillic horizon development (silt to silt loam texture), the massive structure, and the mineralogy of the <2 micron fraction of paleosols in the Roxana Silt suggest that a hiatus in loess deposition does not necessarily indicate a significant warming of the climate. Using the C-14 ages of 21 to 25 ka for the basal Peoria loess in the HMV and a 10 ka age for the top of the Peoria Loess (published age data from Iowa, Nebraska, and Illinois and unpublished data from Indiana) indicate that loess deposition had ceased by 10 ka. If a constant rate of deposition is assumed, then the Peoria represents a 10,000 to 15,000 year interval during which loess was being deposited at a rate of 0.6 to 1.3 m/1,000 years. Since deposition was probably not constant, the maximum rate of deposition for short time periods (lets say 100 years) could easily have exceeded the maximum 0.13 m/100 year maximum average rate. There is no evidence of geologically significant eolian activity in the region during the Holocene.

SELECTED REFERENCES

Clark P.U., Nelson, A.R., McCoy, W.D., Miller, B.B., Barnes, D.K., 1989, Quaternary aminostratigraphy of Mississippi Valley loess: Geological Society of America Bulletin, v. 101, p. 918-924.

Clark, P.U., McCoy, W.D., Oches, E.A., Nelson, A.R., and Miller, B.B.. 1990, Quaternary aminostratigraphy of Mississippi Valley loess: Geological Society of America Bulletin, v. 102, p. 1136-1138.

Fonnan, S.L., Bettis, E.A., Kemmis, T.J;, and Miller, B.B., 1992, Chronologic evidence for multiple periods of loess deposition during the Late Pleistocene in the Missouri and Mississippi River valley, United States: Implications for the activity of the Laurentide icesheet: Paleogeography, Paleoclimatology, Paleoecology, v. 93, p.71-83.

Guccione, M.J., and Rutledge, E.M., (editors.), 1990, Field guide to the Mississippi Alluvial Valley, northeast Arkansas and southeast Missouri: Friends of the Pleistocene, South-Central Cell, Geology Department, University of Arkansas, Fayetteville, Arkansas, 346 p.

Hajic, E.R., Johnson, W.H., Follmer, L.R., (eds.), 1991, Quaternary deposits and landforms, confluence region of the Mississippi, Missouri, and Illinois rivers, Missouri and Illinois: terraces and terrace problems: Midwest Friends of the Pleistocene 38th Field Conference, May 10-12, 1991, Sponsored by Department of Geology, University of Illinois at Urbana-Champaign and Illinois State Geological Survey at Urbana, 105 p.

Markewich, H.W., editor, 1993, Progress report on chronostratigraphic and paleoclimatic studies, Middle Mississippi River Valley, eastern Arkansas and western Tennessee: U.S. Geological Survey Open-File Repon 93-273, 61 p.

Markewich, H.W., Millard, H.T., Jr., Pavich, M.J., Rodbell, D.T., Rich, F.J., Rutledge, E.M., Ward, L., VanValkenburg, Steve., Wysocki, D. 1992, Chronostratigraphic and paleoclimatic data for Quaternary loessial and fluvial deposits in the Mississippi River valley of Arkansas and Tennessee: Geological Society of Arnerica Abstracts with Programs, v. 24, no. 7, p. A50.

Mirecki, J., and Skinner, A., 1991, Arninostratigraphy and electron spin resonance dating of terrestrial mollusks from late Quaternary loesses of the central Mississippi Valley: Geological Society of America Abstracts with Programs, v. 23, no. 5, p. A408.

Pye, K. and Johnson, R., 1988, Stratigraphy, geochemistry, and thermoluminescence ages of Lower Mississippi valley loess: Earth Surface Processes and Landforms, v. 13, p. 103-124.

Ruhe, R.V., 1984, Loess-derived soils, Mississippi valley region: Soil Science Society of Arnerica Journal, v. 48, p. 859-867.

Rutledge, E.M., West, L.T., and Guccione, M.J., 1985, Loesses of Crowleys Ridge and the Western Lowlands of Arkansas: Geological Society of Arnerica Abstracts with Programs, v. 17, p. A189.

Rutledge, W.M., West L.T., and Ornakupt, M., 1985, Loess deposits on a Pleistocene age terrace in eastern Arkansas: Soil Science Society of Arnerica Journal, v. 49, p. 1231-1238.

Rutledge, E.M., West, L.T., and Guccione, M.1., 1990, Loess deposits of northeast Arkansas in, Guccione, M.1., and Rutledge, E.M., (eds.), Field guide to the Mississippi Alluvial Valley, northeast Arkansas and southeast Missouri: Friends of the Pleistocene, South-Central Cell, Geology Department, University of Arkansas, Fayetteville, Arkansas, p. 57-98.

West, L.T., Rutledge, E.M., and Barber, D.M., 1980, Sources and properties of loess deposits on Crowleys Ridge in Arkansas: Soil Science Society of America Journal, v. 44., no. 22, p. 353-358.

Each of these approaches to identifying and mapping ecoregions use slightly different criteria and are for slightly different purposes. It seems logical therefore that some levels be different. However, representatives at the meeting felt that there should be at least one level of the hierarchy, physical maps and map unit descriptions, that we as natural resource agencies can agree on and use to share data and make local, regional, and national assessments. This level appeared to be near the subregion planning scale of the Forest Service hierarchy which includes both the section and subsection levels and are roughly equivalent to the HLRA and LRU, respectively.

Agreement will require some compromise from all agencies and will include adjustment of existing HLRA lines. This is a concern due to the role of MLRA's in technical guide development, resource groups, and the National Resource Inventory. However, the long term benefits seem to outweigh these concerns and we recommended that the agencies make a commitment toward developing a common ecological map for the U.S. at scale of about 1:3,500,000. The following is an hypothesis and a strategy to accomplish that goal.

Hypothesis - STATSGO derived LRU's and MLRA's approximate some level of the Forest Service hierarchy when mapped at 1:250,000 to 1:1,000,000 scales.

Strategy - Test the hypothesis against the Forest Service ecomapping and the EPA ecomapping by either accepting or rejecting LRU linework as representative of ecounit boundaries at 1:250,000 or 1:1,000,000 scale. This would be accomplished through cooperative review of the respective maps at the national, regional, and state levels. The review could be done at the state level for states actively involved in MLRA update projects and now proposing revision of MLRA boundaries. Other states could have the option of direct participation or could request review by the appropriate National Technical Center or the National Soil Survey Center.

Issues to be Addressed - The Forest Service would adopt a common map scale and minimum size delineation for the section and subsection levels. Scale of 1:250,000 to 1:1,000,000 and minimum delineation size of lcm by lcm would be appropriate. The review products would be digital.

The SCS would produce LRU maps on a state by state basis at the designated scale. The two sets of maps would be compared to reconcile scale/concept/size differences. Water body and shoreline mapping issues must be resolved.

Agreed to line changes would be incorporated into STATSGO. The agreed to changes would be generalized to the desired scale - 1:3,500,000.

The final map product would be jointly published by USFS, SCS, and BLM ('and others as appropriate) both in hardcopy with textual descriptions and in digital form with attribute data bases.

This effort is awaiting the sanction of agency leadership in the form of an interagency MOU. The "Eco" climate seems to be right at the present for such a cooperative effort in regional ecological mapping.

A DISCUSSION OF ECO-SYSTEM BASED ASSISTANCE

Jim Caudle
State Resource Conservationist
Arkansas

Positive change is important in any progressive organization. The alternative is stagnation and possible extinction. Change inherently means something is given up in exchange for something else we hope is better. Too rapid change, though, can destroy a system before it can adjust. We have been seeing a change in society's desires for conservation for several years, now. This has been especially true during the past ten years. Eco-system based assistance (EBA), in my opinion, is a reflection of the Soil Conservation Service adjusting to these changes in order to avoid stagnation and extinction while moving forward to address the resource concerns of today's society.

Much of the discussion material in this paper comes from documents developed recently be different people in different disciplines within SCS. It is tinted somewhat by my opinions and attitudes. My intent, however, is to discuss where I see EBA heading within SCS.

What I hope to do this morning is to identify -- not just define -- what eco-system based assistance is. To do this, I want to also briefly compare EBA to what we have called Total Resource management, and to discuss a few ideas concerning implementation of EBA.

We all have some understanding of what an ecosystem is. First, it is a biological community. It includes people and it interacts within its environment through various processes. Eco-system based assistance is an attempt to work within this community and deal with the interactions and processes. SCS has defined it as *The appropriate integration of ecological, economic, and social factors through the SCS planning and assistance process to maintain and enhance the quality of the environment to best meet society's current and future needs".

EBA focuses on managing systems and processes. These are items we have used in the past occasionally to select practices to manage resources. With EBA we will have more emphasis on them. It will be aimed at improving, restoring, and sustaining resources. It will emphasize ecological, economic, and social systems that affect the systems and the land user's ability to implement appropriate conservation measures.

EBA recognizes people as part of the system. It will require that we continue to maintain good relationships with people and organizations as close to the land as possible.

These people are the resource managers on the land - not the Soil Conservation Service.

SCS has recognized the importance of involving people since its inception. During the past ten years our focus has shifted to several single-resource issues, such as erosion, water quality, and wetlands. We have recognized certain interactions of resources as well the economics of resource management, but eventually only one resource has drawn any real attention.

We have usually concentrated our efforts on agricultural land, but that has not been our only concern. We have also worked on urban, recreation, wildlife, and wetland, etc. We must admit though that sometimes we have lapsed into working on a single practice basis, spending much of our time helping people install one particular practice they requested. Too often we did not address other resource issues, especially off-site problems.

SCS has given a definition to EBA, but it needs a broader understanding to recognize it for what it really is -- or is not. Is it only a new term for our old pre-FSA way of planning? Is it only a politically correct catch-phrase for what we feel we already do? Does it mean our old way was not good and that our past work should be thrown aside? If you answer 'yes' to any of these you don't see EBA the way I do.

Eco-system based assistance does sound better in today's political and environmental world. Also, our past work, using our previous methods, was good. It addressed the concerns and resource problems of the time. All too often, as I mentioned earlier, our workload is such that we only assist people with the one practice they have requested. This occurs especially when cost-shares are involved. If we encourage the use of more Long Term Agreements or Contracts, our current process could encompass multiple resources and considerations of interactive processes and encourage the producer to practice long term conservation. Doing this would require some adjustment to our progress system and our concept of planning based on resource interactions. Training, programs, policies, and quality control and attitudes would have to be adjusted.

EBA makes this adjustment and provides a concept for expanding our consideration of systems and processes. It allows us to continue with an effective conservation effort with reduced staff by identifying resource problems that need to be addressed on a geographical basis. We will need to take a positive attitude toward this approach in order to implement EBA effectively. It isn't the name that is important, but the process and our attitude towards it.

Many of our current single-purpose programs are either legislated **or quasi-mandated** by current society concerns. One example is the compliance plan on HEL. Another would be Arkansas' dry litter producing poultry operations. HEL is regulated. Dry litter production is not regulated, but the public has insisted that problems associated with it be cleaned up or regulations will be pursued. Many times programs such as these demand results in a short time frame. These efforts will cause any real efforts at EBA to be short-circuited if SCS tries to do all of the work itself.

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EBA cannot happen immediately. Training must be developed and **provided; policies** must be changed: legislation may sometimes be needed; organizational systems must be altered. There will be a transition period while we develop this items and our staffing needs, organization needs, and expertise needs. Other programs such as cost-shares and other subsidies will need to be adjusted to encourage more multi-year efforts.

There are a variety of underlying ideas and concepts, definitions, and strategies that have emerged within SCS as EBA was developed. **Most** of these differences have been narrowed to a point that a general policy can be developed, but specifics still need to be worked on. We need to focus all participants on a common policy and gain the understanding and endorsement by all organizational levels, other agencies and organizations, and ***even*** legislative bodies.

Call it whatever sounds good to you, but an attitude of developing programs for and planning for management of processes and systems can be a good thing for SCS and for those resources we and our customers are concerned with.

ECOSYSTEM PLANNING
PANEL DISCUSSION

JERRY RAGUS
USFS

I appreciate the opportunity to participate on this panel discussing Ecosystem Planning. I will be discussing briefly the National Hierarchical Framework for Ecological Units that the Forest Service is implementing.

Before beginning this discussion, I would like to share with you a quote from Frank Egler that our Chief, Jack Ward Thomas, has recently used: *Ecosystems are not only more complex than we think, they are more complex than we CAN think.." I believe that we all have come a long way towards ecosystem management, but we still have a long way to go before we con understand all the inter-relationships in managing ecosystems.

Larry Ratliff mentioned the agreement being worked on at the National level related to a *Common Eco-mapping Strategy" for SCS, BLM and FS. The Wording for this agreement has been worked out in the WO and has been signed by the Chief of the FS and is being routed to the other chiefs. Basically it discusses sharing of information and developing a common national map.

We believe that this scale should be at the 1:1,000,000 scale, which would relate to our Subsection level. We realize that there will probably have to be some comprise from everyone to reach this common scale. Some of the other Forest Service Regions are using different scales as well.

Coarse scale patterns and processes are difficult to detect from the "bottom up" while fine scale patterns and processes are difficult to detect from the "top down." Therefore, hierarchical systems should be characterized using a "top down" and "bottom up" approach (Avers, 1994).

In November, 1993, direction was given to the FS Regions for use of a National Hierarchical Framework for Ecological Units. This framework allows for Regions to develop an ecological classification and delineate ecological units using this "top down" "bottom up" approach.

This Framework allows for a stratification of the landscape. It utilizes increasingly uniform ecological potentials. It is based on factors that control or modify solar energy, precipitation, and nutrients. And it utilizes the "top down" and "bottom up" approach.

The Framework objectives are:

1. To provide a uniform approach to Ecosystem Management for Land Management Planning and Analysis.
2. To gain consistency across administrative boundaries.
3. To provide a basis for organizing an Ecological Information System for making interpretations and assessments. and
4. To facilitate interagency data sharing.

To summarize the characteristics of the National Framework, four levels are described for planning and analysis. These are further divided into ecological units with the purpose and use, and map scale described.

At the Ecoregion level, we describe 3 ecological units, the Domain, Division and Province, which are used for national planning and broad analysis and modeling. The map scales used are 1:30 million to 1:3.5 million. Units are 1,000's of square miles in size.

At the Subregion level, 2 ecological units are described, the Section and Subsection, which are used for multi-Forest, multi-agency and statewide analysis. Map scales are 1:3.5 million to 1:250,000. Size of delineation's range from 10's to 10,000 square miles.

At the Landscape level, we describe Landtype Associations which is used for Forest planning. The map scales are 1:250,000 to 1:24,000 with delineation's ranging from 100 to 10,000 acres in size.

At the Land Unit level, Landtypes and Landtype Phases are described and are used for project planning. Scales are 1:60,000 to 1:24,000 or less with size of delineation's ranging from 10's to 100's of acres.

The general procedures and data sources used for delineating ecological unit's are described for the 4 planning and analysis levels.

At the Ecoregion level, minor revisions of existing published Ecoregion maps will be made.

At the Subregion level, assimilation and integration of existing data and information will be done. Sources of information utilized at this level are physiographic maps, Land Resource Region maps, MLRA maps, geological maps, Potential Natural Community maps, STATSGO maps and EPA Ecoregion maps.

At the Landscape level, field mapping or aggregation of more detailed field mapping will be done. The sources of information used are geology and topographic maps, Land

Resource Units, STATSGO, Soil Surveys and plant association maps.

At the Land Unit level field mapping or collection of plot data is utilized. Data sources include plot data, detailed soil maps, and plant community classification field guides.

These data sources are not inclusive and other appropriate data should be used when available.

In developing criteria for designing map units, we use the same 4 planning and analysis scales we have been discussing. The primary map unit criteria for the Ecoregion level are: climatic zone, group and type; and gross physiography. Regional climate, geomorphic process, geological age/region, and vegetation formation or series are criteria used at the Subregion level. At the Landscape level, geomorphic process, geologic formation, relief and land surface formation, and vegetation series or subseries are used. The Land Unit level is described by landform, plant association, soil family and series, rock types, and local topography.

We have discussed scales appropriate for the various planning and analysis levels. Ecological Units at multiple scales can be very useful. Some of these uses are:

- define stable components for ecosystem delineation
- for cumulative effects analysis
- to determine spatial distribution of potentials and land capability
- to establish Goals and Objectives (e.g. Desired Future Condition)
- for monitoring and evaluation
- for understanding relationships and processes between units and between components within units
- for applying standards, guidelines and ranges of variability.

This concludes my presentation and I will be glad to entertain any questions. Thank you.

WETLAND ISSUES

Presentation for the South Regional Work Planning Conference
June 20-24, 1994
Little Rock, Arkansas
by
Maurice J. Wausbach

INTRODUCTION

It is a pleasure for me to be invite to your conference and talk to you about wetland issues. This may be one of the last chances I have to talk to you about wetland issues as we have a new wetlands self-directed team at the National level and because I am stepping down as the chair of the Hydric soils committee. Craig Ditzler will be my replacement as chair of the National Technical Committee for Hydric soils. I will discus the new wetlands team at NHQ, hydric soil indicators and the recent field test, Wade Hurt's new responsibilities on his assignment with the Fish and Wildlife Service in St. Petersburg, Florida, and recent actions from the National Technical Committee for Hydric soils.

NATIONAL WETLANDS STAFF (WET)

The national wetlands staff was recently established by the Chief. They will be responsible for all programs and technology associated with wetlands except for research, technology development, and the wetlands appeals function. They essentially will have all program responsibilities for wetlands. The technical staff consists of:

- Warren Lee co-leader
- Billy Teels co-leader
- Mary Cressel (communications)
- Pete Heard (oversight, records)
- Don Butz (WRP, EWRP, training)
- Bruce Julian (statutory issues, policy and procedures)
- Russell Pringle (hydric soils, indicators, training)
- Mon Yee (tracking determinations, remote sensing, GIS)
- Laura Mazanti (mitigation, technical issues)
- Don Woodward (hydrology, training)
- Rosendo Trevino (policy and procedures)

NYDRIC SOIL INDICATORS

I know that the hydric soil indicators have been discussed previously and that in the south they have been tested over the last 4 to 5 years. You are much ahead of the other areas in establishing a set of field indicators to verify the presence of hydric soils. However, we still receive many questions as to why we developed the indicators, who requested their development, why do the field testing ahead of the National Academy of Sciences

(NAS) committee report, and so on. Therefore, I will attempt to answer these questions and also report on the progress of the indicator testing.

The EPA and Corps of Engineers staffs that are responsible for making wetland determinations have been asking for many years that we develop a set of field indicators of hydric soils. The 1987 Corps Wetland manual has an indicator section for hydric soils that was written by Blake Parker. This section is very general, contains

We believe that the continued development and improvement of the hyaric soil indicators will help increase the consistency of the determinations we make within states, between states, and between regions. We also believe that the indicators will help our soil scientists better document the determinations. So far, we have had a dismal record in documenting wetland determinations as we painfully realize when we deal with appeals.

The initial response from the test has been very positive. We realize that the indicators will not work in some situations such as flooded soils that lack aquic moisture regimes. Some of us believe that these soils may not be hydric and this is one of the issues that Wade will be researching. We also realize that this draft of the indicators is about the third approximation and, if history holds true, we have at least 4 more approximations to go.

WADE **HURT'S ASSIGNMENT**

As I mentioned earlier, Wade Hurt is on a 2-4 year temporary assignment with the Fish and wildlife Service (FWS) in St. Petersburg. This assignment is similar to the one Blake Parker had about 10 years ago. Some of wade duties include:

- resolve the issue of the list of potential hydric soils of the FWS. He has reviewed this list, has made comments on inconsistencies on the soil interpretations record and has sent it to the NTC soil staffs for action.
- participate in the hydric soil indicators field test. He will participate in the field review being conducted in each of the regions. He is in the northeast this week and was unable to attend this meeting. The review in the south will be towards the end of July. wade is also on the steering team, chaired by Russell Pringle, that will evaluate the test results and draft the final document.
- develop indicators for flooded soils. Wade will initially work with the Midwest to attempt to develop indicators for flooded soils. Part of the task will be to collect vegetation data and correlate with hydric soils. If through this study we find that the flooded, nonaquic hyaric soils do not support hydrophytic vegetation, we will propose a change the hydric soil criteria and eliminate them from the list of hydric soils.
- train regional wetland coordinators
- assist quality control staff of the national wetlands inventory
- work with Federal Geographic Data Committee to coordinate wetland database among FWS and SCS.
- become the DRAINMOD expert for soil survey.

NATIONAL TECHNICAL COMMITTEE FOR HYDRIC SOILS

The National Technical Committee for Hydric Soils (NTCHS) continues to evolve and grow. The members are: (new members are in bold print)
- Craig Ditzler, chair
- DeWayne Williams, SNTC
- Arlene Tugel, WNTC
- Chris Smith, NNTC
- Nathan McCaleb, KNTC
- Billy Teels, SCS
- Wade Hurt, FWS
- Porter Reed, FWS
- William Sipple, EPA
- Russell Theriot, ACOE
- Del Fanning, Univ. of Maryland
- Jimmie Richardson, North Dakota State Univ.
- Herb Huddleston, Oregon State Univ.
- Steve Faulkner, Louisiana State Univ.
- Wayne Skaggs, North Carolina State Univ.
- Chien-Lu Ping, Univ. of Alaska
- William Volk, BLM
- Pete Avers, Forest Service
- Blake Parker

Members that have retired from the committee are:
- Bill Patrick, Louisiana State Univ.
- Maurice Hausbach, SCS
- Ray Miles
- C. L. Girdner
- Colin Voigt, BLH

The committee agreed to a change in the definition as follows:

A hydric soil is a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part.

The following criteria reflect this definition. Artificially drained phases may be hydric if the soil in its' undisturbed state meets the criteria.

Basically, the definition relates directly with Soil Taxonomy and takes artificial drainage out of the picture. Once a hydric soil always a hydric soil.

The committee also discussed publication of the national list. We will try to publish it electronically next year. It will be available on-line via INTERNET, and will be available via CD-ROM and hard copy. Hard copies will be available at cost to the customer. The committee discussed artificially wet soils and will meet in Colorado in August to i&solve the issue.

Again I appreciate the opportunity to visit with you on wetland issues and would be pleased to answer any questions.

SUBSECTION MAPPING
USFS

JERRY RAGUS

I am going to discuss the Forest Service effort in mapping Subsections in the Southern Region.

Under the direction of the National Hierarchical Framework of Ecological Units, which I have discussed earlier, we began drafting and describing Subsections for the Southern Region. We began working on this in November of 1993. We are using an interdisciplinary team to draft the lines and prepare the descriptions. After the draft lines are placed on the maps and draft descriptions are prepared, the maps and descriptions will be reviewed and edited by each National Forest and the other partners and cooperators involved.

Our core Subsection team consists of:

- a botanist
- an ecologist
- two soil scientists
- a research forester
- a hydrologist
- a geologist

We have participated in several coordination meetings with other agencies, discussing map scales, mapping criteria and joining between Regions and States. When the team began working on the maps, they first developed the criteria or mapping conventions that would be used for delineation of the subsections and selected the map scale that would allow for broad level analysis and interpretation at the Regional level.

The scale selected was 1:1,000,000.

The base maps used were prepared by our geometronics staff by converting digital data originating from a 1:1,000,000 USGS data base to an Arc Info format.

Map unit size criteria was selected that would allow for consistent stratification of ecological units across the Southern Region. The size of map units selected were 500 square miles and 5 miles in width minimum size and 5,000 square miles maximum size. The width requirement was used to avoid narrow linear delineation's along streams.

The team has used a number of sources of information to aid in stratification of Subsections. USGS surficial geology maps; National Atlas Map 62, Classes of Land-Surface Form; General Soil Association Maps and the current STATSGO maps;

Forest Habitat Regions or Natural Regions for each state and Ecological Life Zones of Puerto Rico and the Virgin Islands; National Atlas Map, Potential Natural Vegetation; Forest Type Groups of the US; MLRA map; NOAA State Climatic Summaries; Omerniks Ecoregions of the Conterminous US; and Griffiths Ecoregions/Subregions of Florida.

The team used a "layering" approach to compare the various sources of information which provided the best integration of biological and physical factors. The goal was to delineate units that differed in their capability and responses to management.

The initial delineation's for each state have been completed and the team is working on the descriptions. The map for Florida and the tabular descriptions have been sent to the Forest with instructions to coordinate review and revisions with SCS, State Forester and others. The remaining states will be sent out as the descriptions are completed.

The acetate master copies are made for distribution to the National Forests. The blue line copies are made from the acetate masters and are used as working copies.

The Regional Team is providing to the NF's, the criteria and process for review and revision of the maps. We feel that this is necessary to maintain consistency in the completed products.

In the next phase of this process, the National Forests will be mapping at the Land Type Association level and will fine-tune the Subsection lines at that time.

This is all the detail about the process that I am going to discuss. In January, we sent a letter to the State Foresters in each state explaining what we were attempting to do. We have also met with the SCS at Lincoln and Ft. Worth to explain our efforts at mapping Subsections. We will be depending on each National Forest to work with the other partners including the SCS at the state level.

This concludes my presentation on Subsection mapping. I will be glad to answer any questions.
Thank you.

MLRA UPDATES - PANEL DISCUSSION
South Region Soil Survey Work Planning Conference
Larry P. Ratliff
June 1994

FOR MY PART IN THIS PANEL DISCUSSION I WILL GIVK A NATIONAL OVERVIEW OF TBE MAJOR LAND RESOURCE AREA ACTIVITIES WITH THE ASSUMPTION THAT OTHER PANEL MEMBERS WILL FOLLOW BY DETAILING SPECIFIC PROJECTS. HOPEFULLY WE CAN THEN HAVE A QUESTION AND ANSWER SESSION.

HOST OF YOU ARE AWARE THAT MANY OF US AT THE NATIONAL SOIL SURVEY CENTER (NSSC) HAVE BEEN ADVOCATING THE UPDATE AND MAINTENANCE OF SOIL SURVEY INFORMATION BY MLRA OF SOME OTHER DEFINED PHYSIOGRAPHIC REGION. THIS WAS NOT A NEW IDEA WITH US. THK CONCEPT WAS IN FACT AN UNDERLYING PRINCIPLE FOR FORMING THK NSSC IN 1988. YOU WILL REMEMBER THAT THE PRODUCTIVITY INPROVEKENT PROGRAM STUDY IN 1986 RECOMMENDED THAT QUALITY ASSURANCE FUNCTIONS BE PERFORMED ALONG MLRA BOUNDARIES. I FIRST HEARD OF THK CONCEPT OF UPDATING SOIL SURVEYS BY MLRA HERE IN TEE SOUTH WITH SOME OF THE WORK STARTED BY CHARLIE TBOMPSON, BILLY WAGGONER, BILL ROTH, WES FUCHS, KARL BLAKKLY, AND OTHERS IN MLRA 77. THIS WAS IN TBE KARLY 1980's AND CBANCES ARE THE IDEA WAS NOT NEW WITH THEM-NOT MUCH IS NEW OR ORIGINAL.

IN ANY EVENT, THK KARLY EFFORTS STALLED MAINLY BECAUSE OF TBK BIGHKR PRIORITY DEMANDS OP THE FOOD SECURITY ACT. ABOUT FOUR YEARS AGO WE REVIVED THK EFFORT AND BEGAN FLESHING OUT SOME OF THE NECHANICS OF INITIATING AND CONDUCTING UPDATES AS MLRA PROJECTS. SOME OF THESE NUTS-AND-BOLTS KINDS OF THINGS INCLUDED:

DEVELOPING A MLRA NOU THAT DEFINED THK PRODUCT DESIRED:
EVALUATION WORKSHEET FOR EXISTING SOIL SURVEYS;
PROTOTYPE OF A MLRA PROJECT PLAN;
PROCEDURE FOR OBTAINING OFFICIAL APPROVAL;
CONCEPT OF A STEERING TEAM/ROLES;
BUILDING ON AN EXISTING GOOD PRODUCT;
DATA SHARING METHODS;
COMMON LEGEND AND DATA BASE;
PUBLICATION OF SUBSETS;
PROPOSED MANAGEMENT STRUCTURE.

UNDERPINNING TBIS KFPORT WAS THE IDEA THAT THE MLRA BECAME THE SURVEY AREA AND THAT PARTS OF IT (COUNTIES, WATERSHEDS) COULD BE "COOKIE CUT" OUT AS NEEDED FOR PUBLICATION OR TO SERVE SPECIAL NEEDS. BY TAKING THIS APPROACH WE DID NOT HAVE TO COMPLETELY CBANGE THK WAY WE DO BUSINESS. WE ARK SIMPLY KNLARGING THE SIZE OF THE SURVEY AREA AND PRACTICING CORRELATION BY SOME NATURAL BOUNDARY RATHER THAT POLITICAL BOUNDARY.

TO THE EXTENT POSSIBLE WE TRIED TO CAPTURE WBATWELEARNED IN VARIOUS ISSUE PAPERS, IN THE REVISED NATIONAL SOIL SURVEY BANDBOOK, AND IN THE GUIDEBOOK, "SOIL SURVEY BY GEOGRAPHIC AREA". WE THEN TOOK THE SHOW ON THE ROAD. OVERALL, GETTING ACCEPTANCE OF THE CONCEPT WAS EASY. MOST RESISTANCE OR OBJECTIONS COULD BE OVERCOME SIMPLY BECAUSE THE APPROACE WAS LOGICAL AND PROVIDED A WAY TO PRACTICE GOOD SCIENCE AND GOOD MANAGEMENT. AT THIS TIME WE HAVE 12 MLRA PROJECTS APPROVED AND SORE ACTIVITY (PRELIMINARY PLANNING, EVALUATIONS) IN ABOUT 25% OF THE MLRA's RATION WIDE. WBAT WE STARTED AT TBE GRASS ROOTS LEVEL BAS, AT LEAST IN PART, BECOME POLICY, IS A CBARGE AT ALL FOUR OF THE WORK PLANNING CONFERENCES THIS YEAR, AND IS IN THE LANGUAGE OF OUR TOP ADMINISTRATORS. I BAD THE OPPORTUNITY A COUPLE OF HONTBS AGO TO SIT IN ON A TELECONFERENCE BETWEEN AN ASSISTANT CHIEF, NOW A DEPUTY CHIEF, AND SOME STATE CONSERVATIONISTS IN THE NORTBEAST. THEY WERE DISCUSSING BOW THEY WIGBT IMPLEMENT PROCEDURES FOR MANAGING SOIL SURVEY ON A MLRA BASIS FOR THE ENTIRE REGION. TBE DEPUTY CHIEF GAVE HIS EXPECTATIONS OF THE GROUP AND IT WAS RIGBT ON TARGET. ONE CERTAINLY GOT THE IMPRESSION THAT BE BAD ASSIMILATED THE INFORMATION AND BELIEVED IN THE CONCEPT. I ALSO UNDERSTAND TEE CHIEF BAS BEEN BRIEFED AND WAS RECEPTIVE TO THE APPROACB.

SO-THE UPSIDE IS TBAT WE HAVE A FORUM FOR LEADING THE SOIL SURVEY IN THE FUTURE. A MEANS OF COORDINATING AND JOINING OUR SOIL RAPS, PROVIDING ONE DESCRIPTION AND ONE SET OF SOIL PROPERTY VALUES AND INTERPRETATIONS FOR EACH UNIQUE LANDFORM SEGMENT HAPPED, ELIMINATING COUNTY AND STATE LINE FAULTS, PROVIDE FOR GREATER EXTRAPOLATION OF RESEARCB RESULTS, REDUCE DATA BASE STORAGE, MD REDUCE OVERALL RAINTENANCE OPERATIONS. I ALSO THINK OUR EFFORTS PUTS THE SOIL SURVEY PROGRAM ON THE CUTTING EDGE OF THE ECOSYSTEMS PLANNING EFFORTS. AFTER ALL, SOILS THEMSELVES REPRESENT A KIND OF ECOSYSTEM AND MLRA's ARE ONE REPRESENTATION OF ECO-REGIONS.

THE DOWN SIDE IS THAT WE HAVE NOT COMPLETED A MLRA PROJECT. WE DO NOT KNOW ALL THE PITFALLS, ALL THE MANAGEMENT PROBLEMS, OR TBE STAFFING NEEDS. NOR DO WE BAVE A STRATEGY FOR UTILIZING LOCAL, STATE, AND FEDERAL FUNDS TO EFFECTIVELY SUPPORT SUCH PROJECTS. WE NEED YOUR INPUT AND KELP. TRY NEW THINGS. LET US KNOW WHAT WORKS AND WE WILL TRY TO GET THE INFORMATION TO OTHERS.

MLRA UPDATES - PANEL DISCUSSION

June 23, 1994

Henry R. Mount
Soil Scientist
NSSC, Lincoln, NE

The last few years hae Been a eerioue commitment from states in the Southern Region on updating soils information on an MLRA basis.

Currently there are two MLRAs approved by Soil Survey Division for updating; MLRA 77 (Southern High Plains) and MLRA 121 (Kentucky Bluegrass). MLRA 77 is in Land Resource Region H (Central Great Plains Wheat and Range Region) and MLRA 121 is in Land Resource Region N (East and Central Farming and Forest Region. According to Agriculture Handbook 296, MLRA 77 is about 50,000 mi^2 and MLRA 121 is about 11,500 mi^2.

During February 1994, a users group meeting was held in Clemson, South Carolina. At this meeting, participants discussed updating opportunities for MLRA 130, 136, 137, 153A, and 153B. The memorandum of understanding and work plan for MLRA 136 and 137 hae been sent to Dr. Arnold for approval two weeks ago. The memorandum of understanding for MLRA 130 (Blue Ridge) has been distributed for peer review. We anticipate that the memorandum of understanding and project plan for MLRA 153A and 153B will be ready for peer review in July 1994.

We would like to see the memorandum of understanding and project plan for MLRA 131 and 134 approved this fiscal year.

<u>Statue of MLRAs bv State Responsible</u>

Kentucky - Approval for MLRA 121. Use meetings held for MLRA 120 with Illinois and Indiana.

Mississippi - Anticipated approval for updating in MLRA 131 and 134.

North Carolina - Anticipated approval for updating MLRA 153A and 153B this fiscal year.

Oklahoma - Planning stage for MLRA 78, 80A, and 84A.

Puerto Rico - Users group meeting held in Mayaguez for the southwest part of the Commonwealth. The field mapping phase for the update of the Virgin Islands of the United States is complete.

South Carolina - MOU and Project Plan for MLRA 136 and 137 sent to NHQ for approval.

Tennessee - MOU and Project Plan for MLRA 130 undergoing current peer review.

Texas - Approval for MLRA 77.

Progress for Soil Survey Updates

The following table shows the acres reported during PY1993 and PY1994 (to date) for soil survey updates (Code 185) by the States in the Southern Region and for the Caribbean Area:

State	Acres PY1993	Acres PY1994
AL	153,945	26,400
AR	128,234	72,550
FL	389,000	60,000
GA	140,520	44,218
KY	223,432	83,590
LA	310,215	161,557
MS	188,986	78,556
NC	112,266	45,149
OK	413,780	74,500
PR	29,986	865
SC	250,389	146,057
TN	178,452	62,322
TX	1,450,828	836,493
VA	0	0

Were do we go from here?

The National Soil Survey Center has recently be reorganioed into teams to service the southern states. Region 1 includes the dominant land area of the Southern States and the Caribbean Area. Teas members are as follows:

Warren Lynn - Research Soil Scientist
Craig Ditzler - Soil Scientist
Susan Samson-Liebig - Soil Scientist
Benry Nount - Soil Scientist
Ronald Bauer - Soil Scientist
Doug Wysocki-Research Soil Scientist and Geomorphologist
and
Ellis

status of **MLRA** 131 **&**

concurrently looking at both MS Valley Silty Uplands (MLRA 134) and MS Valley Alluvium (MLRA 131).

These two MLRAs include 37 counties (parishes) or parts of counties (parishes) in MLRA 134 and 59 in MLRA 131 and 56 are shared by both MLRAs. Some of the broad and more visible problems with the existing soil surveys include:

a) over 1/2 of the survey areas have reports that are more than 20 years old, many of which are in short supply or not available for distribution. (Pm-Taxonomy - 1965).

b) large acreages identified as some kind of miscellaneous land type.

c) most published areas are not on a planimetrically accurate map base.

d) inconsistencies exist in interpretations within MLRAs between counties and states.

Recognizing problems such as these are not as complexed as resolving them. Some of our major concerns include things such as:

a) acquisition of imagery for the project.

b) accommodating a scale relative to customer needs.

c) staffing structure to allow coordination across state, county/parish boundaries.

d) meeting time tables established in the MOU.

Other concerns include:

a) the establishing of a MLRA Legend that will not conflict with existing legends in counties and states, but still be 'user friendly".

b) **carrying out geomorphology** studies of adequate magnitude to serve as a reference and guide throughout the MLRAs.

c) training personnel to meet the requirements and demands needed in updating soil surveys using latest techniques and technology.

The Steering Committee has held several meetings since May 1991, as well as several field trips to observe some of the Landscapes within the two MLRAs.

We have not held a meeting thus far this Fiscal Year; however, we have visited some by phone to discuss mapping scale. We have resolved that issue (1 :12,000) by general consensus.

Last October, the Steering Committee met with the State Conservationists to discuss and share the proposed MOU with them. The proposal achieved general acceptance, however, we were requested to initiate our proposal so that they could see exactly what we were planning. The Steering Committee completed the proposal and distributed it to each State Conservationist. We received a few comments: however, the big discussion was over mapping scale. After a few months and much discussion, the State Soil Scientist from the respective states briefly met at our State Soil Scientist meeting in February and agreed on a mapping scale of 1:12,000. Currently the MOU is ready for submission for approval by the Director of the Soil Survey Division.

NASIS OVERVIEW

David L. Jones, State Soil Scientist, Mississippi

In this era of change, our program is not immune. Just as we are beginning to feel comfortable with the State Soil Survey Database, another database is being developed.

What is the Acronym "NASIS"? National Soil Information System. Why NASIS? Let me give you a little background information.

1. SCS is committed to Ecosystem-Based Assistance for management of Natural Resources.

2. More and more conservation is being defined by the public and in the law in the broadest terms related to soil, water, air, plants and animals and their interaction.

3. In considering these five resources in our planning assistance, soil having one of them, it is imperative that we collect, package and market **the kind of soil data** that our customers want, **need and demand.**

4. While all of the pieces are being put together, we in soils have been diligently working to meet the challenge of having our soil data available.

WHY NASIS?

Because it just happens to be one of our strategies in the National soil survey mission and vision statement. That strategy says: develop, support and make available a National Soil Information System capable of storing, manipulating, and providing tailored soil information meeting NCSS, Federal Geographic Data committee and other agency needs and standards.

WHAT IS NASIS?

It is the National Soil Information System that will provide for collection, storage, manipulation, and dissemination of soil survey information within the NCSS uses of the Iowa State University system.

WHY IS THIS BEING DONE?

1. Because there is a need to build and manage data from the field level up to the national level.

2. A need to quickly and easily revise and malntaln soil properties and interpretations.

3. The need to add new national or unique local data elements and generate appropriite interpretations.

4. The need to incorporate digitized spatial data to create SSURGO, STATSGO, NATSGO and other products.

5. The need to provide for quick and easy evaluations and coordination of soil properties and interpretations.

6. And finally the need to provide SCS and other customers with increased options and flexibility in use of soil survey fnformation.

As NASIS is developed, it is well to keep the following in mind.

Opportunities include things such as:

- Limit impacts of new data elements
- Move to a full featured RDBMS
- Learn from SSSD experiences
- Provide for enhanced editing features
- Provide for future links to GIS
- Help Soil Information Managers do their job
- Generate interpretations focally
- Use new hardware/software tools
- Improve management and reliability of soil data & fnformation
- Increase ability to respond to user needs

Constraints include things such as:

- Pfatform (3B2, Intel, RISC, ?)
- Operating System (DOS, UNIX, ?)
- RDBMS (SE, Online, ?)
- Time Frame
- Money

SCS Resources
Accelerated'change
Policy & Procedures

Implementation Timelines are:

Conversion Beta Test (NASIS Editor Alpha Test)	Jan-Mar 1994: Denver
Training for Beta Testers	May 1994: Fort Collins
NASIS 1.0 Beta Test	Jun-Aug 1994: 4 Sites (1 per NTC region)
Steering Body Meeting	July 1994
Release NASIS 1.0	Oct. 1994

Release 1.O Features include:

Conversion of SSSD to NASIS
- Selective by Soil Survey Area
- Insures clean data loaded into NASIS

Security

Reports (primarily for DSM)
- Duplicate Data Mapunits
- Unlinked Data Mapunits
- Data dump

Name & save queriis
Global edit 'function
Changes **work** on entire selected set
Communication Support
SoilNet capabilities
Facilitate Data Exchange with Security Features
Cakulatii & Validation
Provides for **derivation** of data elements
Facilitates interpretation generation

Release 2.0 Features include:
Interpretation Criteria Maintenance
Interpretation Generation
Data Accumulation
Site **Characterization** Data **(SCR)**
Map Unit Data **(MUR)**
Texonomic Unit Data **(TUR)**
Generalized Date Comparison
Pedon or Component RV vs. **RIC** for Series
(National Standard)
Pedon vs. Component, Series vs. Series, . . .
Export to **FOCS,** external users
Aggregate Pedon & Lab Data
Help create **mapunits**
Statistically **determine** RIC
Exchange Data between NASIS **Sites**

Release 3.0 Features include:
Add GIS capabilities to NASIS
Manage SSURGO, STATSGO, NATSGO
True Survey Area Editor
Coincident areas
Acreage tabulation

I did not mention the release of the Pedon program, but it is scheduled for release in early Fall (4.0 version).

Finally, I want to mention that in addition to all the programming taking place in Fort Collins, CC, there are many teams working on various aspects of NASIS. These Teams are:

1. The Soil Survey Division National Leadership and NASIS Steering Body
2. The National Standards Team
3. Interpretations Team
4. Data Aggregation Team

5. Operational Data Dictionary
6. Analysis Team
7. National Soil Data Access Facility Team
8. NASIS User Group
9. Soil Business Area Analysis Group
10. Data Accumulation Team

Note: Perhaps some others that I may have missed or may not be aware of at this time.

We are excited about NASIS and look forward to Version 1 .O this Fall.

A HYDROLOGIC UNIT PLANNING TOOL FOR WATER QUALITY

The hydrologic unit planning tool will measure the effects of agricultural activities on water resources at the hydrologic area level. It will also provide input into the planning process.

First, the tool allows for input parameters required to run water quality models to

MONITORING WET SOILS ON THE FOREST SERVICE'S LONG-TERM COWPACTION PLOTS

Wayne H. Hudnall[1], Allan E. Tiarks[2] and William B. Patterson'

SUMMARY:

Redox measurements are a common measurement in wetlands and hydric soils. They are usually measured once or twice a week depending upon the time of the year and their accessibility. With data recorder technology, it is possible to continuously record data. Nine locations were instrumented with data loggers on long-term soil productivity management plots in the Kisatchie National Forest to measure: 1. redox potential, 2. soil and air temperature and 3. water table depth. The redox data showed a consistent diurnal fluctuation during some months. The amplitude of the fluctuation is such that the soil may be reduced during the morning, but oxidized in the afternoon. The amplitude of the fluctuations increased slightly with increasing temperature, but most of the change in redox potential seems to be associated with microbial activity. To test this hypothesis, a controlled temperature experiment was conducted using sterilized and unsterilized soil. The diurnal fluctuations were not noted. The change in redox potential of the unsterilized soil was greatly altered by temperature because of microbial activity. There was a lag effect from the fluctuating temperature on the redox potential on both soils. Not all of the questions have been answered, but it does appear that temperature, directly and indirectly, as its effect on microbial activity is responsible for part of the fluctuation. The role of the pine trees has not been investigated.

OBJECTIVES:

To investigate the role of compaction and forest management on the redox potential, water table and soil temperature of the long-term productivity and management plots in the Kisatchie National Forest.

RESULTS:

Figures 1 and 2 present redox verses temperature data obtained during April, 1993. These data are consistent with what one might expect. The soil is saturated near the surface, but oxygen is able to diffuse along the macropores and the soil is less reduced at 50 cm than at 100 cm. There appears to be more of an effect on the redox at 50 cm than at 100 cm. As the temperature fluctuates, there is a corresponding change in redox potential that lags slightly behind the change in temperature.

Figures 3 and 4 show the same soil, but for a longer duration. It appears that the temperature effect is present (Fig. 3), but Figure 4 shows that during this period the water table was dropping. This would allow oxygen to diffuse into the soil

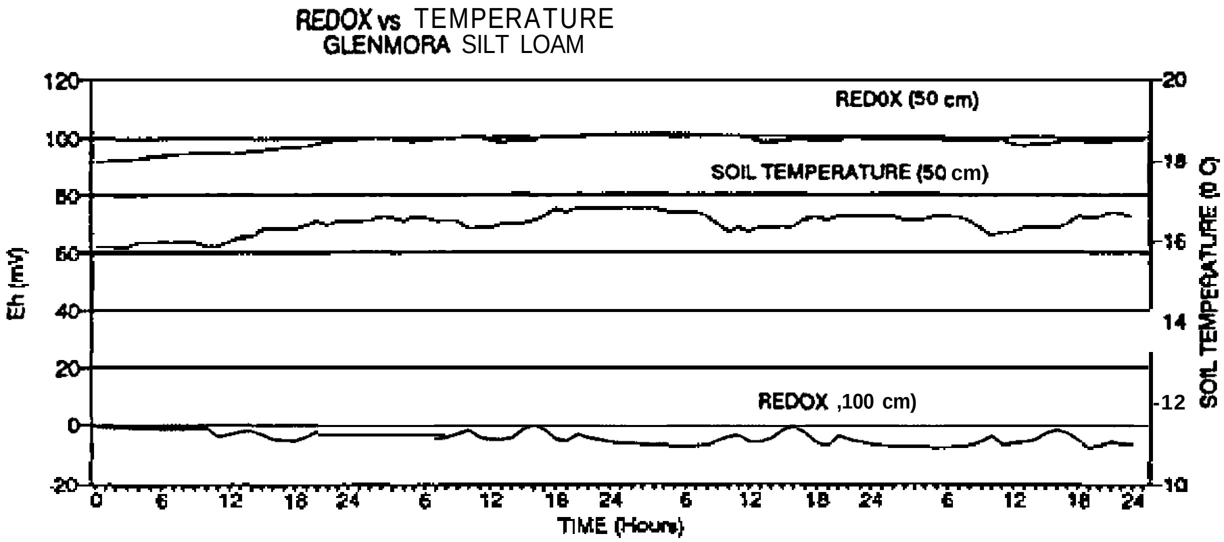
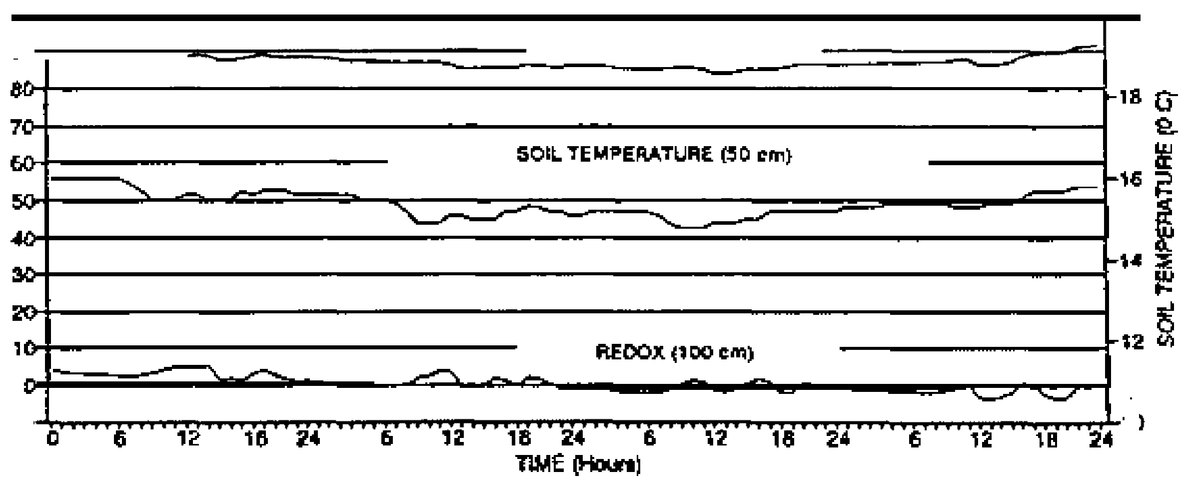


Figure 1. Redox potential verses temperature for the Glenmora



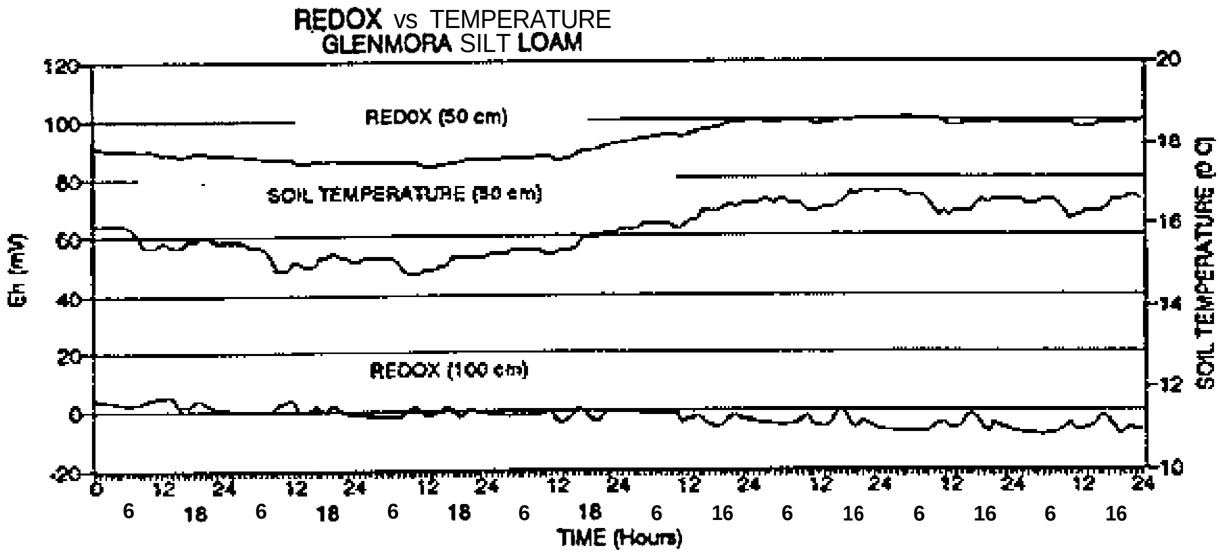


Figure 3. Redox potential verses temperature for the Glenmora soil during April, 1993 showing the apparent effect of temperature.

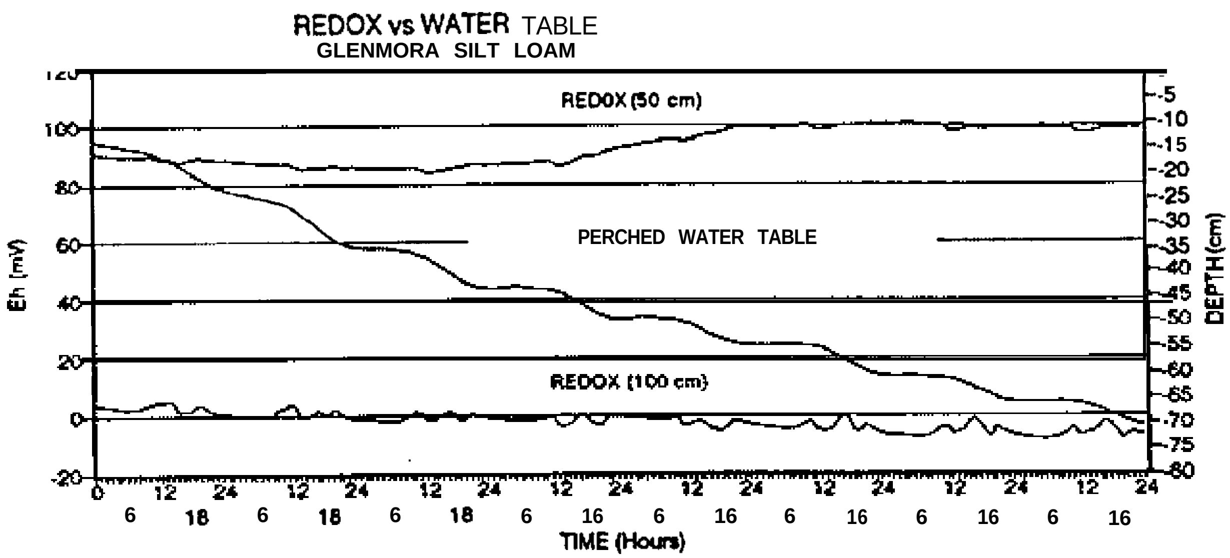


Figure 4. Redox potential verses water table depth for the Glenmora soil during April, 1993 showing oxygenation at 50 cm as the water table drops and the redox potential at 100 cm is decreasing as deoxygenated water reaches that depth.

and raise the redox potential. This is an oxyimorphic effect resulting from oiy-olysis. The perched water table also shows a diurnal fluctuation in the rate of change (Fig. 4). On some dates the redox data showed a consistent diurnal fluctuation with the amplitude of 40mV and 200 mV (Fig. 5.) at 50 cm and 100 cm, respectively. These fluctuations are certainly greater than one would expect from temperature fluctuations. These fluctuations were not noted in just one soil. Figure 6 shows similar data from the Mayhew soil. Maximums in the redox potentials tend to occur in the daytime and at the higher soil temperatures.

The water table at the time of these fluctuations was near the surface (approximately 5 cm) and there was rainfall almost every day. The soil temperature is not optimum for microbial activity and the soil temperature became lower with a rainfall event because of lower air temperature. These events and conditions would decrease the anaerobic activity in the subsoil (100 cm). The water that moved to that depth might not be totally deoxygenated and the diurnal redox would fluctuate in response to temperature and microbial activity.

The laboratory simulation data to test the temperature and microbial effect are presented in Figures 7a. b and c. When the temperature was held constant at 38 C,(Fig. 7a) the redox potential of the sterilized soil was higher than the unsterilized soil. Figure 7b present data for a nearly constant low temperature. The sterilized soil has the same redox potential as when the temperature was high. The redox potential of the unsterilized soil is approximately 225 mV higher at the lower temperature. This indicates that the microbial activity is responsible for the more reduced conditions at the higher temperature.

CONCLUSIONS:

The data show microbial activity accounts for most of the change in redox potentials. In the forest environment, factors other than temperature fluctuations seem to be involved. The combinations of temperature, microbial activity and position of the water table (saturation) are responsible for the redox fluctuations. It is almost impossible to distinguish the cause and effect because each is partially dependent on the other. These findings must be evaluated in terms of both reductimorphic and oxyimorphic processes. Another possibility is that pines, which transport oxygen into the soil through roots, release oxygen into the soil in a diurnal cycle.

This study explains some of the fluctuation one gets in redox readings. One must try to read the redox potential at the same time of day each time the redox potentials are read if the data is manually obtained. The time of day the redox potentials are taken should be changed to know if a fluctuation is occurring. Otherwise, the reading one day might be of sufficient amplitude to conclude that a soil was not reduced, when in fact

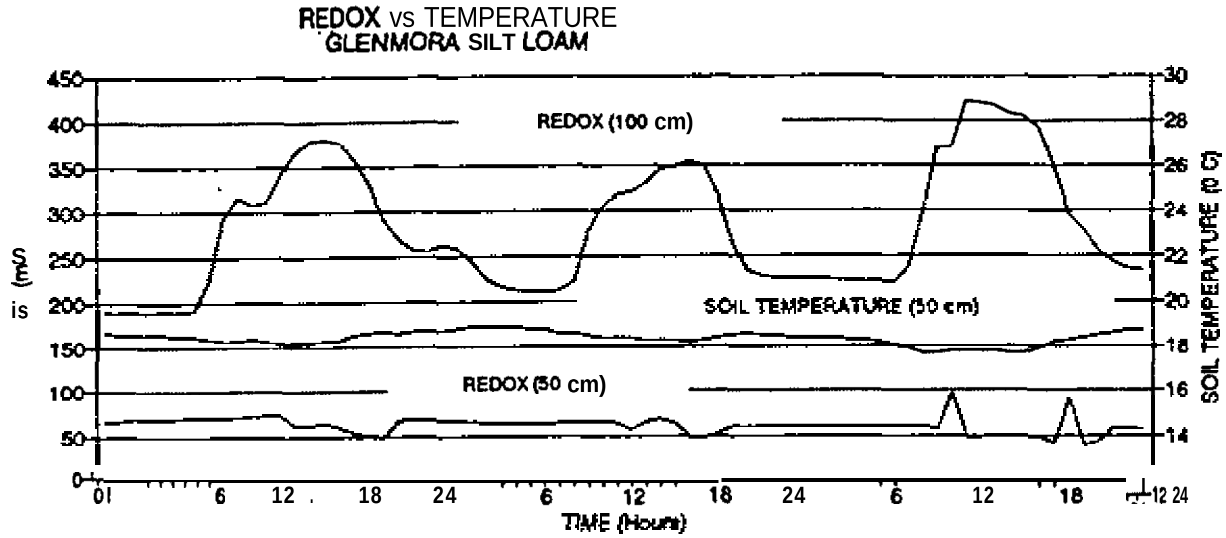


Figure 5. **Redox** potential verses temperature for the **Glenmora** soil showing diurnal variation at 100 cm but only slight variation of the **redox** potential at 50 cm.

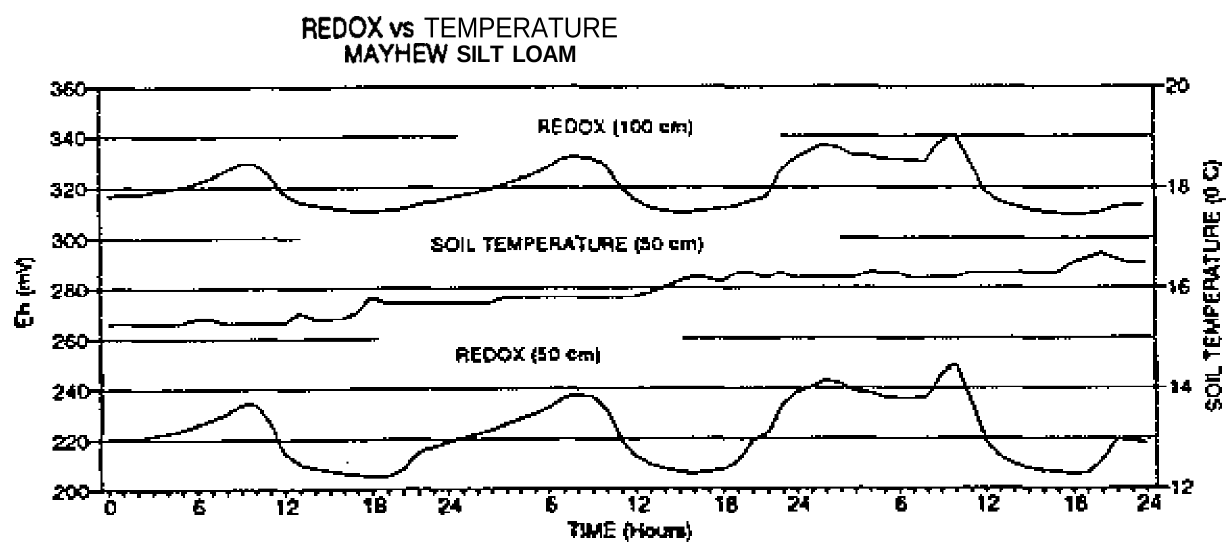
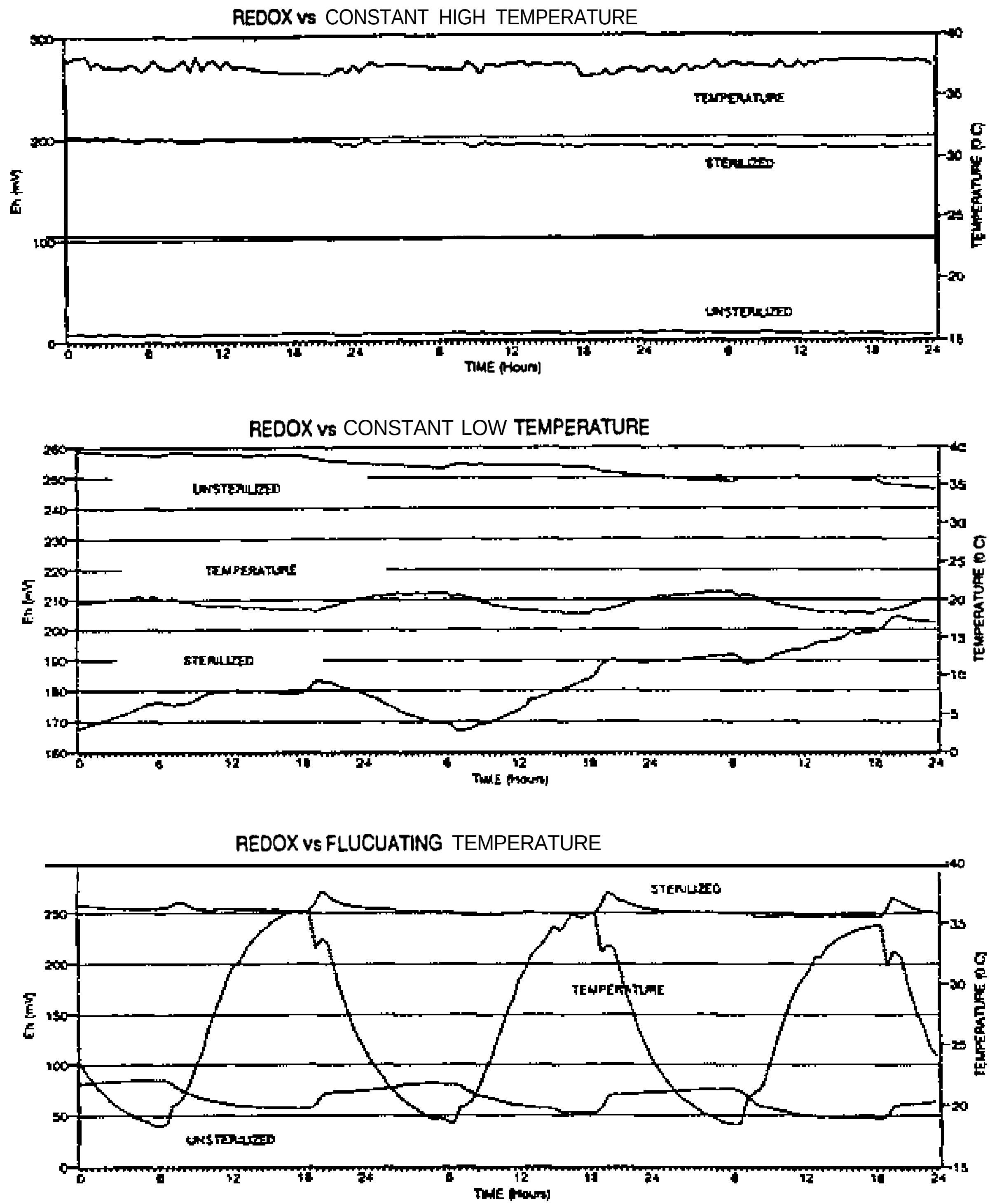


Figure 6. **Redox** potential verses temperature for the Maybew soil during April, 1993 showing diurnal variation in **redox** potential at both 50 cm and 100 cm.



Figures 7a, 7b and 7c. Redox potential verses temperature for laboratory simulated conditions for an unsterilized and sterilized soil. Fig. 7a at constant 38° C. Fig. 7b at near 20° C. Fig. 7c at fluctuating temperature between 18 and 35° C.

it may have been during part of the day. This should caution researchers that a soil may not be reduced even though it is anaerobic and saturated.

[1] Professor and graduate research assistant; Louisiana State University Agricultural Center, Agronomy Department, Baton Rouge, LA; [2] Research Soil Scientist, USDA Forest Service, Southern Forestry Research Station, Pineville, LA.

Hudnall, W. H., A. E. Tiarks and W. B. Patterson. 1994. Monitoring wet soils on the Forest Service's long-term compaction plots. Report of Projects for 1993. Department of Agronomy. Louisiana State University Agricultural Center, Louisiana Agricultural Experiment Station, Baton Rouge, LA. 70803 pp. 151 - 156.

Southern Regional Soil Survey Work Planning Conference

Little Rock, Arkansas

June 20-24, 1994

Committee 1

Soil Survey By MLRA

Jerry J. Daigle, Chair

David E. Pettry, Vice Chair

Soil Survey By MLRA
Committee 1 Report to the Southern Regional Soil Survey Work Planning Conference June 20-24, 1994

Committee Members

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Robert A. Eigel
Louis W. Frost, Jr.
Andy Goodwin
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Glenn Hickman
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Rex Mapes
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Rodney Peters
Dean C Rector
E. Moye Rutledge
H. Ravmond Sinclair
Susan C. Spears
Bruce Stoneman
John R. Vann
Larry B. Ward
Douglas Wysocki

Background

In the past 30 to 40 years, “modern” soil surveys have been completed on about 90 percent of the nation’s 1.6 billion acres of private land, mainly on a county by county basis. As the demand for more reliable soils information grows, there is a need to bring the patchwork of existing county surveys to a common standard, to build on existing information, to develop a coordinated data base to address regional and national concerns, and to better align with current ecosystem planning initiatives.

The Major Land Resource Area (MLRA) is a geographical area that is similar in climate, topography, water resources, land use and soils. It is also an ecosystem. Modernizing soil surveys by MLRA will bring the patchwork of county surveys to a common standard and provide users with a coordinated soils data base for large geographical areas.

The following charges were addressed by the committee:

Charge 1. How should MLRA legends be developed?

Charge 2. What are the problems associated with managing the update of a large MLRA and suggested solutions.

Charge 3. What is the role of the states, NTCs, and NSSC in a MLRA update?

Approach

The charges of this committee were similar to some made by the National Cooperative Soil Survey Conference, held in Burlington, Vermont in July 1993; the Northeast MLRA Work Group; and several other regional soil survey work planning conference committees, They focused on leadership, marketing, funding, technology, and data collection in the MLRA update process.

Many of the ideas and concepts formulated by these work groups have been assembled in the guidebook "Soil Survey By Geographic Area" published by the National Soil Survey Center in December 1993. Many of the broader guidelines in preparing for, evaluating, organizing, and implementing a MLRA update project are included in this guidebook.

The logical approach of this committee was to review existing work group or committee recommendations and guidelines and refine or enhance where possible. The dilemma of this committee was to decide how to best design the implementation of this initiative within budgetary and staffing parameters which, in all probability, will not change from current levels.

Discussion

Management:

As stated in the MLRA guidebook, the management of the maintenance project will vary depending on the size and complexity of the survey area and the number of states involved. If the MLRA is fairly small, entirely or almost entirely within one state, then that state would likely bear the bulk of the responsibility. If the MLRA is large and divided among several states, the management is much more complex.

Management support at all levels is critical, especially for the larger MLRA projects involving several states. The MLRA maintenance survey does not fit with the current political or administrative structure for procuring support. Support within the SCS has always been funnelled from national to regional, regional to state, state to area, and area to county or project level. There are few exceptions to this flow. SCS funding is to the state for use within the state.

Many users of soil survey information also operate in similar political environments. Support from state and local entities is for application within the state or local area. Making the transition away from the status-quo will be no easy task.

The development of work plan objectives for the completion of the MLRA maintenance project and the procedures to accomplish these objectives must be agreed on and supported throughout the life of the project if it is to be completed in a timely manner. Support at all levels in imperative.

The MLRA maintenance soil survey project lends itself well to the Total Quality Management (TQM) process. There is still a need, however, for strong leadership from the National Soil Survey Center, as well as the project steering

committee, to ensure that all persons involved understand and are fulfilling their respective responsibilities.
In the MLRA update, there also needs to be one person with the authority to make technical decisions that concern the survey as a whole. The MLRA guidebook provides for a “Soil Survey Project Development Specialist” that would meet this need.

The size of a MLRA project survey, especially the larger ones involving several states, creates serious logistical problems. How will the field work be accomplished in a reasonable length of time with reduced funding, reduced personnel, and travel limitations?

The acquisition of photography is currently administered through the soil survey schedule in SSSD. It is assumed that this will remain basically the same in NASIS. It will become necessary under the MLRA update mode of operation to acquire photography for portions of a county or portions of several counties. SSSD does not allow this. On the other end of the spectrum, the soil survey area is the MLRA, but acquiring total photographic coverage for large MLRAs would result in photos becoming outdated before the project is completed. An alternate method of photo acquisition is needed.

Accountability concepts will have to change. The measure of the soil survey has always been acres. The MLRA maintenance concept necessitates the use of a greater amount of time on organization, coordination, and evaluation in the early stages. Once the project starts in earnest, more time will be devoted to evaluation and documentation. The objective of the project, it must be remembered, is not to redo but rather to build on an already good product and make it better. New methods have to be developed to measure progress other than by acres mapped.

The data generated during the MLRA update must be manageable. The current SSSD data base is incapable of managing the larger, more complex soil survey areas. The new NASIS data base must be designed to manage the largest of the MLRA areas. It must also be flexible enough to adapt to the changes that will surely occur over time.

Legend Development:

The reason for conducting the soil survey has always been, and still is, to give the landowner or operator a tool for making wise land use decisions based on soil interpretive properties and soil performance data. The soil survey legend, therefore, must be one based on land use potential and interpretations.

Map unit design for existing soil surveys varies greatly based on the time period during which the survey was conducted. Older soil surveys have map units of soil series, numerous phases of soil series,, taxadjuncts, variants, and miscellaneous land types and map units with very narrow slope ranges. More recent soil surveys recognize many new soil series in place of many of the older series with numerous phases, taxadjuncts, variants, and miscellaneous land types.

The availability of detailed profile descriptions, transect data, laboratory data, and other resource data to help support the design and composition of the map unit is generally more available for newer soil surveys.

The types and intensities of interpretations desired for a MLRA, especially a large MLRA, would vary greatly over the area. Parts of the MLRA would see an apparent need for one type of map unit design while other parts would require a completely different design. The point in question is what level of uniformity or flexibility should be applied in developing the MLRA legend?

The perceived needs for a MLRA may vary greatly from one part to another based on local tradition or bias when, in fact, the real needs may vary little. The incorporation of political and personal bias into the decision making process may be the greatest hindrance to uniform legend development.

Most states will maintain county soil survey legends, MLRA legends, state legends, and possibly other sub-state legends. There is concern that GIS and desktop publishers will give states the capability to produce many maps of the same area with many different symbols representing the same delineation. This could cause inconsistencies in our products like never before and will definitely cause confusion for our customers.

Roles:

Organization of the SCS National Headquarters, and the broad responsibilities of the SCS Chief, SCS Deputy Chief for Technology, and the Director of the SCS Soil Survey, relating to soil surveys are in the SCS General Manual Title 430, Part 400, Subpart B. This same title lists the general activities of the SCS National Soil Survey Center; the National Cartographic Center; the National Technical Centers; and state, local, and project soil survey offices. More detailed NCSS responsibilities assigned to these staffs are given in the SCS National Soils Handbook. The MLRA maintenance soil survey concept has not changed any of these responsibilities.

The MLRA update has changed the political boundaries within which the soil survey historically has operated. These political boundaries, unfortunately, seldom aligned with the natural physiographic boundaries now being proposed for soil survey areas. These physiographic boundaries often cross historic political boundaries. This has not changed the role of the national, regional, state, county, or projects offices. It has, however, necessitated the need for cooperation, coordination, and communication at some level between these entities that has never before been required. It possibly also necessitates the realignment of areas of responsibility assigned to the staff of some of these offices.

Management support at all levels is critical, especially for multi-state projects. Work Plan objectives and procedures must be agreed to and supported throughout the life of the project. One person has to be empowered with the authority to make technical decisions that concern the survey as a whole... The MLRA Correlator??

Financial support would be nice!

Recommendations

1. There has to be total commitment to the MLRA maintenance soil survey concept at all levels within SCS, by all cooperators in the national cooperative soil survey, throughout all disciplines and at all levels of management. This is a new concept and, as such, will not develop as it should without the funding and support that comes from commitment. Therefore, commitment must be total in scope, immediate in application, and adequately supported by **staffing** and funding.

2. There has to be a project leader who is in charge. The concept of a project leader, not staffed at the regional or national level, managing a project over several states, is also a new concept. Funding and administration of such a position could become very complex but must be worked out.

3. The only way to report progress in the soil survey data base is by acres. Since all activity contributes to the completion of the project, any measure of completion is acceptable. In the update mode of operation, however, progress will not be consistent and equal throughout the course of the project. There will be very little reportable progress during the organization and evaluation stages of the survey, slow progress during the early stages of field work, and a marked acceleration as the project nears completion. There needs to be an understanding at all levels that progress will not be reported as in the past. It is suggested that every stage of the project be assigned a percent of project value. As each stage is completed, the assigned percentage value is reported. The report could be in percent or it might still be in acres.

4. The MLRA maintenance soil survey will work only if it can be managed by the data base. There must be an assurance that the data base will be designed so that it can handle data from the larger, multi-state MLRA areas. The data should be stored in a national data base. One data base for each MLRA will not work.

5. MLRA legend development should be uniform for all **MLRA's**. To achieve the consistency being sought by the initiative to update/maintain soil surveys by physiographic area, there must be a national mapping convention. Allowing each MLRA maintenance project to develop its own conventions is counter to the basic objectives of the initiative, to coordinate our efforts to develop a quality product for future generations.

6. MLRA legend development should be based on the interpretive needs within the MLRA. This is as it has been with the current project survey by county. It works! Everyone is familiar with it. Why change?

7. The convention used to name MLRA maintenance project map units should be as outlined in the National Soils Handbook (NSH) and the Soil

Survey Manual (SSM). This, also, is as it has been. It works! Why change? ..

8. MLRA legend development should take into consideration all the soils information gathered during earlier soil surveys. The soil map units for all soil surveys within the MLRA should be correlated and coordinated into one legend. Soil interpretations and performance data should be developed using this legend. Soil physical and chemical properties, site features, and climate data should be evaluated to establish these soil interpretations and performance. Some field work will probably be required to make this evaluation. The interpretations and performance data should be used to determine which map units are alike and which map units differ. Map units should be consolidated or maintained separately using this process and a revised legend should be developed. Uniform slope breaks, surface texture, flooding class designations, and other phase criteria should be used as much as possible. New interpretations and performance data should be generated for the revised legend. The interpretations and performance data will need to be tested by users to determine if they are appropriate.

9. MLRA legend development procedures should allow some degree of flexibility. The initial legend will not stand the test of time. Soil classification is a dynamic science. Knowledge of soil features, properties, processes and relationships is ever evolving. More data will be collected over time. More knowledge, hopefully, will be gained. What was, soon will not be. The MLRA legend should be flexible enough to allow it to change with the evolution of the science and the enhancement of human knowledge.

10. The convention for constructing the MLRA map unit symbol recommended by other MLRA work groups and committees seems valid and practical. A unique four digit numeric symbol (0001 through 9999) should be assigned to each map unit within the MLRA. The most logical method would be to assign symbols to alphabetically sorted map units. The alphabetical slope class would be left off. No attempt should be made to group symbols by parent material. The addition of the MLRA designation as a prefix for sorting purposes was first viewed as an option of convenience. For example, map unit 1310562 would represent map unit 0562 in MLRA 131. This could also be designated 131.0562 for clarity. It was decided, however, that without a clear knowledge of how the data base will accommodate these new legends, the insertion of the MLRA designation as part of the map unit symbol was necessary. This convention would result in much added keypunch work over the long haul, but until more is known about the workings of the data base, it is needed.

11. The soil survey data base would need an extra column for the MLRA map unit symbol. The STSSAID and MUID columns would remain the same to facilitate subsets of the MLRA.

12. Request for photographic acquisition must be allowed at a sub-county level and, preferably, at a sub-quad level. It is critical that field personnel have current photography when it is needed but not too far in advance that it becomes outdated. Ability to order by quarter-quad is needed.

13. Some attempt should be made to ensure consistency of the Soil Survey products generated from a system that maintains multiple map unit symbols for a single soil map delineation. Soil maps generated across the country should continue to look the same, having been developed under uniform technical standards and with standard symbols.

14. Probable Roles:

a. States:

(1) Develop, correlate, and coordinate the soil survey legend for the MLRA.
(2) Develop the soil chemical and physical properties, site features, and climate data for each component for all soil map units.
(3) Test the soil survey rating criteria for soil survey interpretations and performance data.
(4) Correlate and coordinate soil survey interpretations and soil performance data.
(5) Work with users of soil survey information to determine if soil interpretations and performance data are appropriate for the MLRA.
(6) Correlate and coordinate soil investigations with agricultural experiment stations.

b. National Technical Centers:

(1) Assist in developing new and revising existing soil survey rating criteria guides.
(2) Assist in testing soil survey rating criteria guides for soil survey interpretations and performance data.
(3) Assist in the correlation and coordination of soil survey interpretations and performance data between states and NTC regions.
(4) Assist in implementation and coordination of conservation programs.
(5) Assist in the correlation and coordination of soil investigations by agricultural experiment stations.

c. National Soil Survev Center:

(1) Develop new technology to improve the soil survey.
(2) Furnish overall management guidelines for making soil surveys.
(3) Conduct quality assurance for all phases of the soil survey.
(4) Assist cooperators coordinate research projects.

d. National Headquarters:

(1) Formulate national policies, guidelines, and procedures.
(2) Represent SCS agency interest to the NCSS.
(3) Provide leadership for the federal part of NCSS.

(4) Develop and maintain relationships and contacts with NCSS cooperators.

e. Agricultural Experiment Stations:

(1) Coordinate all soil survey activities through the National Cooperative Soil Survey program using the annual state soil survey work planning conference as a mechanism to do so.
(2) Participate in the formulation, review and approval processes of policy and procedures that affect the NCSS.
(3) Coordinate research in soils and soils related areas with other members of the NCSS so as to maximize the value of such research.

Summary

SCS seems to have taken its "Damn the torpedos...full speed ahead" approach to the MLRA maintenance survey initiative. We are told, "Future CO-02 soil survey funding will be based on signed memorandums of understanding to conduct maintenance soil surveys based on MLRA boundaries. Each MLRA steering committee, however, is to establish its own procedures and protocol for getting the job done."

The MLRA maintenance soil survey, in concept, is an excellent approach to improving the soil survey. It is also a necessary one in order to align soil survey data with the current ecosysten-based planning initiatives. The recommendations listed by this committee indicate full support, as well as some suggestions and cautions for carrying out this initiative.

Logistically, however, there is neither sufficient staff nor sufficient funding for full implementation of this concept. This is not news... everyone is aware of the problem. It is the opinion of this committee that this initiative, as it is perceived, cannot be fully implemented within the structure of current policies and procedures. It is also the opinion of this committee that the current structure will not change rapidly enough to accommodate those MLRA updates already in progress or very close to initiation. Taking these facts into consideration, this committee makes a summary recommendation that the MLRA maintenance soil survey concept and protocol be used as an operational guideline under which all soil survey activities within the MLRA must function. It is suggested, however, that geographically, these soil survey activities continue at a very local level, much as they have in the past. It is further suggested that, for the time being, the NSSC quality assurance staff person assigned to the MLRA maintain overall correlation responsibilities. In light of current and predicted future restrictions on NSSC travel, it is strongly suggested that these NSSC staff persons be headquartered in the region for which they are responsible.

This committee wholeheartedly supports the soil survey by physiographic area concept. We agree that soil survey by MLRA seems to be the logical way to apply the concept. Coordination, correlation, communication, and commitment are the keys to the'success of this initiative.

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COMMITTEE 2

FUTURE INTERPRETATION NEEDS

BACKGROUND--The demands placed on soil surveys and the interpretations made from them continues to increase. Issues related to wetlands, water quality, nutrient management, and soil quality places emphasis upon the need for reliable soil interpretations. The NCSS is being challenged to meet the current and future needs of soil survey customers. Meeting these challenges will require a vision of customer requirements and a strategy for meeting these needs.

CHARGES:

1. Identify new interpretations needed to meet future demands.

2. Identify present interpretations that need improvements or modifications to meet current demands and outline corrections.

3. Identify new research and investigations needed to support new interpretations.

Roy Vick, Chair
A. D. Karathanasis, Vice Chair

Committee members:

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Fred Beinroth
Randy B. Brown
Brian J. Carter
Marc Crouch
Dennis DeFrancesco
Bruce Dubee
Everett Emino
Charles L. Fultz
R. H. Griffin
B L. Harris
Robert B. Hinton
David L. Jones
David Kriz
Michael E. Lilly
Warren Lynn
George Martin
W. Frank Miller
Dan Neary
Carroll Pierce
Mike Risinger
Gerald Sample
Bill R. Smith
Clyde R. Stahnke
M. J. Vepraskas
Frankie Wheeler

DISCUSSION: Much of the early responses as well as the open discussions dealt with water quality issues, regional criteria, and the need for interpretations on materials deeper in the soil than we presently consider. The responses include:

Charge 1. Identify new interpretations needed to meet future demands.

- Interpretations for groundwater vulnerability to pesticide or nitrate contamination.
- Phosphorus loading with applications of chicken litter and hog manure. Concerns of residence time vs. loading.
- Interpretations for depths greater than 2 meters. Develop methods to describe, classify, and interpret the deep materials. Take into account fracture of bedrock, tilt of strata, and presence of hard rock below Cr. There is a section of lithosphere between realms of geologists and soils that is not addressed. The soils discipline is best suited to assess, categorize, and classify the non-soil regolith.
- The need to better describe materials below the solum and provide interpretations for these.
- Incorporate fuzzy logic - a continuously sliding scale; an example is that the interpretation for roads would slide as depth to bedrock is more critical at steeper slopes.
- We need the ability to predict development of a temporal properties such as traffic pans.

Charge 2. Identify present interpretations that need improvements or modifications to meet current demands and outline corrections.

- Predictions on depths and durations of water tables need improvement.
- Woodland site index data needs improvement. University research needs to be incorporated. Data may be available on hardwoods but needed for pines, or the inverse. Additionally, the SCS plants lists need revision.
- Provide more reasonable ratings for septic tank absorption fields. Soils rated severe may be quite different in their ability to perform with minor design modifications.
- Incorporate soil criteria such as the kandic horizon into interpretations that involve CEC.
- Pesticides leaching and runoff potentials need to be reworked. As more soil properties are identified with NASIS, more sophisticated interpretations could be generated.
- We need to regionalize the national interpretation guides. The opportunity exists for accomplishing this in MLRA updates.
- Distinguish between perched and apparent water tables; concern is connection to aquifer. Need information on soil

water tables, rates of water movement, and relation of morphology to 'water tables.

Charge 3. Identify new research and investigations needed to support new interpretations.

- NASIS will require water table by month; maximum and minimum depth for upper water table; depth of bottom of water table for perched water. Also, inundation by ponding and flooding needs additional study for wetland identification and classification. MLRA updates need to include these types of studies.
- Research on permeability of various horizons, especially at greater depths, for determining effects of chemical solutes on the groundwater.
- Determine the effect of anion exchange capacity on Ultisols and soils with kandic horizons, and implications on water quality.
- Interpretations need to be on the leading edge, with an organizational structure and people to support research of existing data and get new interpretations on line. Interpretations should lead the way for mapping.

RECOMMENDATIONS:

There is a great need for data and research on water states and water tables and ponding, perched and apparent water tables in relation to relate to water quality, especially in MLRA update projects.
All materials to a depth of 2 meters need to be interpreted. Develop methods to describe, classify, and interpret the deep materials. Take into account fracture of bedrock, tilt of strata, and presence of hard rock below Cr within 2 meters.
Develop sliding scale for interpretations. Allow capability to regionalize interpretations. These efforts should be a coordinated effort in MLRA updates.
Work with NCSS cooperators in improving woodland site index data and plant lists.

It is the recommendation that this committee and charges be continued for the next technical work planning conference.

COMMITTEE 3

Classification and Mapping **of Disturbed Soils**

J.T. Ammons and **D.L. Newton**

Committee Charges: A. Develop a literature review directly related to properties of disturbed soils. B. Develop a soil taxonomy proposal for the classification of drastically disturbed soils.

Background

During the meeting of the National Cooperative Soil Survey Conference in Vermont, it was noted that an international committee on disturbed soils was being formed. Further discussion revealed that this committee would focus on paddy soils and severely eroded soils but was not directly related to drastically disturbed soils. The national committee felt Southern Regional Committee 3 should focus its efforts on defining drastically disturbed soils and then develop how this system would fit into Soil Taxonomy. This committee report summarizes the past regional work planning conferences and the recommendations agreed upon at these meetings.

Working Definition of Drastically Disturbed Soils

Drastically disturbed soils consist of soil materials that have been completely removed from their original context and redeposited by man, which resets the pedogenic clock at time zero. These soil materials originate from various surface mining techniques, large civil works projects, major urban excavation projects, and agricultural land that has been drastically disturbed to a depth of two or more meters. Soils resulting from shallow excavations or severe erosion are not considered under this definition. These include paddy soils and severely eroded agricultural lands resulting from past agricultural management.

Soil properties consistently observed in these soil profiles are as follows:

1. Bridging voids related to deposition by various mechanical methods. These voids are randomly located in the soil profile.

2. Disordered coarse fragments (when present) in soil profiles.

3. Pockets of dissimilar material that are randomly oriented in the soil profile.

4. Color mottling not related to drainage in the soil profile.

5. Irregular distribution of oxidized carbon not associated with fluvial processes.

Soil Taxonomy

Various options are available to place disturbed soils in the current taxonomic system (1992 Southern WPC). A new soil order has been proposed and a new suborder has been proposed. The overall consensus among most of the researchers familiar with disturbed soils was to place these soils in a new suborder.

An argument has been made that the properties of the more modern reconstructed minesoils will not meet the criteria consistent with the definition of drastically disturbed soils. Even with highly managed soil replacement techniques, most of the properties unique to drastically disturbed soils are observed. It is critical to inventory these soils as disturbed for future land use interpretations.

Most of the disturbed soils observed at this point in time will fit into the Entisol order of Soil taxonomy. Definitions for the Suborders Udorthents (Ustorthents) and Arents should be rewritten to better depict disturbed soils within the taxon. Present definitions do not allow delineation of all disturbed soils for future land use potential. Do we need to inventory these soils as being disturbed?

Some researchers have reported that cambic horizons have formed in some new soil profiles. This may necessitate the development of a new suborder in the Inceptisol order allowing these soils to be inventoried for future land use. At present, this committee will focus on developing a proposal for a new Suborder in Soil Taxonomy.

Future Actions of Committee

The discussion and input from this committee over the past few years have been fruitful. The next step is to prepare a proposal and have it circulated for review. When the comments are incorporated into the proposal, then it should be submitted to the International committee for review. After editing, it should be submitted from the regional_ soil taxonomy committee for consideration.

Recommendations

1. A proposal should be submitted to Soil Taxonomy for drastically disturbed soils.

2. After the proposal is submitted, the regional committee should be dissolved.

3. Discussion related to soil taxonomy for disturbed soils should be made between the regional soil taxonomy committee and the National Soil Survey Work Planning Conference on Disturbed Soils.

4. A recommendation to the National Soil Survey Work Planning Conference will be made to consider the entire Entisol Order be reviewed to incorporate disturbed soils.

Southern Regional **Work Planning Conference**

Committee 4 Report--Conversion to NASJS

Chair: Ben Stuckey
Vice-Chair: Dave McMillen

Charges:

l-Identify potential **problems in the NASIS conversion.**

Z-HOW to **maintain consistency in the conversion process across the** South region?

3-How do we make thie data readily available to the Ncss

Are there going to be **problems with data editing?**

Many (most) of the data elements will have representative values. Many of these will be simply averages of the current data. Much of this data may need to be edited. For example, AWC on a sandy loam horizon may be shown as 0.10 to 0.16 because the SOILS-5 form has this layer as a SL, SCL, or CL. The representative value on this would be 0.14. This whole data may need to be edited to show only what the SL texture would be. One data element that is going to require a great deal of editing and **also** field verification is the water table information. In NASIS, this information will be in monthly, and will be broken down as wet, capillary fringe, moist, dry, and ice.

Is NASIS **really necessary,** when 3SD **works well today?**

The 3SD program has served us well, but the data in NASIS will be much easier to access by more people. Many are not familiar with the Prelude data **base** and it's commands. New data elements will be added, and data, such as water table, will be expanded to include monthly data. Much of the new data elements is to be tailored toward engineering uses.

Is everyone's **hardware going to be ready by the time NASIS** comes on **line?**

This may be one of the largest problems will NASIS conversion. The recommended system is a workstation, and many states may not have these in place in the soils section. We have been told that the NRI sun workstation that is in most states will handle, not only NRI, **but also NASIS** and the digitizing needs for the state. I doubt this.

Conclusions

Below are the concerns raised during the breakout sessions.

I-Informix database will probably not be the final database that will be used with the info-share effort.

2-NASIS will not be a good field office program- It will only be available in state offices.

3-NASIS will not be easily run by our NCSS cooperators

4-The time frame to implement NASIS is not realistic, since no one really knows what the work load will be to populate many of the data fields.

5-Much of the data for NASIS will either be guesswork or the fields will be left blank.

6-The repository for the "standard" OSD and Soil-5 is unknown-Will it be in each state or in national location?

'I-Method of quality control on data element match across state lines is not known or lacking.

E-The hardware is not in place in all states, and hardware support is lacking.

9-Training on NASIS is lacking.

IO-3SD is working well-Why change in such short time frame?-It is going to have to be kept for the near future anyway.

Recommendations

l-Continue to prepare 3SD data for conversion to NASIS. Do clean up, correct errors, collect missing data, etc.

2-Delay NASIS implementation until info share hardware and software packages are known.

3-Maintain 3SD in each state office.

4-Get and use more input from sates, universities, other NCSS cooperators, and field offices about what data structure is needed.

SOUTHERN REGIONAL TECHNICAL WORK PLANNING CONFERENCE
Little Rock, Arkansas
June 24, 1994
Meeting Minutes

The business meeting was presided over by DeWayne Williams, Soil Scientist, South National Technical Center.

Williams appointed as ad hoc committee to review and update the conference bylaws by the next conference. The members are: Talbert Gerald, Chair; Dr. Larry West; John Meetze; Dr. Ben Hajek.

Motion was made and passed to change the bylaws to remove the Head, Soils Staff, SNTC, as Taxonomy Committee Chair and establish Lead Soil Scientist, Soil Taxonomy as permanent Chair. The Soils discipline leader, SNTC will remain as a permanent member of the committee. The 3 federal members and 3 university members will remain on the committee, each serving a 3-year term.

Taxonomy committee members elected at this conference are:

Dr. Tom Hallmark	1994-1997
Dr. A. D. Karathanasis	1995-1998
Steve Lawrence	1994-1997
Bill Craddock	1995-1998

Taxonomy Committee for the Southern Region:

Robert Ahrens, Chair	
DeWayne Williams	
Dr. David Pettry	term expires June, 1995
Larry Ward	"
Dr. Bill Smith	term expires June, 1996
Ken Murphy	"
Dr. Tom Hallmark	term expires June, 1997
Steve Lawrence	"
Dr A.D. Karathanasis	term begins June, 1995
Bill Craddock	"

Conference membership asked that Dr. Mary Collins and DeWayne Williams to draft a letter to Dick Arnold and Steve Holzhey expressing concern for the fragipan proposal sent out to selected states dated April 28, 1994, authored by Culver, Glocker, and Quandt of the National Soil Survey Staff in Lincoln.

Recommend that the Soil Health/Quality team at the National Soil Survey Center expand its role with the cooperators of the NCSS.

Recommend that an ad hoc committee be formed to explore how to handle map unit symbols in consideration of county/parish, MLRA and state legends and the possibility of producing maps at all three levels.

Ben Stuckey and Dr. Bill Smith invited the conference to convene in Charleston, South Carolina in 1996. Unanimous approval was given.

DEWAYWE WILLIAMS

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INTRODUCTION

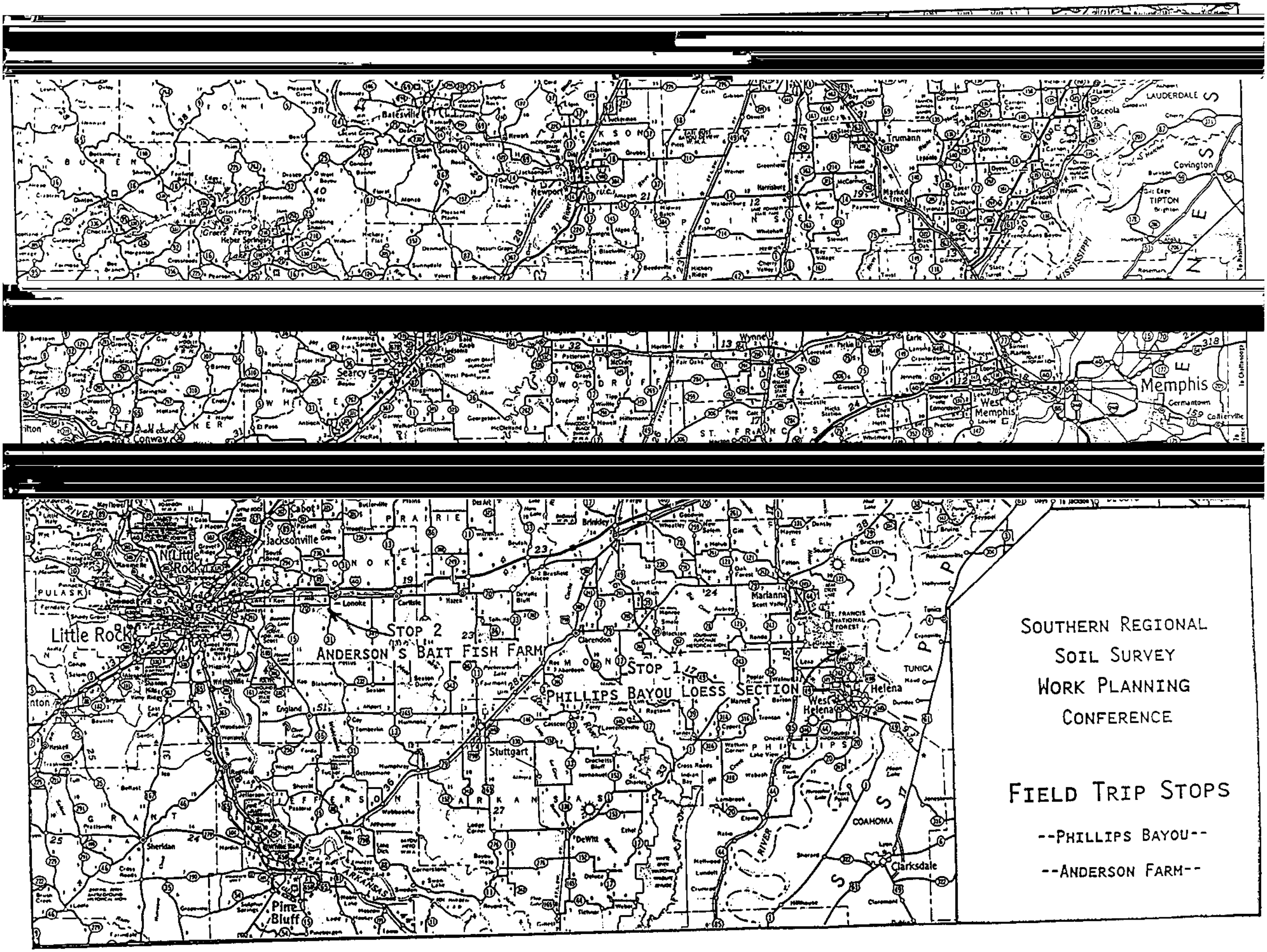
Boy! It going to be another hot one. The weatherman is predicting about 95° today, so we're only going to make two stops. We are going to take about a 2 1/2 hour bus (and van) ride from North Little Rock to Crowleys Ridge. We're going to travel Interstate 40 to Brinkley. From Brinkley, we will head south on US 49 to US 79. Then east on US 79 to Marianna. From Marianna, we will head south on Arkansas 44 into the St. Francis National Forest and our first stop.

Phillips Bayou is one of the "benchmark" sites being used to construct regional chronostratigraphic and lithostratigraphic frameworks for the Middle Mississippi River Valley (MMV). This old abandon gravel pit is one of the best places to study loess deposits in the MMV. It also may be one of the hottest places on earth in June. so it won't take us long to look at this "hot horseshoe".

After a short stay in the pit, we'll return to Bear Lake for a picnic. After a leisurely lunch, we'll head back toward North Little Rock via the same route, until we get to Lonoke. At Lonoke, we will drop down on US 70, which parallels Interstate 40. For a change of pace, we're going to visit Anderson's bait fish farm. This is the largest bait fish operation in the country and maybe the world. Tom Fortner, District Conservationist for Lonoke County will join us and conduct a tour of the operation. From Anderson's, we will head back to the Hilton via US 70.

Since we will have about a 2 1/2 hours to kill on the trip over to the first site, we thought you might want to "windshield" a few soils as we travel east on Interstate 40. We have put together a little travel log, pointing out the major landscapes with a brief description of the soils on them. We hope you'll enjoy your trip.

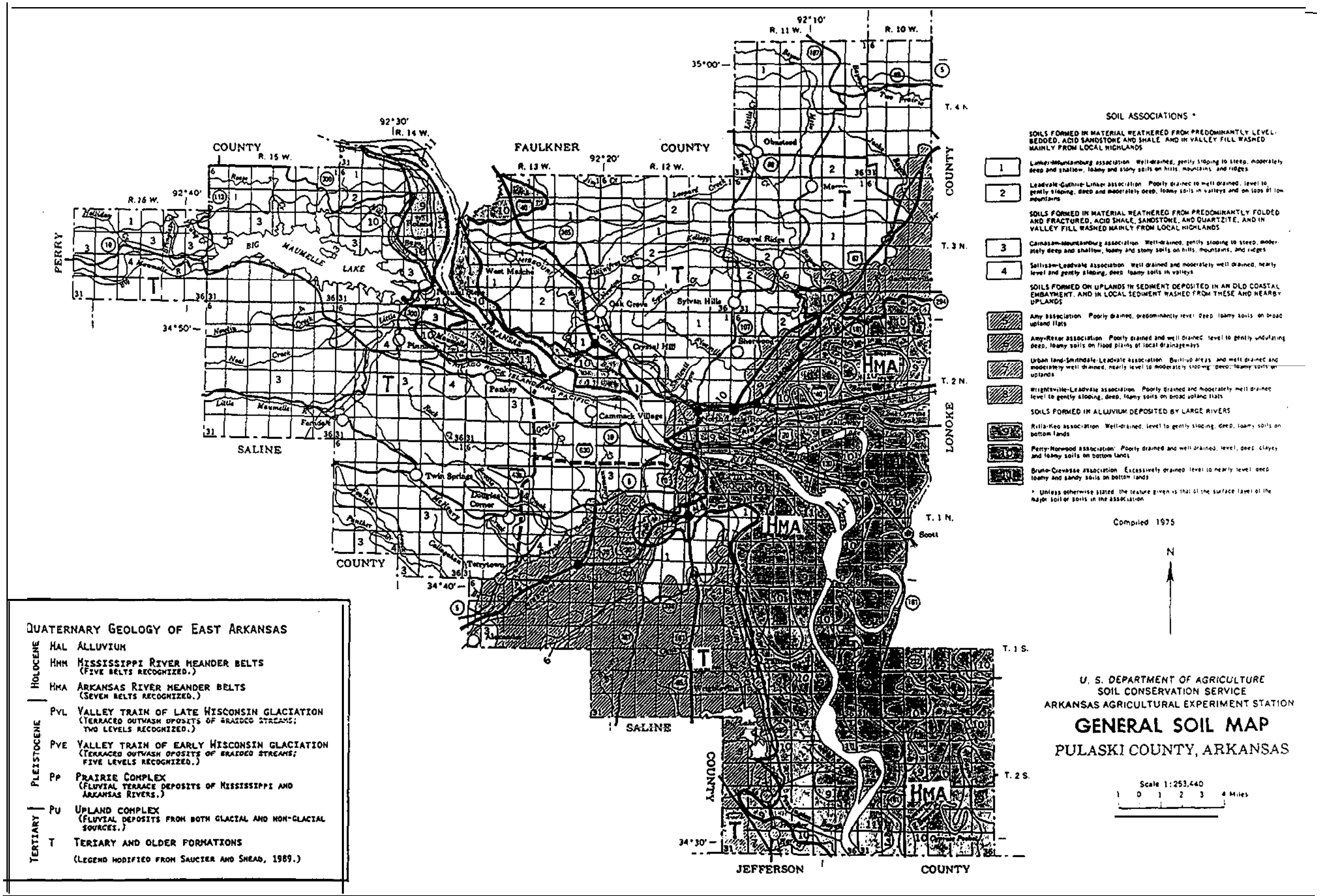
Arkansas Soils Staff



SOUTHERN REGIONAL
SOIL SURVEY
WORK PLANNING
CONFERENCE
FIELD TRIP STOPS
--PHILLIPS BAYOU--
--ANDERSON FARM--
STOP 2
ANDERSON'S BAIT FISH FARM
STOP 1
PHILLIPS BAYOU LOESS SECTION
Little Rock
N Little Rock
Jacksonville
Cabot
Lonoke
Carlisle
Stuttgart
Pine Bluff
DeWitt
Clarendon
Brinkley
Marianna
Helena
West Helena
Clarksdale
TUNICA
COAHOMA
Memphis
West Memphis
Germantown
Collierville
Searcy
Conway
Wynne
Newport
Batesville
Trumann
Osceola
Covington
TIPTON
LAUDERDALE
Marked Tree
Heber Springs
Greers Ferry
Sheridan
England
PULASKI
LONOKE
PRAIRIE
WOODRUFF
WHITE
JACKSON
POINSETT
ST. FRANCIS
LEE
PHILLIPS
MONROE
ARKANSAS
JEFFERSON
GRANT
FAULKNER
VAN BUREN
IZARD
MISSISSIPPI
ARKANSAS RIVER

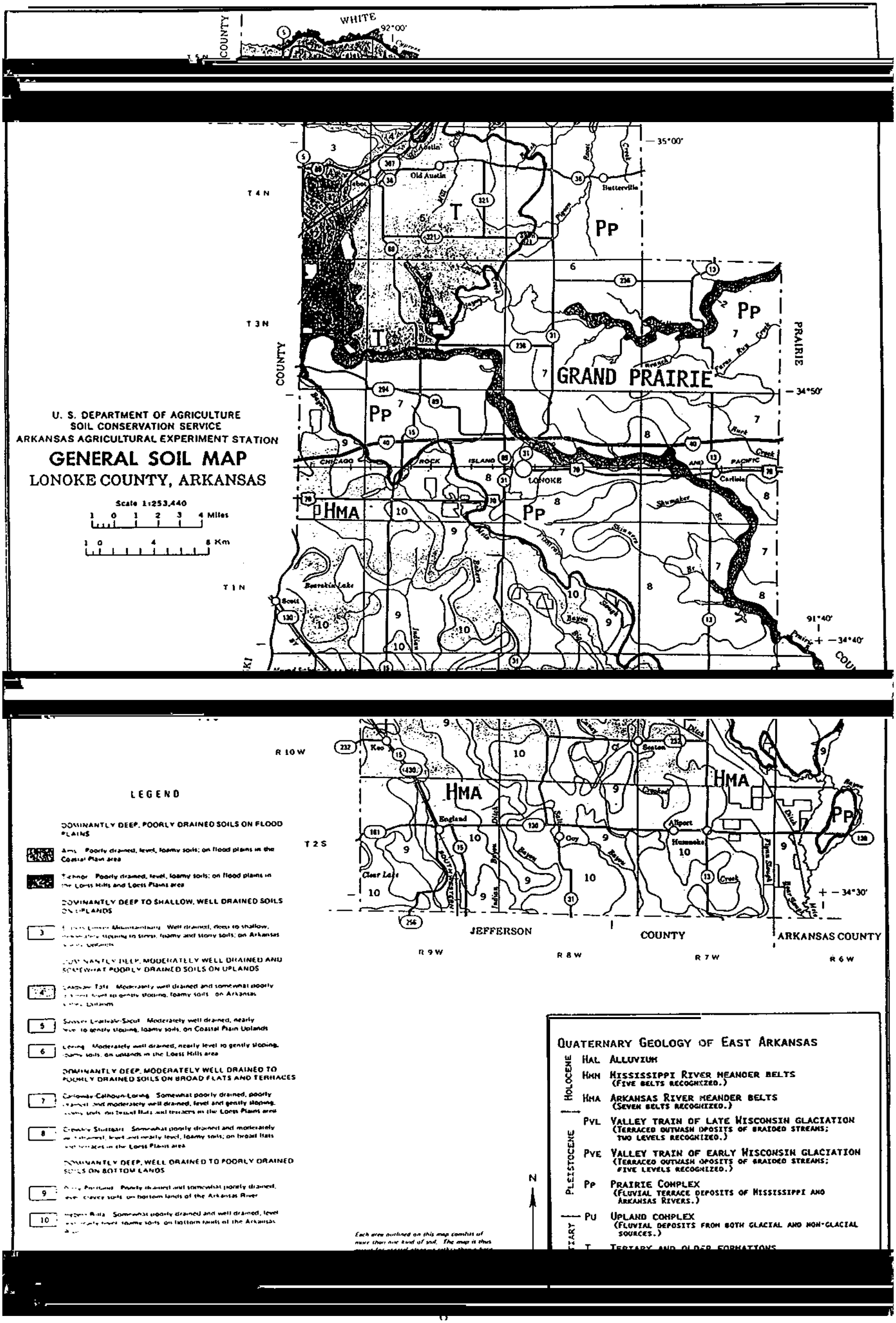
SOIL-LANDSCAPE RELATIONSHIPS

The soil survey update of MLRA 131 and 134 will use the existing terrace interpretations of Saucier, 1964, and Smith and Saucier, 1971, and Saucier and Snead, 1989. These studies give a basic framework, but little field verification has been done to confirm the published interpretations. Existing soil patterns suggest that in some parts of the region the age and (or) composition of the parent material may be different than indicated in these studies. These problems must be resolved for the update. Knowledge of the loess stratigraphy is an essential building block for understanding the age and parent material relationships of the entire terrace system of the Middle Mississippi Valley.


SOIL ASSOCIATIONS *
SOILS FORMED IN MATERIAL WEATHERED FROM PREDOMINANTLY LEVEL-BEDDED, ACID SANDSTONE AND SHALE AND IN VALLEY FILL WASHED MAINLY FROM LOCAL HIGHLANDS
1 Linker-Mountainburg association Well-drained, gently sloping to steep, moderately deep and shallow, loamy and stony soils on hills, mountains, and ridges
2 Leadvale-Guthrie-Linker association Poorly drained to well drained, level to gently sloping, deep and moderately deep, loamy soils in valleys and on tops of low mountains
SOILS FORMED IN MATERIAL WEATHERED FROM PREDOMINANTLY FOLDED AND FRACTURED, ACID SHALE, SANDSTONE, AND QUARTZITE, AND IN VALLEY FILL WASHED MAINLY FROM LOCAL HIGHLANDS
3 Carnasaw-Mountainburg association Well-drained, gently sloping to steep, moderately deep and shallow, loamy and stony soils on hills, mountains, and ridges
4 Sallisaw-Leadvale association Well drained and moderately well drained, nearly level and gently sloping, deep loamy soils in valleys
SOILS FORMED ON UPLANDS IN SEDIMENT DEPOSITED IN AN OLD COASTAL EMBAYMENT, AND IN LOCAL SEDIMENT WASHED FROM THESE AND NEARBY UPLANDS
5 Amy association Poorly drained, predominantly level deep loamy soils on broad upland flats
6 Amy-Rexor association Poorly drained and well drained level to gently undulating deep, loamy soils on flood plains of local drainageways
7 Urban land-Smithdale-Leadvale association Built-up areas and well drained and moderately well drained, nearly level to moderately sloping deep, loamy soils on uplands
8 Wrightsville-Leadvale association Poorly drained and moderately well drained level to gently sloping, deep, loamy soils on broad upland flats
SOILS FORMED IN ALLUVIUM DEPOSITED BY LARGE RIVERS
9 Rilla-Keo association Well-drained, level to gently sloping, deep, loamy soils on bottom lands
10 Perry-Norwood association Poorly drained and well drained, level, deep clayey and loamy soils on bottom lands
11 Bruno-Crevasse association Excessively drained level to nearly level deep loamy and sandy soils on bottom lands
* Unless otherwise stated the texture given is that of the surface layer of the major soil or soils in the association
Compiled 1975
N
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ARKANSAS AGRICULTURAL EXPERIMENT STATION
GENERAL SOIL MAP
PULASKI COUNTY, ARKANSAS
Scale 1:253,440
1 0 1 2 3 4 Miles
QUATERNARY GEOLOGY OF EAST ARKANSAS
HOLOCENE
HAL ALLUVIUM
HMM MISSISSIPPI RIVER MEANDER BELTS (FIVE BELTS RECOGNIZED.)
HMA ARKANSAS RIVER MEANDER BELTS (SEVEN BELTS RECOGNIZED.)
PLEISTOCENE
PVL VALLEY TRAIN OF LATE WISCONSIN GLACIATION (TERRACED OUTWASH DEPOSITS OF BRAIDED STREAMS; TWO LEVELS RECOGNIZED.)
PVE VALLEY TRAIN OF EARLY WISCONSIN GLACIATION (TERRACED OUTWASH DEPOSITS OF BRAIDED STREAMS; FIVE LEVELS RECOGNIZED.)
PP PRAIRIE COMPLEX (FLUVIAL TERRACE DEPOSITS OF MISSISSIPPI AND ARKANSAS RIVERS.)
PU UPLAND COMPLEX (FLUVIAL DEPOSITS FROM BOTH GLACIAL AND NON-GLACIAL SOURCES.)
TERTIARY
T TERTIARY AND OLDER FORMATIONS
(LEGEND MODIFIED FROM SAUCIER AND SNEAD, 1989.)
FAULKNER COUNTY
PERRY
SALINE
SALINE COUNTY
LONOKE COUNTY
JEFFERSON COUNTY
R. 16 W.
R. 15 W.
R. 14 W.
R. 13 W.
R. 12 W.
R. 11 W.
R. 10 W.
T. 4 N.
T. 3 N.
T. 2 N.
T. 1 N.
T. 1 S.
T. 2 S.
92°40'
92°30'
92°20'
92°10'
35°00'
34°50'
34°40'
34°30'
BIG MAUMELLE LAKE
ARKANSAS
Olmstead
Gravel Ridge
Sylvan Hills
Sherwood
Crystal Hill
Oak Grove
West Marche
Pankey
Cammack Village
Twin Springs
Douglas Corner
Terrytown
Ferndale
Scott
HMA
T

PULASKI COUNTY SOIL-LANDSCAPE RELATIONSHIPS

From the motel, onto I-30, then east on I-40, we are traveling on the modern and Holocene floodplains of the Arkansas River. The floodplain is madeup of several meander belts and backswamp deposits. Did you note the levee, just across the street from the motel. Sediments on the floodplain range from sandy to fine. This part of the floodplain is mainly fine textured backswamp deposits. You'll notice several old abandon channels as we near the I-440 overpass and continue east. Saucier and Snead, 1989 recognized seven Arkansas River meander belt. Only one unit was delineated for this trip. As we near the Pulaski-Lonoke County line, we will go up a couple of feet and travel over one of the older meander belts. Soil Associations 9, Rilla-Keo, and Association 10, Perry-Norwood was mapped in this part of Pulaski County



U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ARKANSAS AGRICULTURAL EXPERIMENT STATION
GENERAL SOIL MAP
LONOKE COUNTY, ARKANSAS
Scale 1:253,440
1 0 1 2 3 4 Miles
1 0 4 8 Km
WHITE
COUNTY
PRAIRIE
GRAND PRAIRIE
JEFFERSON
COUNTY
ARKANSAS COUNTY
T 4 N
T 3 N
T 1 N
T 2 S
R 10 W
R 9 W
R 8 W
R 7 W
R 6 W
35°00'
34°50'
34°40'
34°30'
91°40'
92°00'
Pp
T
HMA
Austin
Old Austin
Butlerville
Lonoke
Carlisle
Scott
Keo
England
Coy
Seaton
Allport
Humnoke
Bearskin Lake
Clear Lake
CHICAGO
ROCK
ISLAND
AND
PACIFIC
LEGEND
DOMINANTLY DEEP, POORLY DRAINED SOILS ON FLOOD PLAINS
Poorly drained, level, loamy soils; on flood plains in the Coastal Plain area
Poorly drained, level, loamy soils; on flood plains in the Loess Hills and Loess Plains area
DOMINANTLY DEEP TO SHALLOW, WELL DRAINED SOILS ON UPLANDS
3
DOMINANTLY DEEP, MODERATELY WELL DRAINED AND SOMEWHAT POORLY DRAINED SOILS ON UPLANDS
4
5 Moderately well drained, nearly level to gently sloping, loamy soils, on Coastal Plain Uplands
6 Moderately well drained, nearly level to gently sloping, loamy soils, on uplands in the Loess Hills area
DOMINANTLY DEEP, MODERATELY WELL DRAINED TO POORLY DRAINED SOILS ON BROAD FLATS AND TERRACES
7 Calhoun-Loring Somewhat poorly drained, poorly drained, and moderately well drained, level and gently sloping, loamy soils, on broad flats and terraces in the Loess Plains area
8 Stuttgart Somewhat poorly drained and moderately well drained, level and nearly level, loamy soils; on broad flats and terraces in the Loess Plains area
DOMINANTLY DEEP, WELL DRAINED TO POORLY DRAINED SOILS ON BOTTOM LANDS
9 Poorly drained and somewhat poorly drained, level, clayey soils on bottom lands of the Arkansas River
10 Somewhat poorly drained and well drained, level and nearly level, loamy soils on bottom lands of the Arkansas River
QUATERNARY GEOLOGY OF EAST ARKANSAS
HOLOCENE
HAL ALLUVIUM
HMN MISSISSIPPI RIVER MEANDER BELTS (FIVE BELTS RECOGNIZED.)
HMA ARKANSAS RIVER MEANDER BELTS (SEVEN BELTS RECOGNIZED.)
PLEISTOCENE
PVL VALLEY TRAIN OF LATE WISCONSIN GLACIATION (TERRACED OUTWASH DEPOSITS OF BRAIDED STREAMS; TWO LEVELS RECOGNIZED.)
PVE VALLEY TRAIN OF EARLY WISCONSIN GLACIATION (TERRACED OUTWASH DEPOSITS OF BRAIDED STREAMS; FIVE LEVELS RECOGNIZED.)
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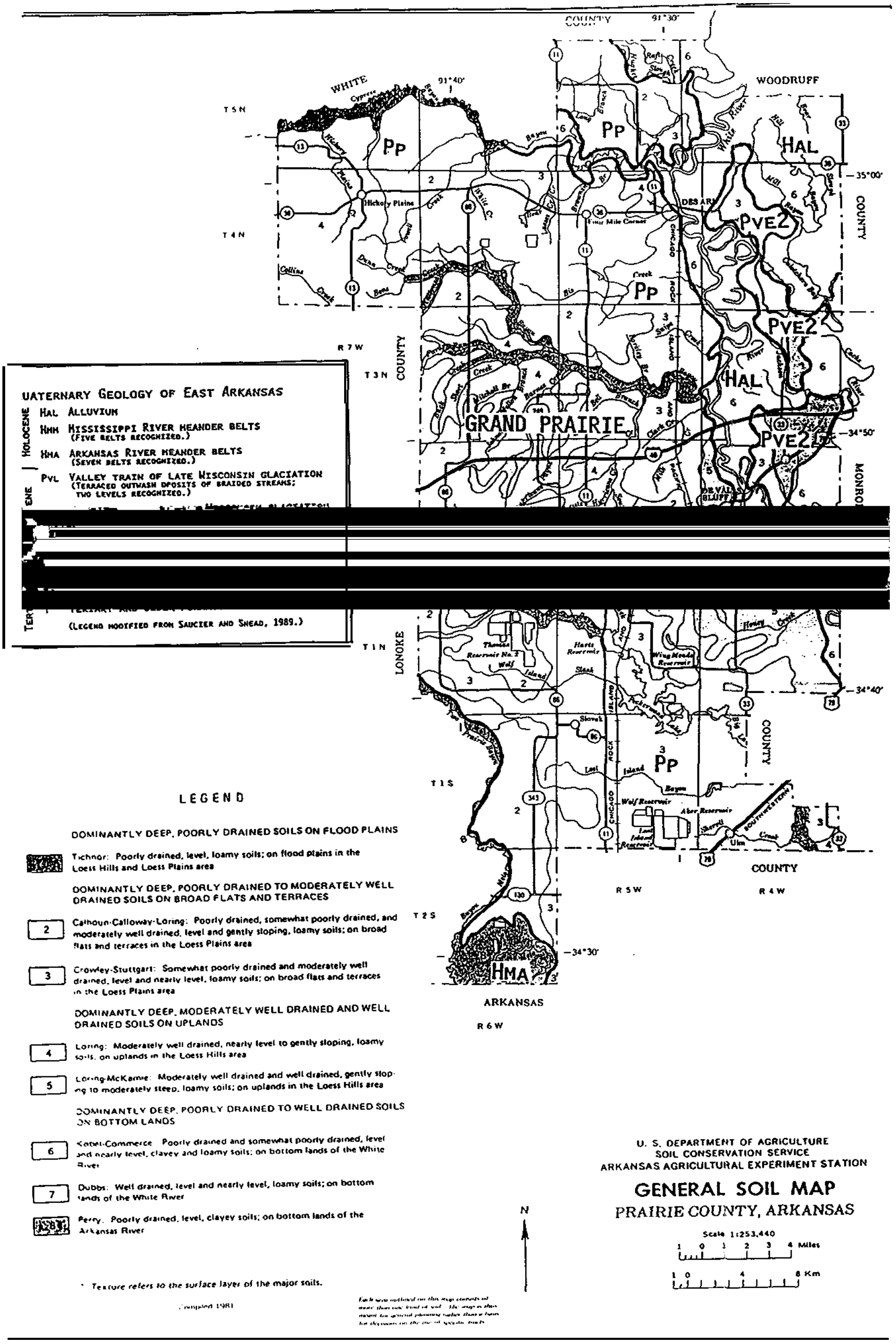
PU UPLAND COMPLEX (FLUVIAL DEPOSITS FROM BOTH GLACIAL AND NON-GLACIAL SOURCES.)
N

LONOKE COUNTY SOIL-LANDSCAPE RELATIONSHIPS

As we enter Lonoke County, we continue to travel across loamy sediments and backswamp deposits of the Arkansas River. Soil unit 9, Perry-Portland, and unit 10 Hebert-Rilla soils were mapped in this area. As we approach Remington Arms (you'll see their tower on the horizon on the right side on the road) you will note a significant rise in elevation. Bayou Meto seperates the Arkansas River floodplain and the Grand Prairie. This Prairie Terrace is madeup red Arkansas River sediments and capped by a brownish silty deposit. Once thought to be loess, Mersiovsky 1993, transected the terrace at two locations and determined that the brownish deposit were alluvium, but was inconclusive as to its orgin.

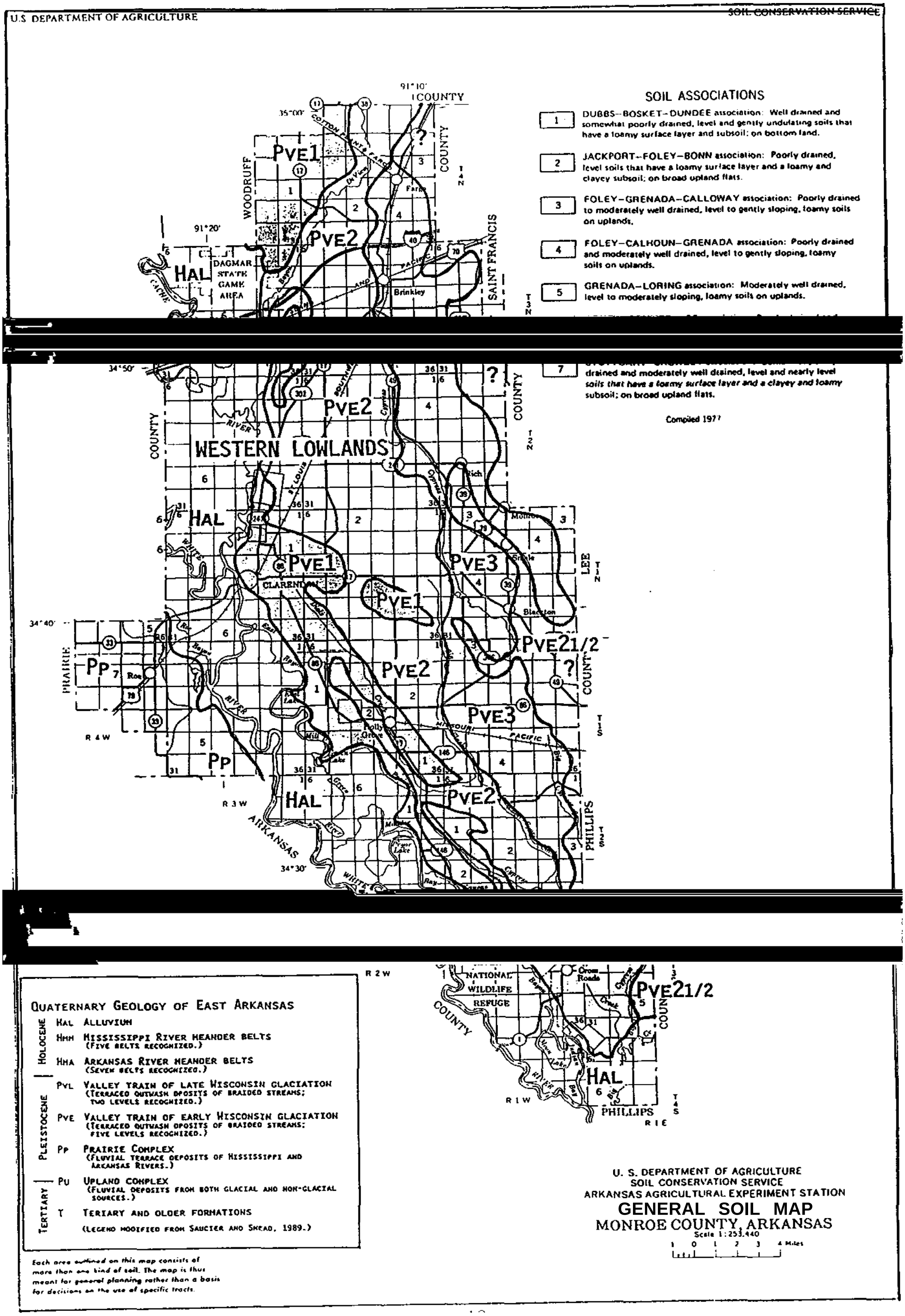
Soils on this surface are typically fine-silty and fine Alfisols. The Calloway, Calhoun and Loring series were mapped. These series are typically mapped in loess. All will be recorrelated to other series or new series established when this soil survey is updated. Also mapped on this surface are the Crowley and Stuttgart series. These fine Alfisols have red, or red mottled argillic horizons, which would indicate an Arkansas River source, but they are also high in sodium, which would indicate a Mississippi River source.


UATERNARY GEOLOGY OF EAST ARKANSAS
HOLOCENE
HAL ALLUVIUM
HMM MISSISSIPPI RIVER MEANDER BELTS (FIVE BELTS RECOGNIZED.)
HMA ARKANSAS RIVER MEANDER BELTS (SEVEN BELTS RECOGNIZED.)
PVL VALLEY TRAIN OF LATE WISCONSIN GLACIATION (TERRACED OUTWASH DEPOSITS OF BRAIDED STREAMS; TWO LEVELS RECOGNIZED.)
(LEGEND MODIFIED FROM SAUCIER AND SNEAD, 1989.)
LEGEND
DOMINANTLY DEEP, POORLY DRAINED SOILS ON FLOOD PLAINS
Tichnor: Poorly drained, level, loamy soils; on flood plains in the Loess Hills and Loess Plains area
DOMINANTLY DEEP, POORLY DRAINED TO MODERATELY WELL DRAINED SOILS ON BROAD FLATS AND TERRACES
2 Calhoun-Calloway-Loring: Poorly drained, somewhat poorly drained, and moderately well drained, level and gently sloping, loamy soils; on broad flats and terraces in the Loess Plains area
3 Crowley-Stuttgart: Somewhat poorly drained and moderately well drained, level and nearly level, loamy soils; on broad flats and terraces in the Loess Plains area
DOMINANTLY DEEP, MODERATELY WELL DRAINED AND WELL DRAINED SOILS ON UPLANDS
4 Loring: Moderately well drained, nearly level to gently sloping, loamy soils; on uplands in the Loess Hills area
5 Loring-McKamie: Moderately well drained and well drained, gently sloping to moderately steep, loamy soils; on uplands in the Loess Hills area
DOMINANTLY DEEP, POORLY DRAINED TO WELL DRAINED SOILS ON BOTTOM LANDS
6 Kobel-Commerce: Poorly drained and somewhat poorly drained, level and nearly level, clayey and loamy soils; on bottom lands of the White River
7 Dubbs: Well drained, level and nearly level, loamy soils; on bottom lands of the White River
Perry: Poorly drained, level, clayey soils; on bottom lands of the Arkansas River
* Texture refers to the surface layer of the major soils.
Compiled 1981
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ARKANSAS AGRICULTURAL EXPERIMENT STATION
GENERAL SOIL MAP
PRAIRIE COUNTY, ARKANSAS
Scale 1:253,440
Miles
Km
N
WOODRUFF
COUNTY
MONRO
LONOKE
ARKANSAS
GRAND PRAIRIE
Hickory Plains
Four Mile Corner
DES ARC
DEVALLS BLUFF
Slovak
Ulm
Pp
HAL
PVE2
HMA
T5N
T4N
T3N
T1N
T1S
T2S
R7W
R6W
R5W
R4W
91°40'
91°30'
35°00'
34°50'
34°40'
34°30'

PRIAIRE COUNTY SOIL-LANDSCAPE RELATIONSHIPS

It is more of the same as we enter Prairie County and continue on to Hazen. Fine-silty Alfisols are mapped across this surface, mainly the Loring series. Again, this will require a recorrelation when the survey is updated. YOU will note the surface becomes more disected as we past the Hazen exit. As we approach the White River the eastern boundary of the Grand Prairie local streams have entrenched exposing fine red sediments. The McKamie series, also a fine Alfisol is mapped on the more sloping areas.

As we cross the White River and travel into the Western Lowland, keeping up with the landscapes becomes more difficult. The floodplain of the White River is extensive and designed HAL on your geology overlay. Then we immediately cross a valley train terrace designed PVE2. When updating Woodruff County to the north, we found this surface to be covered with mainly fine and very-fine textured soils. The Prairie County General soils map shows this area to be mapped Crowley, Stuttgart and Dubbs. This areas will require some study on an update. These series typically are not found on this surface. After crossing the PVE2 terrace, we go down onto terraces and floodplains of the Cache River. These units are designed HAL, but the Cache River terraces are delineated on larger scale maps. The Cache River seperates Prairie and Monroe Counties.

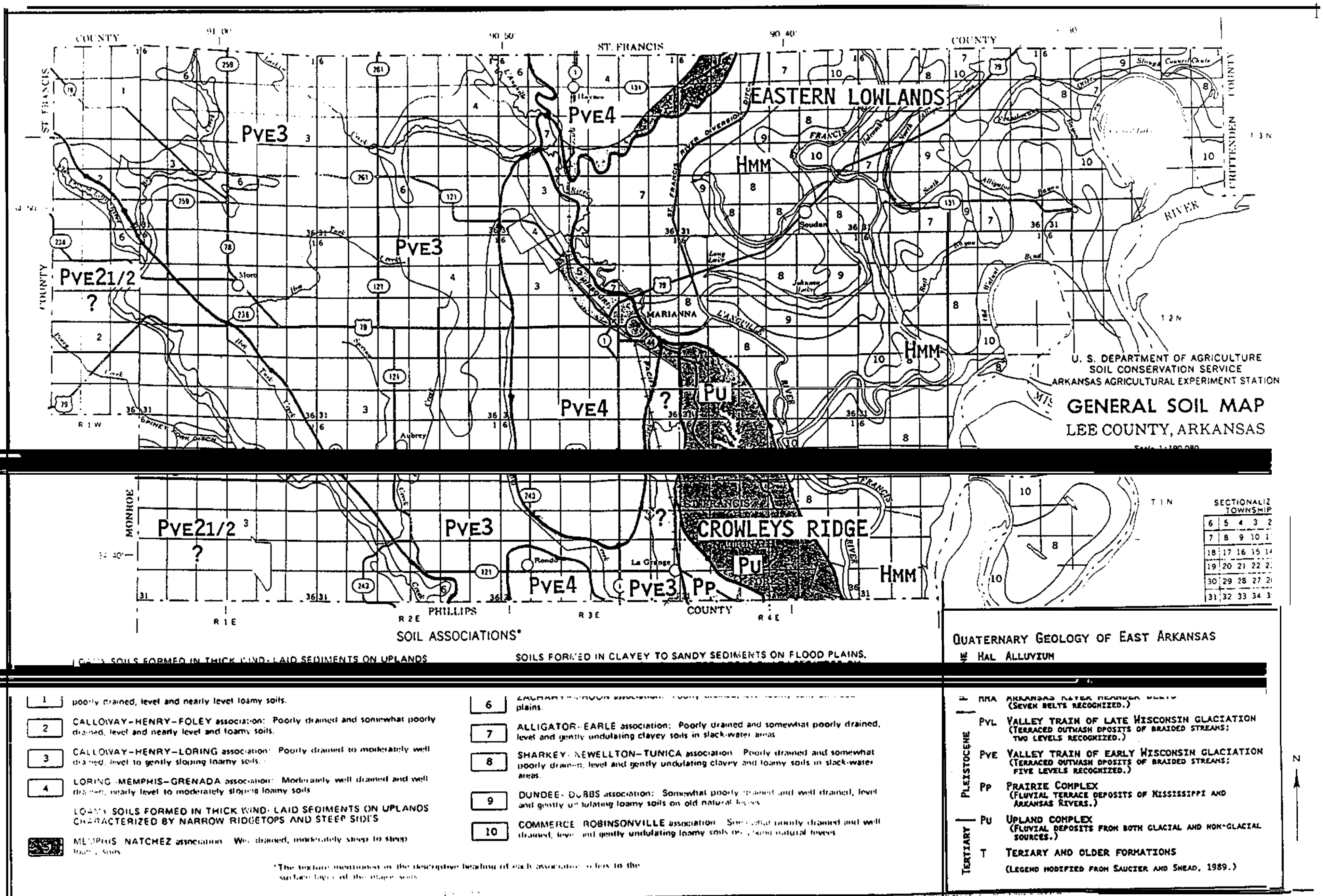

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOIL ASSOCIATIONS
1 DUBBS–BOSKET–DUNDEE association: Well drained and somewhat poorly drained, level and gently undulating soils that have a loamy surface layer and subsoil; on bottom land.
2 JACKPORT–FOLEY–BONN association: Poorly drained, level soils that have a loamy surface layer and a loamy and clayey subsoil; on broad upland flats.
3 FOLEY–GRENADA–CALLOWAY association: Poorly drained to moderately well drained, level to gently sloping, loamy soils on uplands.
4 FOLEY–CALHOUN–GRENADA association: Poorly drained and moderately well drained, level to gently sloping, loamy soils on uplands.
5 GRENADA–LORING association: Moderately well drained, level to moderately sloping, loamy soils on uplands.
7 drained and moderately well drained, level and nearly level soils that have a loamy surface layer and a clayey and loamy subsoil; on broad upland flats.
Compiled 1977
WESTERN LOWLANDS
PVE1
PVE2
PVE3
PVE21/2
HAL
PP
WOODRUFF COUNTY
SAINT FRANCIS COUNTY
LEE COUNTY
PHILLIPS COUNTY
PRAIRIE COUNTY
ARKANSAS COUNTY
DAGMAR STATE GAME AREA
Brinkley
CLARENDON
Holly Grove
Roe
Blackton
NATIONAL WILDLIFE REFUGE
PHILLIPS
R 4 W
R 3 W
R 2 W
R 1 W
R 1 E
QUATERNARY GEOLOGY OF EAST ARKANSAS
HOLOCENE
HAL ALLUVIUM
HMM MISSISSIPPI RIVER MEANDER BELTS (FIVE BELTS RECOGNIZED.)
HMA ARKANSAS RIVER MEANDER BELTS (SEVEN BELTS RECOGNIZED.)
PLEISTOCENE
PVL VALLEY TRAIN OF LATE WISCONSIN GLACIATION (TERRACED OUTWASH DEPOSITS OF BRAIDED STREAMS; TWO LEVELS RECOGNIZED.)
PVE VALLEY TRAIN OF EARLY WISCONSIN GLACIATION (TERRACED OUTWASH DEPOSITS OF BRAIDED STREAMS; FIVE LEVELS RECOGNIZED.)
PP PRAIRIE COMPLEX (FLUVIAL TERRACE DEPOSITS OF MISSISSIPPI AND ARKANSAS RIVERS.)
TERTIARY
PU UPLAND COMPLEX (FLUVIAL DEPOSITS FROM BOTH GLACIAL AND NON-GLACIAL SOURCES.)
T TERTIARY AND OLDER FORMATIONS
(LEGEND MODIFIED FROM SAUCIER AND SNEAD, 1989.)
Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ARKANSAS AGRICULTURAL EXPERIMENT STATION
GENERAL SOIL MAP
MONROE COUNTY, ARKANSAS
Scale 1:253,440
4 Miles

MONROE COUNTY SOIL-LANDSCAPE RELATIONSHIPS

As we enter Monroe County, we continue to bounce back and forth from floodplain to terrace to floodplain. The Sharkey and Commerce series are mapped on surfaces. The Monroe County soil survey is one of our older surveys and needs significant updating. These soils would be recorrelated to other series. These landscapes are all Cache River deposits. At Bayou DeView, we again climb back onto the PVE2 terrace for a short distance, then down to a PVE1 terrace. This is the youngest of the valley train terraces. Sediments on this terrace range from coarse-loamy to fine-silty. It also has the most series delineated of all the valley train terraces, mostly Alfisols. As we approach Brinkley, note the Interstate becomes level with surrounding landscape. This again is the PVE2 terrace. Jackport, Foley and Bonn soils are mapped on this surface. These are very-fine and fine-silty soils high in sodium. Looking to the left, the level with the young pine stand is the PVE1 terrace. Looking east, you will see a significant rise in elevation (20 ft.). This the PVE3 terrace, Rutledge 1985, has shown this terrace to have both Peoria and Loveland/Sicily Inland loesses.

We leave the Interstate at Brinkley and head south on Arkansas 49-US 70. The town of Brinkley sits on a remnant of the Pve3 terrace. You will note this as we leave town and drop back down to the Pve2 terrace temporarily. We will follow the escarpment between PVE2 and PVE3 for several miles south on Arkansas 49 to the junction with US 79.

We will turn east on US 79 and travel on the level 3 terrace. As we approach the town of Monroe, we down a few feet in elevation. This is a level that we are currently studying. This level may only be capped with Peoria.



ST. FRANCIS
COUNTY
CRITTENDEN COUNTY
MONROE
PHILLIPS
COUNTY
EASTERN LOWLANDS
CROWLEYS RIDGE
PVE3
PVE4
PVE21/2
HMM
Pu
PP
MARIANNA
Moro
Aubrey
Rondo
La Grange
Soudan
RIVER
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ARKANSAS AGRICULTURAL EXPERIMENT STATION
GENERAL SOIL MAP
LEE COUNTY, ARKANSAS
SECTIONALIZED TOWNSHIP
SOIL ASSOCIATIONS*
SOILS FORMED IN CLAYEY TO SANDY SEDIMENTS ON FLOOD PLAINS.
1 poorly drained, level and nearly level loamy soils.
2 CALLOWAY-HENRY-FOLEY association: Poorly drained and somewhat poorly drained, level and nearly level and loamy soils.
3 CALLOWAY-HENRY-LORING association: Poorly drained to moderately well drained, level to gently sloping loamy soils.
4 LORING-MEMPHIS-GRENADA association: Moderately well drained and well drained, nearly level to moderately sloping loamy soils
LOAMY SOILS FORMED IN THICK WIND-LAID SEDIMENTS ON UPLANDS CHARACTERIZED BY NARROW RIDGETOPS AND STEEP SIDES
5 MEMPHIS-NATCHEZ association: Well drained, moderately steep to steep loamy soils
plains.
7 ALLIGATOR-EARLE association: Poorly drained and somewhat poorly drained, level and gently undulating clayey soils in slack-water areas
8 SHARKEY-NEWELLTON-TUNICA association: Poorly drained and somewhat poorly drained, level and gently undulating clayey and loamy soils in slack-water areas.
9 DUNDEE-DUBBS association: Somewhat poorly drained and well drained, level and gently undulating loamy soils on old natural levees.
10 COMMERCE-ROBINSONVILLE association
QUATERNARY GEOLOGY OF EAST ARKANSAS
HAL ALLUVIUM
(SEVEN BELTS RECOGNIZED.)
PVL VALLEY TRAIN OF LATE WISCONSIN GLACIATION (TERRACED OUTWASH DEPOSITS OF BRAIDED STREAMS; TWO LEVELS RECOGNIZED.)
PVE VALLEY TRAIN OF EARLY WISCONSIN GLACIATION (TERRACED OUTWASH DEPOSITS OF BRAIDED STREAMS; FIVE LEVELS RECOGNIZED.)
PP PRAIRIE COMPLEX (FLUVIAL TERRACE DEPOSITS OF MISSISSIPPI AND ARKANSAS RIVERS.)
PU UPLAND COMPLEX (FLUVIAL DEPOSITS FROM BOTH GLACIAL AND NON-GLACIAL SOURCES.)
T TERTIARY AND OLDER FORMATIONS
(LEGEND MODIFIED FROM SAUCIER AND SNEAD, 1989.)
PLEISTOCENE
TERTIARY
N

ARKANSAS
Land Use and Agriculture Production Statistics

LAND USE

Total Surface Area 34.0 million acres

	In million acres
Nonfederal land	30.2
Federal land	3.1
Census water	.7

General Land/Cover Use for Nonfederal Land

Forestland	14.3
Cropland	8.2
Pastureland	5.7
Other	2.0

AGRICULTURE PRODUCTION

1992 Major Field Crops

	In million acres	Avg. yield/acre
Soybeans	3.2	37 bu.
Rice	1.4	131 bu.
Cotton	1.0	919 lbs.
Wheat	1.0	46 bu.
Grain sorghum	.4	76 bu.
Corn	.1	130 bu.

Arkansas' Rank Among States

Number:

One in: Rice production
Broiler production
Baitfish production

Two in catfish production

Three in turkey production

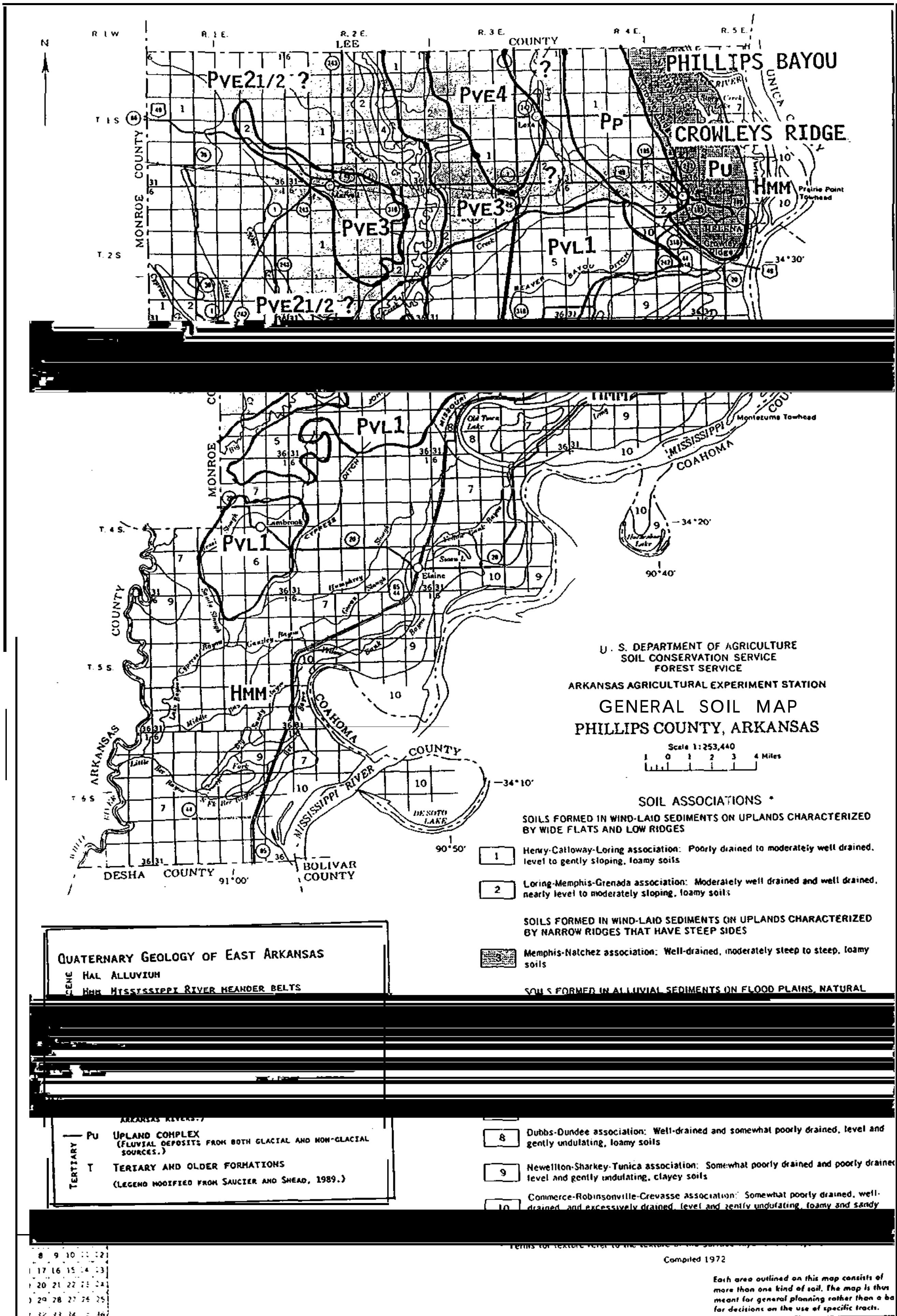
Four in cotton production

Five in: Egg production
Grain sorghum

LEE COUNTY SOIL-LANDSCAPE RELATIONSHIPS

We continue on the "PVE2 1/2" level for several miles into Lee County. From our preliminary work, it appears that many of the soils on this intermediate terrace are high in sodium. We hope to finish sampling on this level in the fall of 1994. Fine-silty Alfisols are mapped on this surface. Series typically formed in loess. At Hog Tusk Creek, we cross a good escarpment (10-15 ft., grain bins on right) back onto PVE3. A couple miles west of Marianna, we cross onto PVE4. The escarpment has eroded down with the help of passed farm practices. It better expressed at other locations. This terrace is thought to have two and probably three loesses; Peoria, Roxana and Loveland/Sicily Inland. Fine-silty Alfisols are mapped of level 4; soils typically formed in loess. The Peoria is several feet thick on this surface.

At Marianna, we head east, then south on Arkansas 44 into the St. Francis National Forest and Crowleys Ridge. Crowleys Ridge is an erosional remnant of unconsolidated Eocene sediments capped by Pliocene sand and gravel and Pleistocene loess. It rises 100-200 feet above the surrounding landscapes. Its a divide formed during the Pleistocene by ancestors of the Mississippi River to the west and the Ohio River to the east. The ridge is highly dissected and eroded.


U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FOREST SERVICE
ARKANSAS AGRICULTURAL EXPERIMENT STATION
GENERAL SOIL MAP
PHILLIPS COUNTY, ARKANSAS
Scale 1:253,440
1 0 1 2 3 4 Miles
SOIL ASSOCIATIONS *
SOILS FORMED IN WIND-LAID SEDIMENTS ON UPLANDS CHARACTERIZED BY WIDE FLATS AND LOW RIDGES
1 Henry-Calloway-Loring association: Poorly drained to moderately well drained, level to gently sloping, loamy soils
2 Loring-Memphis-Grenada association: Moderately well drained and well drained, nearly level to moderately sloping, loamy soils
SOILS FORMED IN WIND-LAID SEDIMENTS ON UPLANDS CHARACTERIZED BY NARROW RIDGES THAT HAVE STEEP SIDES
3 Memphis-Natchez association: Well-drained, moderately steep to steep, loamy soils
SOILS FORMED IN ALLUVIAL SEDIMENTS ON FLOOD PLAINS, NATURAL
8 Dubbs-Dundee association: Well-drained and somewhat poorly drained, level and gently undulating, loamy soils
9 Newellton-Sharkey-Tunica association: Somewhat poorly drained and poorly drained, level and gently undulating, clayey soils
10 Commerce-Robinsonville-Crevasse association: Somewhat poorly drained, well-drained, and excessively drained, level and gently undulating, loamy and sandy
Compiled 1972
Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a ba for decisions on the use of specific tracts.
QUATERNARY GEOLOGY OF EAST ARKANSAS
HAL ALLUVIUM
HMM MISSISSIPPI RIVER MEANDER BELTS
PU UPLAND COMPLEX (FLUVIAL DEPOSITS FROM BOTH GLACIAL AND NON-GLACIAL SOURCES.)
TERTIARY
T TERTIARY AND OLDER FORMATIONS
(LEGEND MODIFIED FROM SAUCIER AND SHEAD, 1989.)
PHILLIPS BAYOU
CROWLEYS RIDGE
PVE2 1/2 ?
PVE4
PP
PU
HMM
PVE3
PVL1
LEE COUNTY
MONROE COUNTY
DESHA COUNTY
BOLIVAR COUNTY
COAHOMA COUNTY
MISSISSIPPI RIVER
ARKANSAS
Elaine
Lambrook
Helena
DESOTO LAKE
Montezuma Towhead
Prairie Point Towhead
34°30'
34°20'
34°10'
90°40'
90°50'
91°00'
R. 1 W.
R. 1 E.
R. 2 E.
R. 3 E.
R. 4 E.
R. 5 E.
T. 1 S.
T. 2 S.
T. 4 S.
T. 5 S.
T. 6 S.

PHILLIPS COUNTY SOIL-LANDSCAPE RELATIONSHIPS

Continuing south on Forest Service road 1900, we enter Phillips County. Phillips Bayou is locate one mile south of the Lee-Phillips County line.

We hope you enjoyed our "windshield" mapping trip across east Arkansas.

REFERENCES

Fielder, R.T., Crader, K.J., Simon, M.A., and Wilson, C.R., 1981, Soil Survey of Lonoke and Prairie Counties, Arkansas. U.S.D.A. Soil Conservation Service, U.S. Government Printing Office.

Gray, J.L., 1977, Soil Survey of Lee County, Arkansas. U.S.D.A. Soil Conservation Service, U.S. Government Printing Office.

Haley, G.J., Buckner, R.O., and Festervand, D.F., 1975, Soil Survey of Pulaski County, Arkansas. U.S.D.A. Soil Conservation Service, U.S. Government Printing Office.

Hogan, J.I., and Gray, J.L., 1974, Soil Survey of Phillips County, Arkansas. U.S.D.A. Soil Conservation Service, U.S. Government Printing Office.

Maxwell, G.R., Harris, C., and Gore, W.A., 1978, Soil Survey of Monroe County, Arkansas. U.S.D.A. Soil Conservation Service, U.S. Government Printing Office.

Mersiovsky, E.P., 1993, Silty Sediments on the Grand Prairie of Arkansas. Masters Thesis, University of Arkansas, Fayetteville.

Rutledge, E.M., West L.T., and Omakupt, M., 1985, Loess deposits on a Pleistocene age terrace in eastern Arkansas: Soil Science Society of America Journal, v. 49, p. 1231-1238.

Saucier, R.T., 1964, Geological Investigation of the St. Francis Basin, Lower Mississippi Valley: U.S.Army Engineers Waterways Experiment Station Technical Report 3-659, scale 1:62,500.

Smith, F.L., and Saucier, R.T., 1971, Geological Investigation of the Western Lowlands Area, Lower Mississippi Valley: U.S.Army Engineers Waterways Experiment Station Technical Report S-71-5, scale 1:62,500.

Saucier, R.T., and Snead, J.I., (compilers), 1989, Quaternary Geology of the Lower Mississippi River Valley: Louisiana Geological Survey, map scale 1:1,100,000.

LOESS AND ASSOCIATED PALEOSOL STRATIGRAPHY, MIDDLE MISSISSIPPI RIVER VALLEY 1/

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L.B. Ward[5], D.T. Rodbell[6], Meyer Rubin[4], H.T. Millard[6], M.J. Pavich[4]

1/ U.S. Geological Survey . Peachtree Center, Suite 130.3039 Amwiler Rd., Atlanta. GA 30360-2824; V USDA, Soil

chemical and clay mineral analyses, respectively. **Loesses** and paleosols exposed at intervening localities are described and sampled less rigorously and correlated to **loess** units at the benchmark localities.

To date, loesses and paleosols at two "benchmark" localities, Old **River** and Phillips Bayou, have been described and sampled (fig. 1). Samples have been submitted for analyses. A detailed description of the Phillips Bayou section, x-ray diftiactometry data from the Old River section, as well as age and magnetic susceptibility data from both localities are now available, as are some preliminary compositional and age data from exposures at Wittsburg quarry (fig. 1). Initial results suggest a consistent loess stratigraphy for the MMV. The following paragraphs summarize the chronostratigraphy and the **lithostratigraphy** of **the** region as compiled from available published and unpublished data.

Four stacked loesses are present on the high bluffs east of the Mississippi River and on Crowleys Ridge. From oldest to youngest the **loesses** are identified as **the** Crowley's Ridge Sift, the Loveland loess, the Roxana Silt, and the Peoria Loess. The general morphology of individual loess sheets and their associated paleosols is notably consistent from one locality to another.

At the Old River and Phiiips Bayou localities, the **2**- to 4-m thick Crowley's Ridge Silt grades from a **10YR 5/4** to **7.5YR 4/6-5/6** sandy loam or fine sandy loam in the basal meter to a **10YR 5/3, 6/4,** or **5/4** to **7.5YR 4/4** silt or silt loam in the uppermost meter. At the Phiips Bayou locality, a **10YR 7/2-7/3** fiie sand (of **fluvial** or eoliab origin) is either the basal part of, or stratigraphically underlies, the **Crowley's** Ridge Silt. The sand grades upward into a silt or silt loam. Clay minerals in the **Crowley's** Ridge Silt are dominantly kaolinite with lesser amounts of **illite/smectite.**

Commonly, the contact between the Crowley's Ridge paleosol and the overlying Loveland loess is accretionary (the result of loess being deposited at a rate less than the rate of soil formation) with a biologically mixed zone marking the Loveland **Silt/Crowley's** Ridge paleosol contact. Locally, such as at Wittsburg **quarry,** the mixed layer, and ***(or)*** upper part, of the Crowley's Ridge paleosol has been eroded and the Loveland **loess/** Crowley's Ridge paleosol contact is unconformable.

The **6**- to 8-m thick Loveland loess commonly grades from a **10YR 5/3-5/4** loam or fine sandy loam in the basal 1 to 2 m to a **10YR 5/4-6/4** silt in its middle section to a **7.5YR 4/6-5/6** silty clay loam in the argillic horizon of the **2**- to 3-m thick Sangamon paleosol at the Roxana Silt/Loveland loess contact. At the Phillips Bayou section, the upper part of the argillic horizon of the Sangamon paleosol has a maximum <2 micron content of 32 percent The Fe and Mn oxyhydroxide (present as part of the <2 micron fraction, along ped faces, as liing in pores, and as concretions) content in the argillic horizon is also high (Fe content of 2 to 3 percent by weight). X-ray data from the Old River section indicate that the <2 micron fraction of the Sangamon paleosol has a higher kaolinite content and lower illite and illite/smectite contents than does the Crowley's Ridge paleosol.

Where thicker than 4-5 meters, the Loveland loess is strongly calcareous in the basal part. Locally, the basal 2 m is characterized by hard round carbonate concretions, 5-50 mm in diameter as well as disseminated, thin vein, and filament carbonate. Where observed, the contact between the overlying Roxana Silt and the Loveland loess is an erosional unconformity.

Locally, where the Roxana Silt is >2 m thick and the lower unnamed paleosol is absent, the basal meter is calcareous and contains highly weathered terrestrial gastropod shells. At these localities, Irregularly shaped, soft to hard, clay-rich, 2- to 10-mm thick carbonate concretions are common in the basal meter of loess, even where shells are absent. The contact between the top of the Farmdale paleosol and the overlying Peoria loess is generally sharp and easily identified strongly calcareous above the contact and noncalcareous below.

In the MMV the Peoria Loess is commonly from 6 to 20 m thick, but can be as thin as a meter and still recognizable in outcrop and (or) core. The Alfisol generally associated with the Peoria Loess in this region has a 2 to 3 m thick solum, some fragic properties (slight to moderate brittleness) from 1 to 2 m depth, and an accumulation of Mn oxides along ped faces. Colors in the A and BA horizons are generally 10YR 4/2 and 7.5YR 3/4 - 4/4. Bt horizons are 7.5YR 4/4 - 5/4, with the 4/4 being the dominant color of clay films along ped faces. X-ray data from the Old River and Wittsburg quarry localities suggest that clay minerals in the Peoria are dominantly illite/smectite with a very a minor amount of kaolinite.

Generally the Peoria is calcareous to dolomitic. Hard round concretions from 1 to 25 mm in diameter am common in the basal 3-5 m of loess. Terrestrial gastropods are common in the basal third of sections thicker than 5 m. Depth of carbonate dissolution in relatively uneroded topographic positions varies from 3 to 9 m.

Magnetic susceptibility (MS) and other mineral magnetic parameters including isothermal remanent magnetization (IRM) and anhysteretic remanent magnetization (ARM), measured at six exposures in western Tennessee and eastern Arkansas, indicate systematic and widespread variations in the amount, gram size, and type of magnetic minerals in the four loess units. The following trends are present: a) MS generally increases with depth within each of the loess units; b) the contacts between loess units are generally marked by sharp reductions in MS; c) the highest MS in most exposures is found in the basal part of the Peoria Loess and the upper part of the Roxana Silt, d) whereas there appears to be no simple relations between the degree of soil development and MS, the percent of the MS that is dependent on the frequency of the applied field (% FD) closely follows trends in soil development; e) the percentage of MS removed after the citrate-bicarbonate-dithionite (CBD) treatment ranges from about 10 percent in unaltered Peoria Loess to about 60 percent in the Sangamon paleosol; f) the CBD treatment removes nearly all of the percentage FD of samples. **Finally,** preliminary paleomagnetic results indicate a normal polarity for the Crowley's Ridge Silt.

Data from studies on the ages of individual loesses and on the time represented by the inter-loess unconformities are preliminary. No data am available on the age of the Crowley's Ridge Silt. Preliminary Be-10 data suggest a residence time of about 16 years for the Cmwley's Ridge paleosol at the Wittsburg quarry locality. Published amino acid racemixation data and TL data from Wittsburg quarry indicate that the Loveland loess is >100,000 years old. Recent TL analyses suggest that the lower 3-5 m of Loveland loess at Wittsburg quarry are greater than 150,009 years old. TL data from Wittsburg quarry and C-14 data from Old River and Phillips Bayou suggest that the upper meter of Roxana Silt was deposited about 28,009 years ago and that the Farmdale paleosol dates from 29,000 to 25,000 years before present. TL and C-14 data for four localities (the Hombeak, Old River, Wittsburg quarry, and Phillips Bayou localities; fig. 1) suggest that deposition of the Peoria loess in the MMV began about 25,000 years ago and sustained a depositional rate of 1 m/1,000 years from 25,000 to 20,000 years ago. No age data are available for the upper part of the Peoria loess in the MMV.

We can interpret from the age data for the MMV: (1) loess was deposited during glacial and just-post-glacial climatic periods in the late Quatemary; (2) by adding the 100,000 year residence time for the Crowley's Ridge paleosol with the 150,000 year age of the Loveland loess the calculated age of the Crowley's Ridge loess is >250,000 old; and (3) the 150 ka TL age for the Loveland loess suggests that the associated Sangamon paleosol probably represents oxygen-isotope stage 5 (from about 80,000 to 132,000 years ago).

Some climatic interpretation of the data is possible. The accretionary characteristic of the Loveland loess/Crowley's Ridge Silt contact suggests that the initial rate of deposition of the Loveland loess was slower than the rate of pedogenic development. Present data suggest that the Sangamon(?) paleosol associated with the Loveland loess in the MMV is the most strongly developed of the paleosols. The color, structure, texture, chemistry, and mineralogy of the Sangamon paleosol suggest that the climate was warmer, but probably not wetter, that the present climate in the region. The presence of the unnamed paleosol in the basal part of the Roxana Silt, and by the Farmdale paleosol at the Peoria Loess/Roxana Silt boundary, indicates that short periods of nondeposition interrupted the major depositional episode. The gray to black colors, the lack of argillic horizon development (silt to silt loam texture), the massive structure, and the mineralogy of the <2 micron fraction of paleosols in the Roxana Silt suggest that a hiatus in loess deposition does not necessarily indicate a significant warming of the climate.

Using the C-14 ages of 21 to 25 ka for the basal Peoria loess in the MMV and a 10 ka age for the top of the Peoria Loess (published age data from Iowa, Nebraska, and Illinois and unpublished data from Indiana) indicate that loess deposition had ceased by 10 ka. If a constant rate of deposition is assumed, then the Peoria represents a 10,000 to 15,000 year interval during which loess was being deposited at a rate of 0.6 to 1.3 m/1,000 years. Since deposition was probably not constant, the maximum rate of deposition for short time periods (let's say 100 years) could easily have exceeded the maximum 0.13

Missouri and Illinois: terraces and terrace problems: Midwest Friends of the Pleistocene 38th Field Conference, May 10-12, 1991, Sponsored by Department of Geology, University of Illinois at Urbana-Champaign and Illinois State Geological Survey at Urbana, 105 p.

Markewich, H.W., *editor*, 1993. progress report on chronostratigraphic and paleoclimatic studies, Middle Mississippi River Valley, eastern Arkansas and western Tennessee: U.S. Geological Survey Open-File Report 93-273, 61 p.

Markewich, H.W., Millard, H.T., Jr., Pavich, M.J.. Rodbell, D.T., Rich, F.J., Rutledge, E.M., Ward, L., VanValkenburg, Steve., Wysocki, D. 1992, Chronostratigraphic and paleoclimatic data for Quatemary loessial and fluvial deposits in the Mississippi River valley of Arkansas and Tennessee: Geological Society of America Abstracts with programs, v. 24, no. 7, p. A50.

Mirecki, J., and Skinner, A., 1991, Aminostratigraphy and electron spin resonance dating of terrestrial mollusks from late Quaternary loesses of the central Mississippi Valley: Geological Society of America Abstracts with Programs, v. 23, no. 5, p. A408.

Pye, K. and Johnson, R, 1988, Stratigraphy, geochemistry, and thermoluminescence ages of Lower Mississippi valley loess: Earth Surface Processes and Landforms, v. 13. p. 103-124.

Ruhe, R.V., 1984, Loess-derived soils, Mississippi valley region: Soil Science Society of America Journal, v. 48, p. 859-867.

Rutledge, E.M., West, L.T., and Guccione, M.J.. 1985, Loesses of Crowleys Ridge and the Western Lowlands of Arkansas: Geological Society of America Abstracts with programs, v. 17, p. A189.

Rutledge, W.M., West L.T., and Omakupt, M., 1985, Loess deposits on a Pleistocene age terrace in eastern Arkansas: Soil Science Society of America Journal, v. 49, p. 1231-1238.

Rutledge, E.M., West, L.T., and Guccione, M.J., 1990, Loess deposits of northeast Arkansas in , Guccione, M.J., and Rutledge, E.M., *(eds.)*, Field guide to the Mississippi Alluvial Valley, northeast Arkansas and southeast Missouri: Friends of the Pleistocene, South-Central Cell, Geology Department, University of Arkansas, Fayetteville, Arkansas, p. 57-98.

West, **L.T.,** Rutledge, E.M.. and Barber, D.M., 1980, Sources and properties of loess deposits on Crowleys Ridge in Arkansas: Soil Science Society of America Journal, v. **44.,** no. 22, p. 353-358

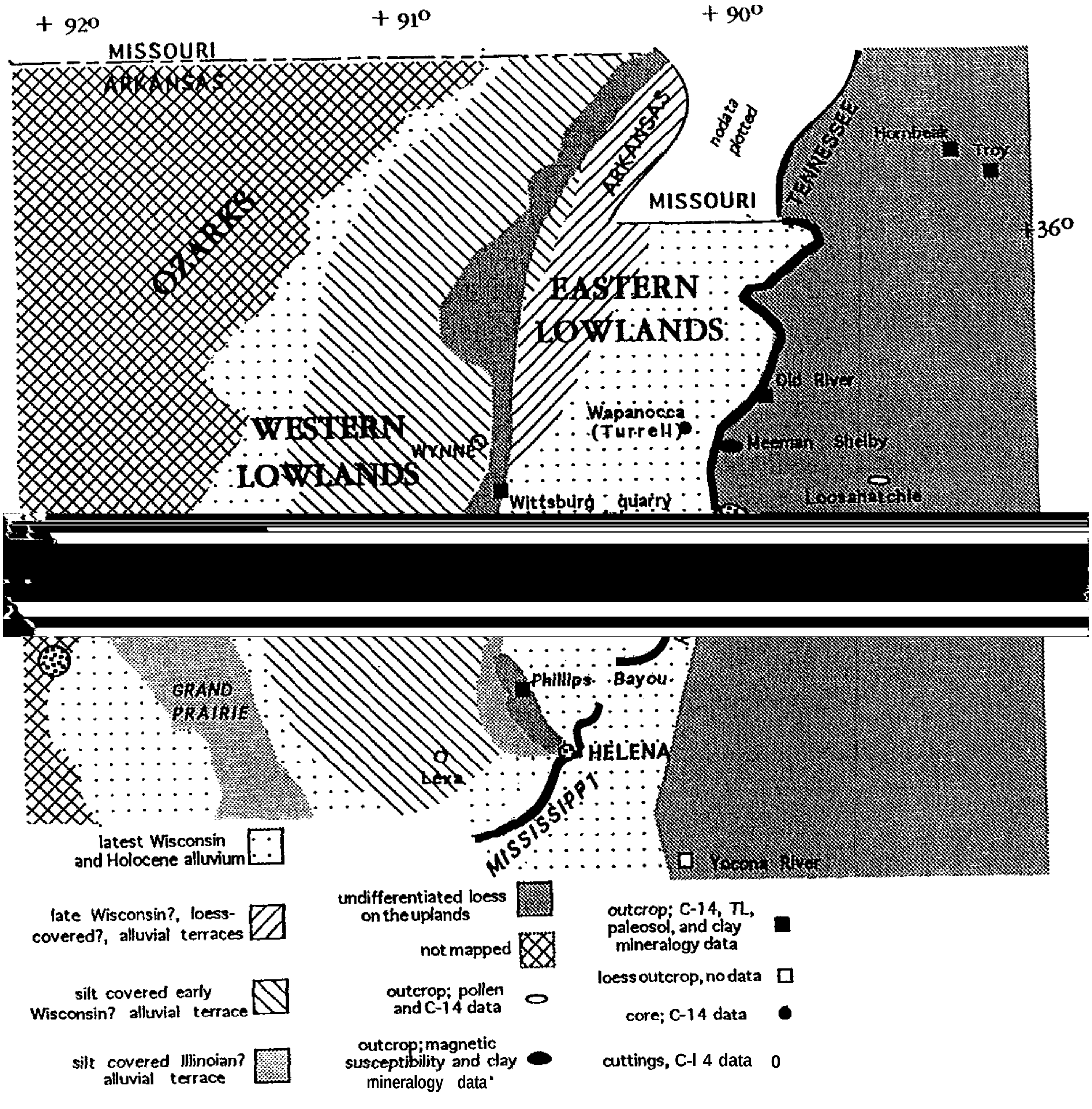
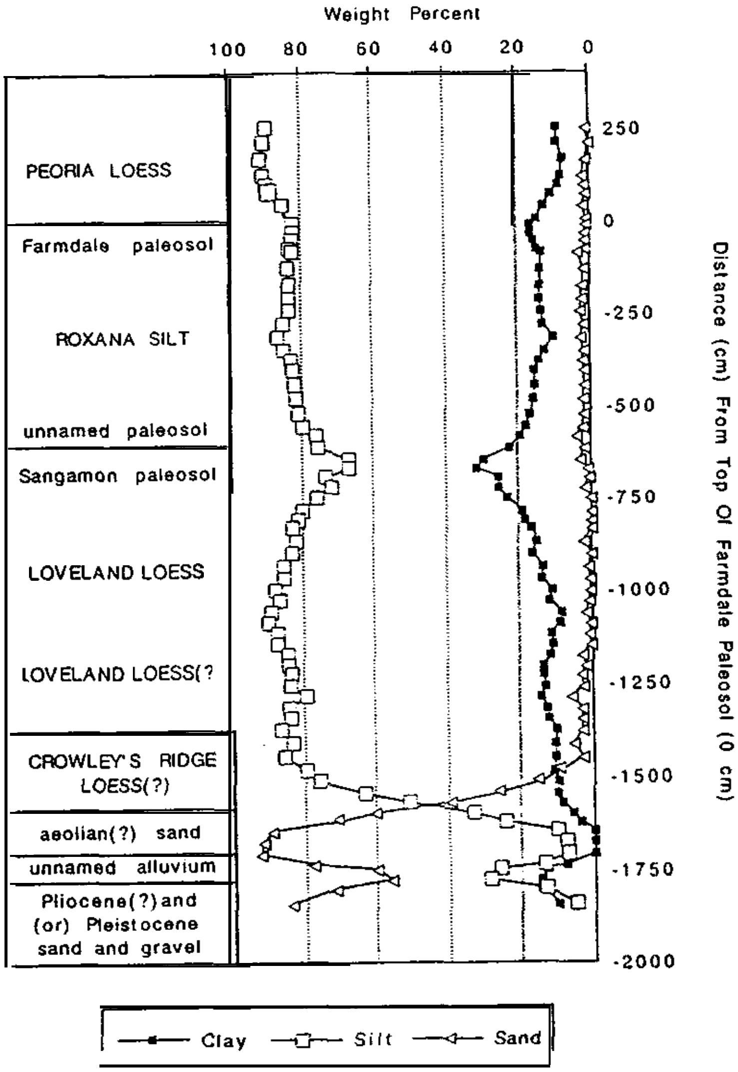
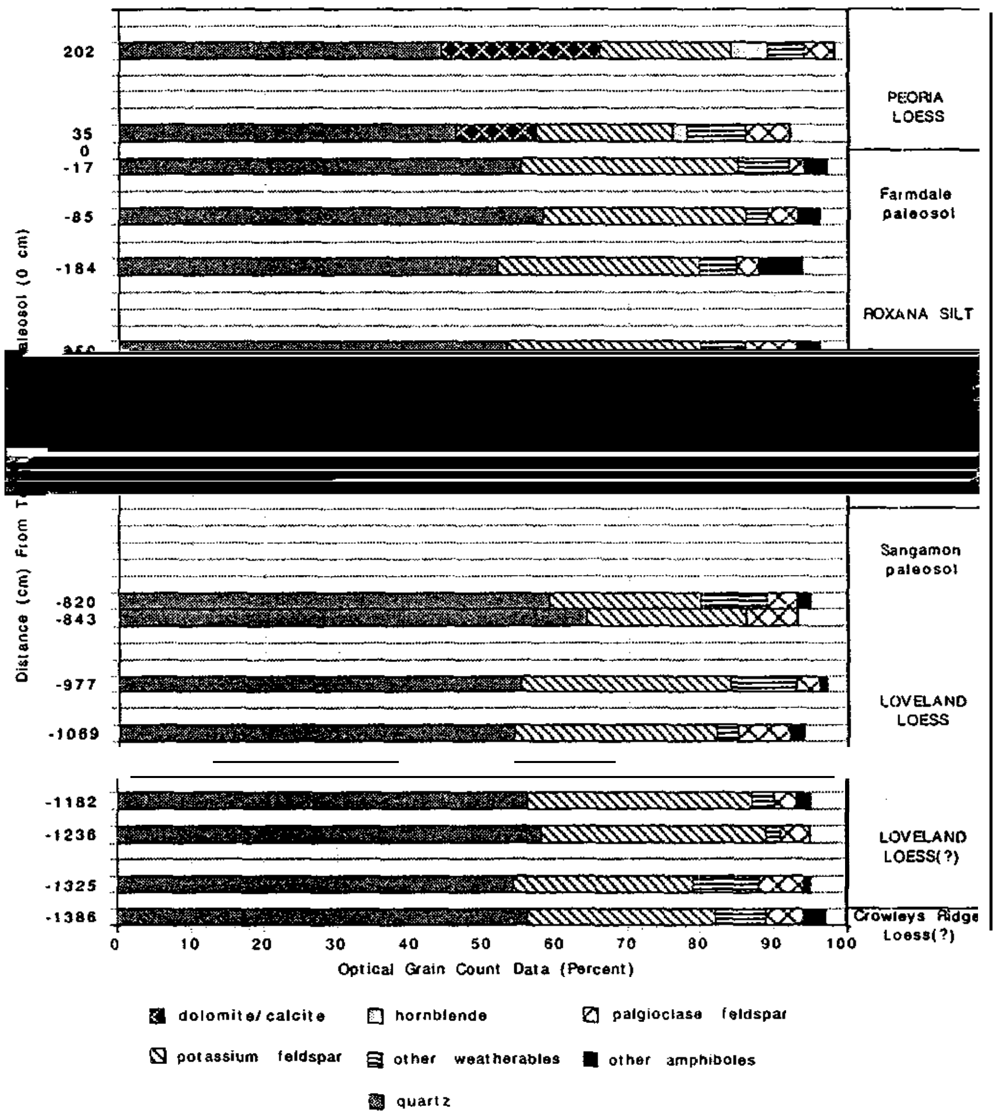


Figure 1. Schematic representation of geomorphic units in the study area.

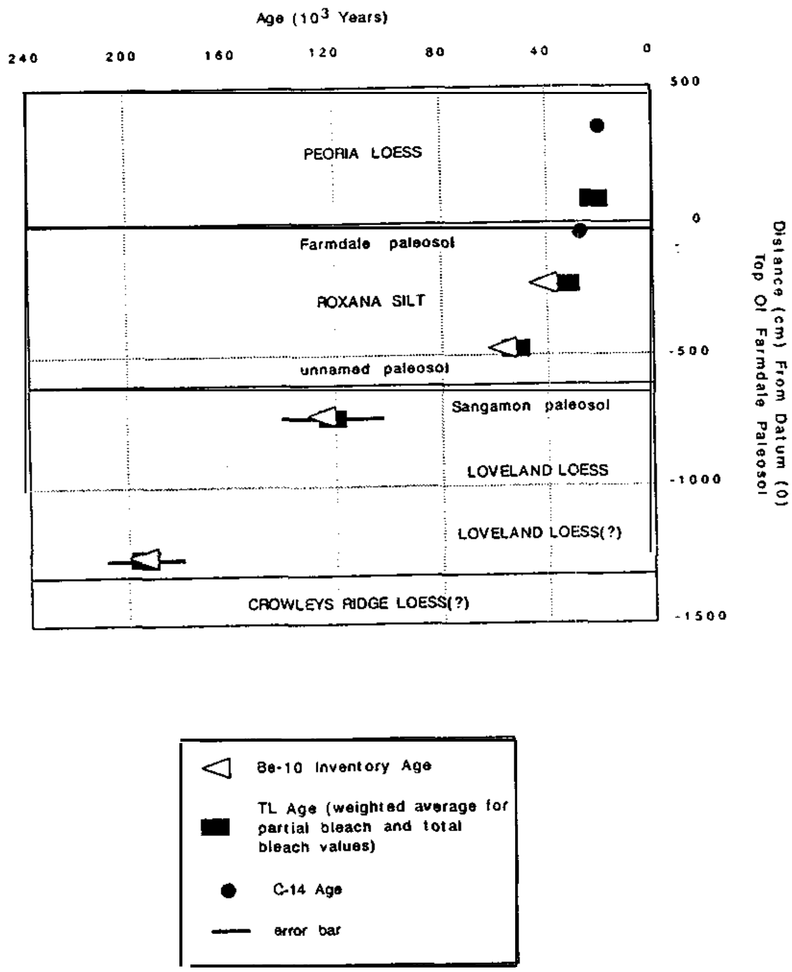
Selected Data From Phillips Bayou



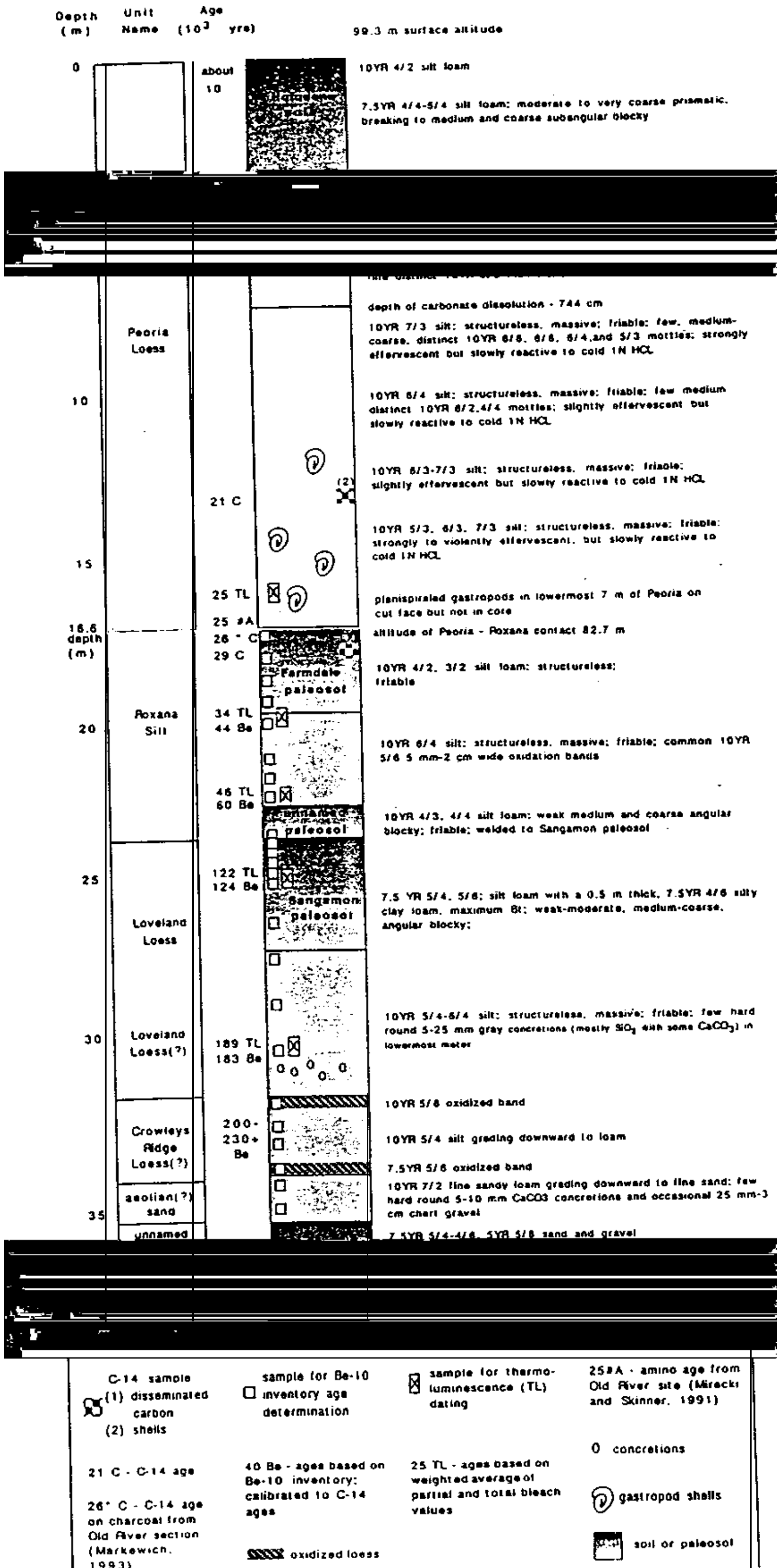
Particle size distribution data for Phillips Bayou quarry including basal portion of the Peoria Loess.



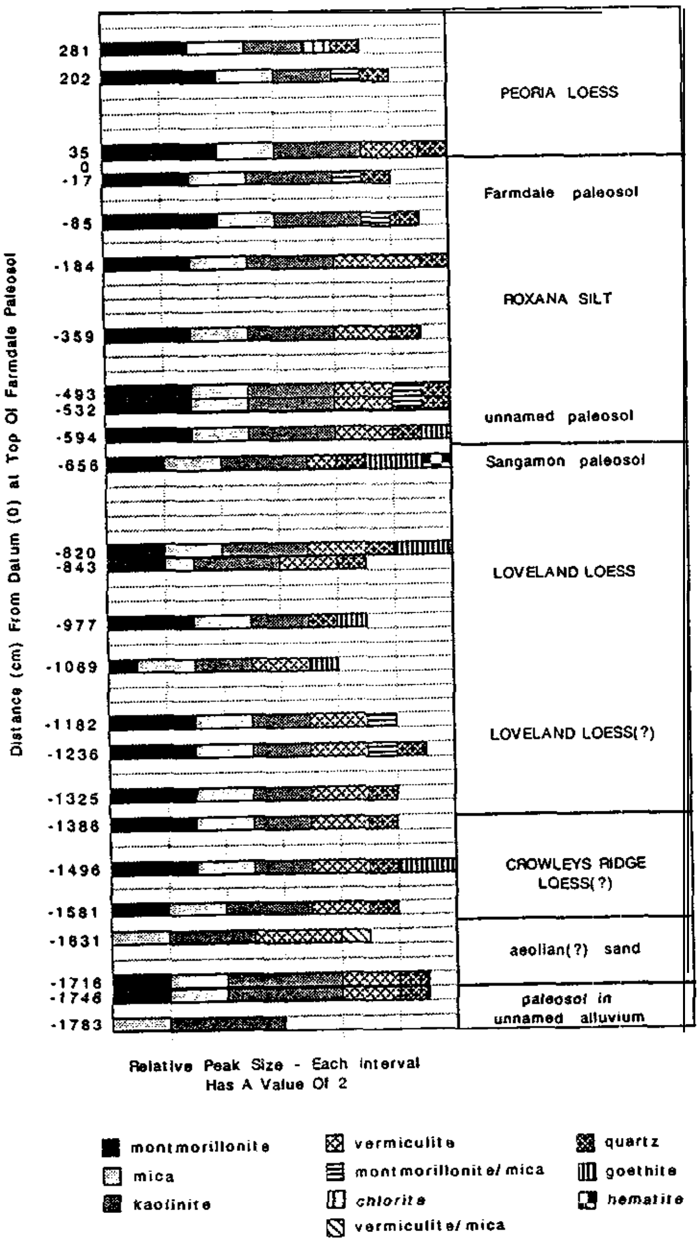
Optical mineralogy for coarse silt of selected horizons in quarry face at Phillips Bayou.



Age data vs. depth and stratigraphy in quarry face at Phillips Bayou.



Composite stratigraphic column for Phillips Bayou showing TL and isotopic ages.



Claymineralogy for selected horizons in quarry face at Phillips Bayou.

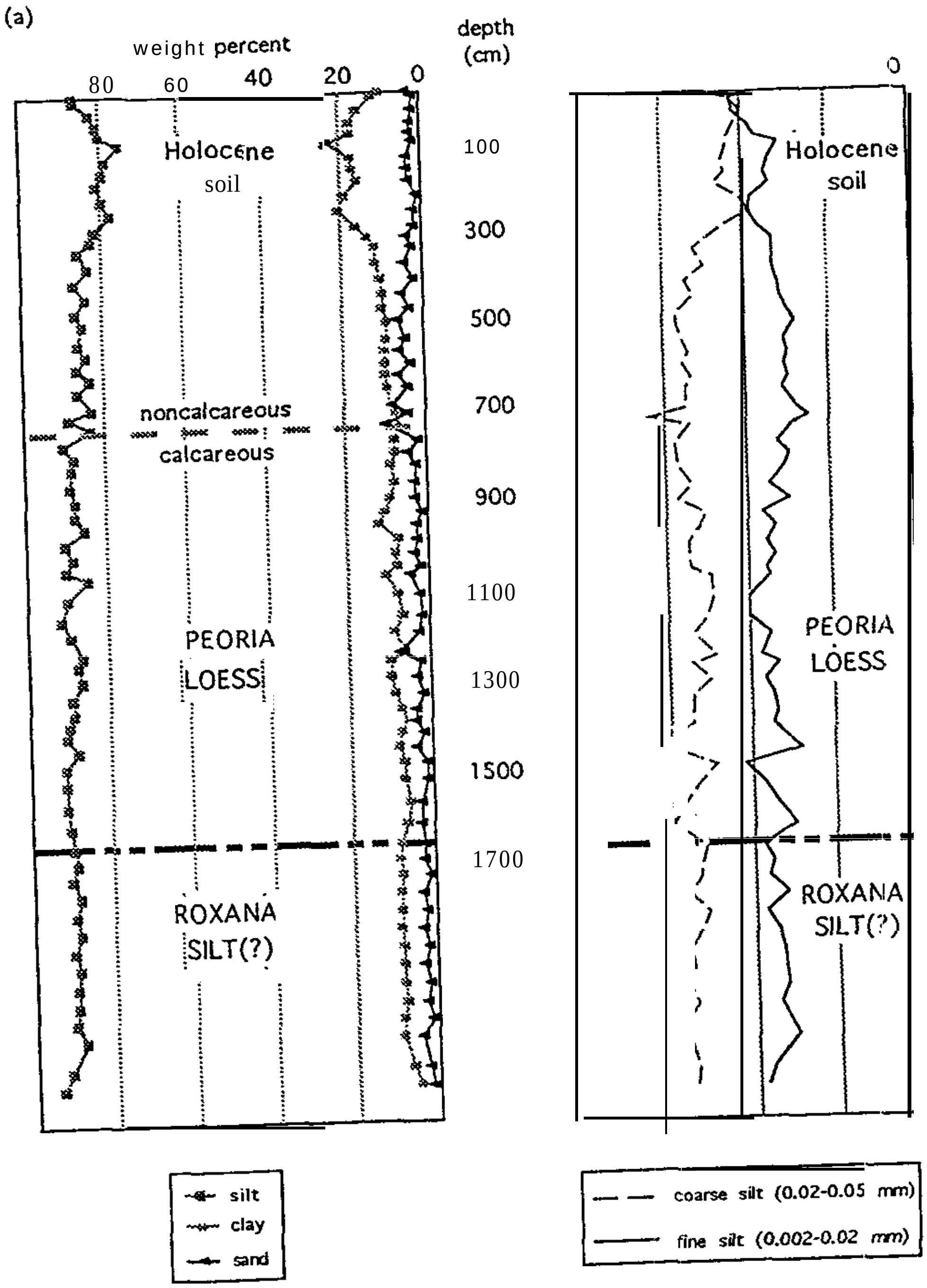

(a)
weight percent
80
60
40
20
0
depth (cm)
100
300
500
700
900
1100
1300
1500
1700
Holocene soil
noncalcareous
calcareous
PEORIA LOESS
ROXANA SILT(?)
silt
clay
sand
0
Holocene soil
PEORIA LOESS
ROXANA SILT(?)
coarse silt (0.02-0.05 mm)
fine silt (0.002-0.02 mm)

Table 1. Selected analytical data for loesses on south end of Crowleys Ridge, east-central Arkansas

Letter/number notation are codes used by the National Soil Survey Laboratory in Lincoln, NB for analytical procedures.

The reader is referred to Soil Survey Staff (1992) for complete descriptions of these methods.

Where data elements are blank, no analysis was run.

horiz. top (cm)	horiz. base (cm)	horiz. thk. (cm)	horiz. desig.	color	cly .002 pct of <2mm 3A1*	fcly .0002 pct of <2mm 3A1	CO3 cly .002 pct of <2mm 3A1	si .002-.05 pct of <2mm 3A1*	s .05-2.0 pct of <2mm 3A1*	fsi .002-.02 pct of <2mm 3A1*	csi .02-.05 pct of <2mm 3A1*	vfs .05-.10 pct of <2mm 3A1*	fs .1-.25 pct of <2mm 3A1*	ms .25-.5 pct of <2mm 3A1*	cs .5-1.0 pct of <2mm 3A1*	vcs 1.0-2.0 pct of <2mm 3A1*	dith-cit Fe pct <2mm 6C2b*	dith-cit Al pct <2mm 6G7a*	dith-cit Mn pct <2mm 6D2a*	NH4OAC extr. Ca meq/ 100g 5B5a 6N2e*	NH4OAC extr. Mg meq/ 100g 5B5a 6O2d*	NH4OAC extr. Na meq/ 100g 5B5a 6P2b*	NH4OAC extr. K meq/ 100g 5B5a 6Q2b*	NH4OAC extr. Sum Bases meq/ 100g	CEC [NH4OAC] meq/ 100g 5A8b	CO3 pct<2 mm 6E1g	Al2O3 pct <.002 mm 7C3*	Fe2O3 pct <.002 mm 7C3*	K2O pct <.002 mm 7C3*	orgn C pct 6A1c*	total C pct <2mm 6A2d*
Phillips Bayou cut-face																															
Peoria Loess																															
281	245	36	C	2.5Y6/4	6.3	3.5	0.6	91.5	2.2	41.3	50.2	0.6	0.1	0.3	0.5	0.7	0.6	0.1	0.1	31	12.6	0.1	0.2	43.8	8.1	17	15	11.4	1.4	0.08	2.12
245	202	43	C	2.5Y5/2	9.1		0.6	89.7	1.2	45	44.7	0.6	0.1	0.1	0.1	0.3	0.4	0.1	0.1	21	15.2	0	0.1	36.3	9.1	12.8				0.11	
202	159	43	C	2.5Y5/2	8.8	5.4	0.3	90.8	0.6	44	46.6	0.5	0.1	0.1	0.1	0	0.5	0.1	0.1	20.5	16.8	0	0.2	37.5	8.4	17.9	11	10.7	1.6	0.1	2.34
159	115	44	C	2.5Y5/2	7.4		0.6	91.2	1.4	43.5	47.7	1.2	0.1	0.1	0.1	0	0.4	0.1	0.1	21	17.9	0.4	0.1	39.4	7.8	21.5				0.09	
115	90	25	C	10YR6/3	7.7	5.9		90.3	2	42.9	47.4	1.6	0.1	0.1	0.1	0.1	0.5	0.1	0.1	20.4	17.1	0	0.1	37.6	7.9	20.2				0.07	2.57
90	65	25	C	10YR5/3	8.4			89.8	1.8	41.8	48	1.5	0.1	0.1	0.1	0.1	0.6	0.1	0.1	18.6	5.4	0	0.1	24.1	8.1	19				0.09	2.46
65	35	30	C	10YR5/3	10.6		0.6	88.3	1.1	41.3	47	0.9	0.1	0.1	0.1	0	0.7	0.1	0.1	19.6	16.4	0	0.1	36.1	9.4	14.3				0.13	1.91
35	0	35	C	10YR5/3	12.6	9.6		85.2	2.2	39.8	45.4	2	0.1	0.1	0.1	0	0.7	0.1	0.1	19.4	16.3	0.1	0.2	36	10.9	8.2	16	10.6	1.9	0.17	1.23
Roxana Silt																															
0	-17	17	2A1	10YR4/3	14.7	10		84	1.3	37.1	46.9	1.1	0.1	0.1	0.1	0	0.8	0.1	0	15.4	10.9	0.1	0.4	26.8	12.5	2.4				0.2	0.55
-17	-43	26	2A2	10YR4/2	16.5	11.6		82.3	1.2	36.2	46.1	1	0.1	0.1	0.1	0	0.8	0.1	0	11	5.6	0.2	0.5	17.3	14.6		17	10.3	1.5	0.33	0.39
-43	-62	19	2A3	10YR4/2	16.2	11.6		82.2	1.6	34.4	47.6	1.4	0.1	0.1	0.1	0	0.5	0.1	0	10.9	5.1	0.2	0.3	16.5	14.4					0.38	0.43
-62	-85	23	2A4	10YR3/2	15.4			82.8	1.8	35.3	47.5	1.6	0.1	0.1	0.1	0	0.5	0.1	0	10.8	4.6	0.1	0.4	15.9	13.9					0.41	0.47
-85	-96	11	2A5	10YR3/2	14.6	9.7		83.6	1.8	34.9	48.7	1.6	0.1	0.1	0.1	0.1	0.5	0.1	0	9.8	4.4	0.1	0.3	14.6	12.8		18	8.9	1.6	0.3	0.36
-96	-140	44	2BT1	10YR5/3	13.3	9		82.9	3.8	34.2	46.7	3.1	0.3	0.2	0.2	0	1.1	0.1	0	9.3	4.1	0.1	0.3	13.8	12					0.14	0.18
-140	-184	44	2BT1	10YR5/3	13.8	9.3		84	2.2	35	49	1.8	0.3	0.1	0.1	0	0.9	0.1	0	9.7	4.4	0.1	0.4	14.6	12.8	0				0.12	0.14
-184	-218	34	2BT2	10YR6/3	14	9.6		83.4	2.6	32.6	50.8	2.2	0.4	0.1	0	0	0.9	0.1	0	9.7	4.6	0.1	0.3	14.7	13.1		17	10.2	1.3	0.11	0.15
-218	-252	34	2BT2	10YR6/3	14			83.7	2.3	32.5	51.2	1.9	0.3	0.1	0.1	0.1	0.8	0.1	0	9.3	4.4	0.1	0.4	14.2	12.7	0				0.1	0.13
-252	-285	33	2BT2	10YR6/3	13.6	9.8		83.5	2.9	32.3	51.2	2.5	0.3	0.1	0.1	0	1	0.1	0	9	4.2	0.1	0.3	13.6	12.1					0.1	0.12
-285	-322	37	2BT3	10YR6/4	12.9			85	2.1	33.2	51.8	1.8	0.2	0.1	0.1	0.1	1	0.1	0	8.1	3.9	0.1	0.3	12.4	11.1					0.07	
-322	-359	37	2BT3	10YR6/4	10.4	6.8		86.6	3	34.2	52.4	2.2	0.6	0.2	0.1	0	0.9	0.1	0	7.6	3.6	0.1	0.2	11.5	9.9					0.07	
-359	-387	28	2BT4	10YR6/4	12.8			85.3	1.9	36.9	48.4	1.1	0.4	0.3	0.1	0	1.1	0.1	0	8.3	3.9	0.1	0.5	12.8	11		19	10.3	1.5	0.09	
-387	-415	26	2BT4	10YR6/4	14.2			83.3	2.5	35.5	47.8	1.8	0.3	0.3	0.1	0	0.9	0.1	0	8.4	4	0.1	0.3	12.8	11.4					0.08	
-415	-454	39	2BT5	7.5YR5/4	15.4			82.7	1.9	37.8	44.9	1.2	0.3	0.3	0.1	0.1	1.1	0.1	0	8.5	4.1	0.1	0.3	13	11.6					0.1	
-454	-493	39	2BT5	7.5YR5/4	15.6			82.3	2.1	37.6	44.7	1.4	0.3	0.3	0.1	0.1	1.1	0.1	0	8.6	4.2	0.1	0.3	13.2	11.4					0.12	
-493	-532	39	2BT5	7.5YR5/4	15.8			81.9	2.3	37	44.9	1.3	0.3	0.4	0.2	0.1	1.2	0.1	0	8.9	4.8	0.3	0.3	14.3	13.1		21	10.3	1.5	0.13	0.18
-532	-568	36	2BT	10YR4/3	16.8			81	2.2	35.1	45.9	1.8	0.2	0.1	0.1	0	1	0.1	0	8.8	4.6	0.1	0.3	13.8	12.5		21	9.9	1.5	0.16	
-568	-594	26	2AT	10YR4/3	17.8			79.8	2.4	35.2	44.6	1.5	0.3	0.3	0.2	0.1	1.3	0.1	0	9.2	4.8	0.1	0.3	14.4	12.6					0.17	
-594	-623	29	2ABT	10YR4/4	19.6			76.2	4.2	33.1	43.1	2.7	0.5	0.4	0.3	0.3	1.6	0.1	0	8.8	4.8	0.1	0.3	13.9	12.1		23	10.7	1.4	0.11	0.19
Loveland Loess																															
-623	-656	33	3BT1	7.5YR5/4	22.4			75.6	2	33.8	41.8	1.2	0.3	0.3	0.2	0.1	1.8	0.1	0.1	8.9	5	0.1	0.3	14.2	11.9					0.09	
-656	-680	24	3BT2	7.5YR4/6	28.7			67.2	3.1	31.9	35.3	1.1	0.8	0.7	0.4	0.1	2.1	0.2	0.6	11.4	6.8	0.1	0.2	18.5	16.2		26	11	1.2	0.09	0.14
-680	-703	23	3BT2	7.5YR4/6	31.7			67.1	1.2	33.2	33.9	0.8	0.2	0.2	0.1	0.1	2.6	0.2	0.1	11.1	7	0	0.2	18.3	12.2					0.09	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	2.1	0.2	0.1	10	6.7	0	0.3	17	15					0.06	
[illegible]																															
-843	-877	34	3BCT	10YR5/4	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					[illegible]	
-877	-911	34	3BCT	10YR5/4	15.3			82.1	2.8	40.3	41.8	2.3	0.2	0.1	0.1	0.1	1.4	0.1	0.1	7.2	5.7	0.1	0.2	13.2	11.8					0.03	
-911	-946	35	3BCT	10YR5/4	16.2			83.2	0.6	41.1	42.1	0.5	0.1	0.1	0	0	1.3	0.1	0.1	7.3	6.2	0.1	0.3	13.9	12.3					0.04	
-946	-977	31	3C1	10YR5/4	13.3			85.5	1.2	43.2	42.3	1	0.1	0.1	0	0	1.2	0.1	0.1	6.6	5.8	0.1	0.1	12.6	11.3					0.02	
-977	-1008	31	3C1	10YR5/4	13.8			85.5	0.7	45	40.5	0.6	0.1	0.1	0.1	0	1.1	0.1	0.1	6.7	6.1	0.1	0.3	13.2	11.8		26	11	1.3	0.04	0.02
-1008	-1039	31	3C1	10YR5/4	11			88.1	0.9	41.7	46.4	0.7	0.1	0.1	0	0	1.2	0.1	0.1	5.9	5.2	0.1	0.2	11.4	10.3					0.01	
-1039	-1069	30	3C1	10YR5/4	12			86.6	1.4	40.5	46.1	1.2	0.1	0.1	0.1	0	1.1	0.1	0.1	5.9	5.3	0.1	0.2	11.4	10.3					0.03	
-1069	-1099	30	3C2	10YR5/4	8.5			89.4	2.1	40.5	48.9	1.7	0.2	0.1	0.1	0	1.1	0.1	0.1	5.4	4.6	0.1	0.2	10.2	9		17	11.4	1.3	0.03	0.04
-1099	-1128	30	3C2	10YR5/4	9.1			90.2	0.7	48.3	41.9	0.6	0.1	0.1	0.1	0.1	1.1	0.1	0.1	5.5	4.6	0	0.1	10.2	9					0.01	
-1128	-1155	27	3C3	10YR6/4	11.3			87.4	1.3	45.2	42.2	1.2	0.1	0.1	0.1	0	0.6	0.1	0.1	6.3	5.4	0	0.2	11.9	10.9					0.02	

Table 1. ***Selected analytical data** for loesses on **south end** of **Crowleys** Ridge, **east-central** Arkansas*

Letter/number notation are codes used by the National Soil Survey Laboratory in Lincoln, NB for analytical procedures.

The reader is referred to Soil Survey Staff (1992) for complete descriptions of these methods.

Where data elements are blank, no analysis was run.

oriz. op cm)	horiz. base (cm)	horiz. thk. (cm)	horiz. desig.	color	cly .002 pct of <2mm 3A1*	fcly .0002 pct of <2mm 3A1	CO3 cly .002 pct of <2mm 3A1	si .002-.05 pct of <2mm 3A1*	s .05-2.0 pct of <2mm 3A1*	fsi .002-.02 pct of <2mm 3A1*	csi .02-.05 pct of <2mm 3A1*	vfs .05-.10 pct of <2mm 3A1*	fs .1-.25 pct of <2mm 3A1*	ms .25-.5 pct of <2mm 3A1*	cs .5-1.0 pct of <2mm 3A1*	vcs 1.0-2.0 pct of <2mm 3A1*	dith-cit Fe pct <2mm 6C2b*	dith-cit Al pct <2mm 6G7a*	dith-cit Mn pct <2mm 6D2a*	NH4OAC extr. Ca meq/ 100g 5B5a 6N2e*	NH4OAC extr. Mg meq/ 100g 5B5a 6O2d*	NH4OAC extr. Na meq/ 100g 5B5a 6P2b*	NH4OAC extr. K meq/ 100g 5B5a 6Q2b*	NH4OAC extr. Sum Bases meq/ 100g	CEC (NH4OAC) meq/ 100g 5A8b	CO3 pct<2 mm 6E1g	Al2O3 pct <.002 mm 7C3*	Fe2O3 pct <.002 mm 7C3*	K2O pct <.002 mm 7C3*	orgn C pct 6A1c*	total C pct <2mm 6A2d*
1155	-1182	27	3C3	10YR6/4	11.2			87.8	1	44.5	43.3	0.9	0.1	0.1	0.1	0	0.5	0.1	0.1	6.4	5.5	0.1	0.1	12.1	11.1					0.02	
1182	-1209	27	3C3	10YR6/4	11.9			84.7	3.4	35.1	49.6	2.9	0.3	0.1	0.1	0.1	0.4	0.1	0.1	6.4	5.5	0.2	0.3	12.4	11.3		19	9	1.4	0.02	0.03
1209	-1236	27	3C3	7.5YR6/3	13.4			84.4	2.2	35.9	48.5	1.7	0.3	0.1	0.1	0	0.5	0.1	0.1	6.7	5.7	0.2	0.4	13	11.5					0.04	
1236	-1266	30	3C4	7.5YR6/3	13.4			83.5	3.1	32.7	50.8	2.8	0.2	0.1	0.1	0	0.7	0.1	0.1	6.8	5.7	0.2	0.3	13	11.4		20	9.6	1.3	0.02	0.04
1266	-1295	29	3C4	7.5YR6/3	12.9			84.1	3	29.4	54.7	2.5	0.3	0.1	0.1	0				6.8	5.6	0.2	0.3	12.9	11.5					0.03	
1295	-1325	30	3C5	10YR6/4	14.3			79.6	6.1	29.7	49.9	5.6	0.3	0.1	0.1	0	0.5	0.1	0.1	7.4	6.1	0.2	0.3	14	12.5					0.03	
1325	-1355	30	3C5	10YR6/4	12.5			84.4	3.1	31	53.4	2.8	0.2	0.1	0.1	0	0.5	0.1	0.1	7.7	6.3	0.3	0.3	14.6	12.4		19	9.2	1.2	0.01	0.04
1355	-1386	31	3C5	10YR6/4	12.4			84.1	3.5	33.1	51	3.4	0.1	0.1	0.1	0.1	0.6	0.1	0.1	7.4	5.8	0.2	0.2	13.6	12.5					0.03	
rowleys Ridge Loess(?)																															
1386	-1423	37	4A	10YR6/4	10.1			86.8	3.1	33.4	53.4	2.7	0.2	0.1	0.1	0.1	0.9	0.1	0.1	6.7	6	0.3	0.1	13.1	10.6		16	11.3	1.5	0.02	0.04
1423	-1459	36	4A	10YR5/4	10.6			83.7	5.7	30.9	52.8	4.5	0.6	0.4	0.2	0.1	0.7	0.1	0.1	6.9	5.1	0.2	0.2	12.4	11.1					0.02	0.03
1459	-1496	37	4A	10YR5/4	10.6			85.9	3.5	31.8	54.1	2.2	0.8	0.4	0.1	0	0.7	0.1	0.1	7.2	5.4	0.2	0.2	13	11.1					0.03	
[illegible]																															
1525	-1554	29	4CT1	10YR5/4	9.7			76.2	14.1	27.6	48.6	2.7	7.1	3.8	0.4	0.1	0.8	0.1	0.1	6.7	4.9	0.2	0.2	12	10					0.02	
1554	-1581	27	4CT2	10YR5/3	9.8			63.7	26.5	24.6	39.1	2.9	13.9	8.9	0.8	0.1	0.8	0.1	0.1	6.2	4.5	0.2	0.3	11.2	9.3					0.04	
1581	-1607	26	4CT2	10YR5/3	8.6			51.3	40.1	21.4	29.9	3.1	23.7	12.6	0.7	0	0.6	0.1	0.1	5.2	3.6	0.2	0.2	9.2	7.6	0.1	17	9.3	1.3	0.04	
1607	-1631	24	5CT	10YR5/4	5.9			33.5	60.6	14.9	18.6	4.2	33.8	21.6	1	0.1	0.4	0.1	0	3.7	2.4	0.2	0.2	6.5	5.1					0.01	
1631	-1656	35	5CT	10YR5/4	3.6			24.5	71.9	10.8	13.7	4.1	44.2	22.6	1	0	0.3	0.1	0	2.9	1.8	0.2	0.1	5	3.7		14	7.6	1.1	0.03	
eolian(?) or alluvial sand																															
1656	-1686	30	6C	10YR7/2	0			10.3	89.7	4.6	5.7	4	51.7	32.5	1.5	0.1	0.1	0.1	0.1	1.5	0.5	0.1	0.1	2.1	1.3					0.01	
1686	-1716	30	6C	10YR7/2	0			7.9	92.1	3.3	4.6	4.7	56.2	29.7	1.5	0	0.1	0.1	0.1	1.4	0.5	0.1	0	1.9	1		3.9	3.3	0.3	0	
1716	-1746	30	6C	10YR7/2	0			7.3	92.7	3	4.3	6.8	54.7	29.9	1.3	0.1	0.1	0.1	0.1	1.4	0.5	0.1	0.1	2	1.2					0.02	
nnamed alluvium																															
1746	-1756	10	6BT	7.5YR5/4	7.8	3.9		13.9	78.3	5.8	8.1	5.7	46.9	24.3	1.1	0.3	0.5	0.1	0.1	3.4	1.7	0.4	0.1	5.6	4		21	7.1	1.1	0.02	0.04
1756	-1783	27	7BT1	7.5YR4/6	13.1			26.3	60.6	9.5	16.8	3.9	36.4	19.2	0.8	0.3	1	0.1	0.1	4.6	2.8	0.1	0.2	7.6	6.1					0.03	
1783	-1810	27	7BT1	7.5YR4/6	14.5	10.5		28.9	56.6	10.2	18.7	3.9	27.7	21.4	2.4	1.2	1.7	0.1	0.1	5.2	3	0.1	0.2	8.5	7.2		23	9.4	0.7	0.03	
[illegible]																															
elena No. 2 core, upslope from cut-face in Phillips Bayou quarry																															
eoria Loess																															
0	10	10	A	10YR4/2	10			66.6	3.4	38.7	47.9	1.9	0.5	0.6	0.3	0.1	0.6	0.1	0.1	6.9	2.1	0.1	0.1	9.1	11					2.33	2.53
10	40	30	AB	7.5YR3/4	11.8	6.2		86.3	1.9	43	43.3	1	0.4	0.4	0.1	0.1	0.7	0.1	0.1	1.7	1.1	0	0.1	2.8	6.3		17	7	1.1	0.47	0.47
40	67	27	BA	7.5YR4/4	15.6			82.5	1.9	42.2	40.3	1	0.4	0.4	0.1	0.1	0.9	0.1	0.1	2.3	1.5	0	0.1	3.9	7.3					0.18	0.25
67	92	25	BW2	7.5YR5/4	17.2			80.7	2.1	38.6	42.1	1.1	0.5	0.4	0.1	0	1.1	0.1	0.1	2.8	1.8	0	0	4.6	9					0.11	0.14
92	110	18	E/B	10YR7/2	17.3	9.7		80.2	2.5	36.8	43.4	1.3	0.5	0.5	0.2	0	1.2	0.1	0.1	2.8	2.3	0.2	0.3	5.6	10.8		19	10.9	1.6	0.11	0.11
110	148	38	BT1	7.5YR4/4	22.8			75.4	1.8	31.5	43.9	1.3	0.2	0.2	0.1	0	1.6	0.1	0.1	4.9	4.4	0.8	0.3	10.4	16.1					0.09	0.13
148	175	27	BT1	7.5YR4/4	17.3			79.1	3.6	34	45.1	3.2	0.2	0.2	0.1	0.1	1.5	0.1	0.1	5.8	4.4	1.2	0.3	11.7	14.8					0.07	0.09
175	200	25	BT2	7.5YR5/4	17	10.1		79.6	3.4	34.9	44.7	2.7	0.2	0.2	0.2	0.1	1.4	0.1	0.1	6.7	4.4	1.7	0.2	13	15.2		18	12.2	1.3	0.07	0.01
200	233	33	BT3	7.5YR5/4	15.7			81.2	3.1	34	47.2	2.8	0.1	0.1	0.1	0.1	1.5	0.1	0.1	6.7	4.1	1.8	0.2	12.8	14					0.07	
233	266	33	BT3	7.5YR5/4	19.3			79.5	1.2	38.5	41	0.8	0.2	0.1	0.1	0.1	1.5	0.1	0.1	8	4.6	2.2	0.2	15	15.4					0.08	
266	300	34	BT3	7.5YR5/4	20.4			77.6	2	38.9	38.7	1.6	0.2	0.2	0.1	0.1	1.5	0.1	0.1	8.6	4.8	2.6	0.3	16.3	16.1					0.08	
300	325	25	BC1	7.5YR4/4	16.3	9.8		81.8	1.9	36.3	45.5	1.6	0.2	0.1	0.1	0.1	1.6	0.1	0.1	8.1	4.3	2.6	0.2	15.2	14.5					0.08	
325	349	24	BC1	7.5YR4/4	13.4			82.8	3.8	33.4	49.4	3.6	0.1	0.1	0.1	0	1.5	0.1	0.1	7.5	3.8	2.5	0.2	14	13.1					0.08	
349	385	36	BC2	7.5YR5/4	11.5			85.7	2.8	33.1	52.6	2.6	0.2	0.1	0.1	0.1	1.4	0.1	0.1	7.1	3.9	2.7	0.3	14	11.9		13	12.2	1.3	0.06	0.09
385	421	36	BC2	7.5YR5/4	11.7			83.6	4.7	33.4	50.2	4.4	0.2	0.1	0.1	0.1				7.3	3.5	2.3	0.1	13.1	11.8					0.07	
421	455	34	C1	10YR7/2	10.6	5.7		87	2.4	32.3	54.7	2.1	0.2	0.1	0.1	0	1.5	0.1	0.1	6.9	3.5	2.5	0.2	13.1	11.5		11	12.2	1.1	0.07	0.1
455	489	34	C1	10YR7/2	10.2			84.5	5.3	31.7	52.8	4.8	0.3	0.1	0.1	0	1.7	0.1	0.1	7	3.5	2.4	0.1	13	11.9					0.07	

Table 1. Selected analytical data for loesses on south end of Crowleys Ridge, east-central Arkansas

Letter/number notation are codes used by the National Soil Survey Laboratory in Lincoln, NB for analytical procedures.

The reader is referred to Soil Survey Staff (1992) for complete descriptions of these methods.

Where data elements are blank, no analysis was run.

horiz. top (cm)	horiz. base (cm)	horiz. thk. (cm)	horiz. desig.	color	cly .002 pct of <2mm 3A1*	fcly .0002 pct of <2mm 3A1	CO3 cly .002 pct of <2mm 3A1	si .002-.05 pct of <2mm 3A1*	s .05-2.0 pct of <2mm 3A1*	fsi .002-.02 pct of <2mm 3A1*	csi .02-.05 pct of <2mm 3A1*	vfs .05-.10 pct of <2mm 3A1*	fs .1-.25 pct of <2mm 3A1*	ms .25-.5 pct of <2mm 3A1*	cs .5-1.0 pct of <2mm 3A1*	vcs 1.0-2.0 pct of <2mm 3A1*	dith-cit Fe pct <2mm 6C2b*	dith-cit Al pct <2mm 6G7a*	dith-cit Mn pct <2mm 6D2a*	NH4OAC extr. Ca meq/100g 5B5a 6N2e*	NH4OAC extr. Mg meq/100g 5B5a 6O2d*	NH4OAC extr. Na meq/100g 5B5a 6P2b*	NH4OAC extr. K meq/100g 5B5a 6Q2b*	NH4OAC extr. Sum Bases meq/100g	CEC (NH4OAC) meq/100g 5A8b	CO3 pct<2 mm 6E1g	Al2O3 pct <.002 mm 7C3*	Fe2O3 pct <.002 mm 7C3*	K2O pct <.002 mm 7C3*	orgn C pct 6A1c*	total pct <2m 6A2
489	513	24	C2	10YR4/3	9.9			86.6	3.5	30	56.6	2.9	0.4	0.2	0.1	0	1.5	0.1	0.1	7.2	3.6	2.4	0.1	13.3	12.1					0.06	
513	555	42	C3	10YR5/2	8.9			85.1	6	28.1	57	5.5	0.4	0.1	0.1	0	1.4	0.1	0.1	7.1	3.6	2.2	0.2	13.1	11.6					0.05	
555	582	27	C4	2.5Y5/2	9.1			86.3	4.6	30.8	55.5	3.9	0.5	0.1	0.1	0.1	0.8	0.1	0.1	7	3.6	1.9	0.1	12.6	11.3					0.06	
582	609	27	C4	2.5Y5/2	9.6			84.3	6.1	30	54.3	5.1	0.7	0.2	0.1	0.1	0.8	0.1	0.1	6.9	3.6	1.9	0.2	12.6	11.8					0.07	
609	636	27	C4	2.5Y5/2	9.8	7.2		86.7	3.5	31	55.7	3	0.4	0.1	0.1	0	0.6	0.1	0.1	7	3.8	1.9	0.2	12.9	11.6		12	9.7	1.5	0.06	0.[illegible]
636	663	27	C4	2.5YS/2	9.6			83.7	6.7	30.1	53.6	5.9	0.5	0.1	0.1	0.1	1	0.1	0.1	7.3	4	1.8	0.1	13.2	11.5					0.07	
[redacted]																															
834	874	40	C11	10YR6/2	8.9			88.4	2.7	31.1	57.3	2.6	0.1	0.1	0.1	0.1	0.4	0.1	0.1	18.2	15.5	1.4	0.2	35.3	10.2	9.3				0.05	
874	908	34	C12	10YR6/4	8.2			88.9	2.9	34.9	54	2.4	0.4	0.1	0.1	0	0.8	0.1	0.1	19.1	17.1	1.2	0.1	37.5	10	12.1				0.05	
908	942	34	C12	10YR6/4	9.2	6.5		87.7	3.1	30.3	57.4	2.9	0.2	0.1	0.1	0	0.7	0.1	0.1	18	16	1	0.4	35.4	11.4	6.9				0.04	
942	969	27	C13	10YR6/3	10.6			87.9	1.5	36.9	51	1.2	0.2	0.1	0.1	0	0.6	0.1	0.1	18.4	16.6	1	0.4	36.4	12.4	6				0.04	
969	1001	32	C14	10YR6/4	11.9			85.6	2.5	33.6	52	2.4	0.1	0.1	0.1	0.1	1	0.1	0.1	16.8	14.6	1.4	0.4	33.2	13.3	3.8				0.04	
1001	1033	32	C14	10YR6/4	6.8			90.5	2.7	35.7	54.8	2.1	0.4	0.2	0.1	0.1	1.5	0.1	0.2	18.8	17.1	0.8	0.3	37	8	12.1				0.06	
1033	1060	27	C15	10YR6/2	8	6		88.6	3.4	33.9	54.7	3.1	0.2	0.1	0.1	0	0.6	0.1	0.1	18.7	17.1	0.7	0.3	36.8	9.5	9.7				0.03	
1060	1079	19	C16	10YR6/4	7.6			90.5	1.9	36	54.5	1.5	0.3	0.1	0.1	0	1.1	0.1	0.1	20.5	19	0.9	0.3	40.7	8.7	13.5				0.05	
1079	1124	45	C17	10YR6/3	10.5			85	4.5	35.4	49.6	4	0.3	0.1	0.1	0	0.7	0.1	0.1	18.6	17.4	0.9	0.4	37.3	11.5	8.1				0.04	
1124	1172	48	C18	10YR6/3	7.8			90	2.2	40.6	49.4	1.8	0.3	0.1	0.1	0	1	0.1	0.1	21	19.5	0.8	0.3	41.6	9.6	12.4				0.05	
1172	1210	38	C19	10YR7/3	6.7			91.5	1.8	40.5	51	1.7	0.1	0.1	0.1	0	0.7	0.1	0.1	20.4	19	0.8	0.3	40.5	8.3	16				0.04	
1210	1256	46	C20	10YR6/3	8.3	5.5		89.2	2.5	35.3	53.9	2.4	0.1	0.1	0.1	0	0.6	0	0.1	20.2	18.9	0.8	0.4	40.3	9.4	11.2				0.04	
1256	1276	20	C21	10YR7/3	6			86.5	7.5	37.8	48.7	7.1	0.3	0.1	0.1	0.1	1.2	0.1	0.1	20.2	19.1	0.6	0.2	40.1	7.6	16.2				0.03	
1276	1311	35	C22	10YR6/3	9.7			88	2.3	33.5	54.5	2	0.2	0.1	0.1	0	1.2	0.1	0.1	20.8	19.3	0.6	0.3	41	8.6	16.1				0.05	
1311	1347	36	C23	10YR6/4	9.7			87	3.3	37	50	3.1	0.2	0.1	0.1	0	0.4	0.1	0.1	21	19.6	0.6	0.3	41.5	8.6	16.6				0.04	
1347	1383	36	C23	10YR6/4	8.7			89.4	1.9	34.9	54.5	1.7	0.2	0.1	0.1	0	0.7	0.1	0.1	19.7	18.5	0.6	0.2	39	8.3	14.1				0.04	
1383	1408	25	C24	10YR5/8	7.3	3.7		88.9	3.8	34.1	54.8	3.2	0.5	0.1	0.1	0	2.2	0.1	0.1	26.5	17.5	0.6	0.2	44.8	5.8	23.5				0.06	
1408	1434	26	C24	10YR5/8	6			90.1	3.9	35.4	54.7	3.4	0.3	0.1	0.1	0.1	1.5	0.1	0.1	40.1	13.3	0.5	0.1	54	5.1	27.8				0.07	
1434	1467	33	C25	10YR6/3	7.3			90.8	1.9	32.6	58.2	1.8	0.1	0.1	0.1	0.1	0.4	0.1	0.1	26.6	15.5	0.5	0.2	42.5	6.8	19.2				0.05	
1467	1501	34	C25	10YR6/3	7.9	4.5		88.1	4	28.5	59.6	3.6	0.3	0.1	0.1	0.1	0.5	0.1	0.1	19.6	18	0.4	0.2	38.2	8	14				0.05	
1501	1540	39	C26	10YR6/4	7.1	4		91.3	1.6	42	49.3	1.3	0.2	0.1	0	0.1	0.7	0.1	0.1	32.3	15.2	0.5	0.3	48.3	6.7	20.1				0.07	
1540	1589	49	C27	10YR6/3	7.1	4.2		91.2	1.7	37.7	53.5	1.4	0.2	0	0.1	0	0.5	0.1	0.1	27.8	14.4	0.6	0.3	43.1	6.7	18.6				0.05	
1589	1635	46	C28	10YR6/3	5.7			91.4	2.9	34.3	57.1	2.1	0.3	0.2	0.2	0.1	1	0.1	0.1	42.8	10.2	0.2	0	53.3	4.8	26.8				0.06	
1635	1682	47	C28	10YR6/3	6.4	3.4		90.4	3.2	30.2	60.2	2.8	0.2	0.1	0.1	0.1	0.8	0.1	0.1	39.3	10.8	0.3	0.1	50.4	6	22.8				0.07	
1682	1717	35	C28	2.5Y6/4	8.2	4.5		89.6	2.2	37.7	51.9	1.8	0.3	0.1	0.1	0.1	0.5	0.1	0.1	25.6	15.5	0.2	0.2	41.5	8.1	15.2				0.08	
1717	1752	35	C28	2.5Y6/4	8.4	4.5		89	2.6	35.9	53.1	2.4	0.2	0.1	0.1	0.1	0.5	0.1	0.1	19.4	13.9	0.2	0.1	33.6	8.3	14.6				0.05	
1752	1792	40	C30	2.5Y5/4	8.2	4.4		90.5	1.3	36.9	53.6	1.2	0.1	0.1	0.1	0	0.8	0.1	0.1	21.9	15.8	0.2	0.1	38	8	14.6				7	
1792	1832	40	C30	2.5Y5/4	8.3			88.7	3	32.4	56.3	2.5	0.3	0.1	0.1	0.1	0.5	0.1	0.1	22.4	16.2	0.2	0.2	39	7.5	15.5				0.07	
1832	1872	40	C30	2.5Y5/4	8.3			89.6	2.1	37.8	51.8	1.6	0.4	0.1	0.1	0.1	0.5	0.1	0.1	21.7	17.2	0.3	0.1	39.3	7.5	16.1				0.07	
1872	1912	40	C30	2.5Y5/4	8.4			88.4	3.2	34.6	53.8	2.9	0.2	0.1	0.1	0.1	0.6	0.1	0.1	21	16.1	0.2	0.1	37.4	7.4	15.6				0.09	
1912	1951	39	C30	2.5Y5/4	7.9	4.5		90.1	2	33.7	56.4	1.8	0.1	0.1	0.1	0.1	0.7	0	0.1	20.6	16	0.2	0.2	37	7.2	15.6				0.09	
1951	1993	42	C30	2.5Y5/4	8.2			88.8	3	33.3	55.5	2.6	0.2	0.1	0.1	0	0.6	0.1	0.1	21.9	15.8	0.2	0.1	38	6.9	16				0.11	
1993	2035	42	C31	5Y5/2	8.1	4.7		89.9	2	32.7	57.2	1.6	0.3	0.1	0.1	0.1	0.5	0.1	0.1	18	13.6	0.3	0.2	32.1	6.7	17				0.15	
2035	2073	38	C32	2.5Y6/4	7.7			89.7	2.6	34.8	54.9	2.4	0.1	0.1	0.1	0	0.6	0.1	0.1	26.8	12.8	0.4	0.1	40.1	6.7	17.4				0.08	
2073	2111	38	C32	2.5Y6/4	8.4	4.3		90.2	1.4	32.4	57.8	1.3	0.1	0.1	0.1	0	0.6	0.1	0.1	16.8	12.7	0.3	0.2	30	6.8	16.8				0.1	
2111	2180	69	C33	5GY5/1	8.3	3.9		87.9	3.8	30.7	57.2	3.6	0.1	0.1	0.1	0	0.6	0	0.1	14.2	10.2	0.3	0.2	24.9	6.2	16.7				0.19	
2180	2219	39	C34	5BG4/1	6.3	4.3		91.5	2.2	36.5	55	1.7	0.3	0.1	0.1	0	0.3	0	0.1	13.8	10.8	0.4	0.2	25.2	5.7	16.6				0.24	
2219	2257	38	C39	5BG4/1	4.5	3.7		93.8	1.7	38.3	55.5	1.4	0.2	0.1	0.1	0	0.6	0.1	0.1	22.1	8.3	0.3	0.1	30.8	5.3	19				0.21	

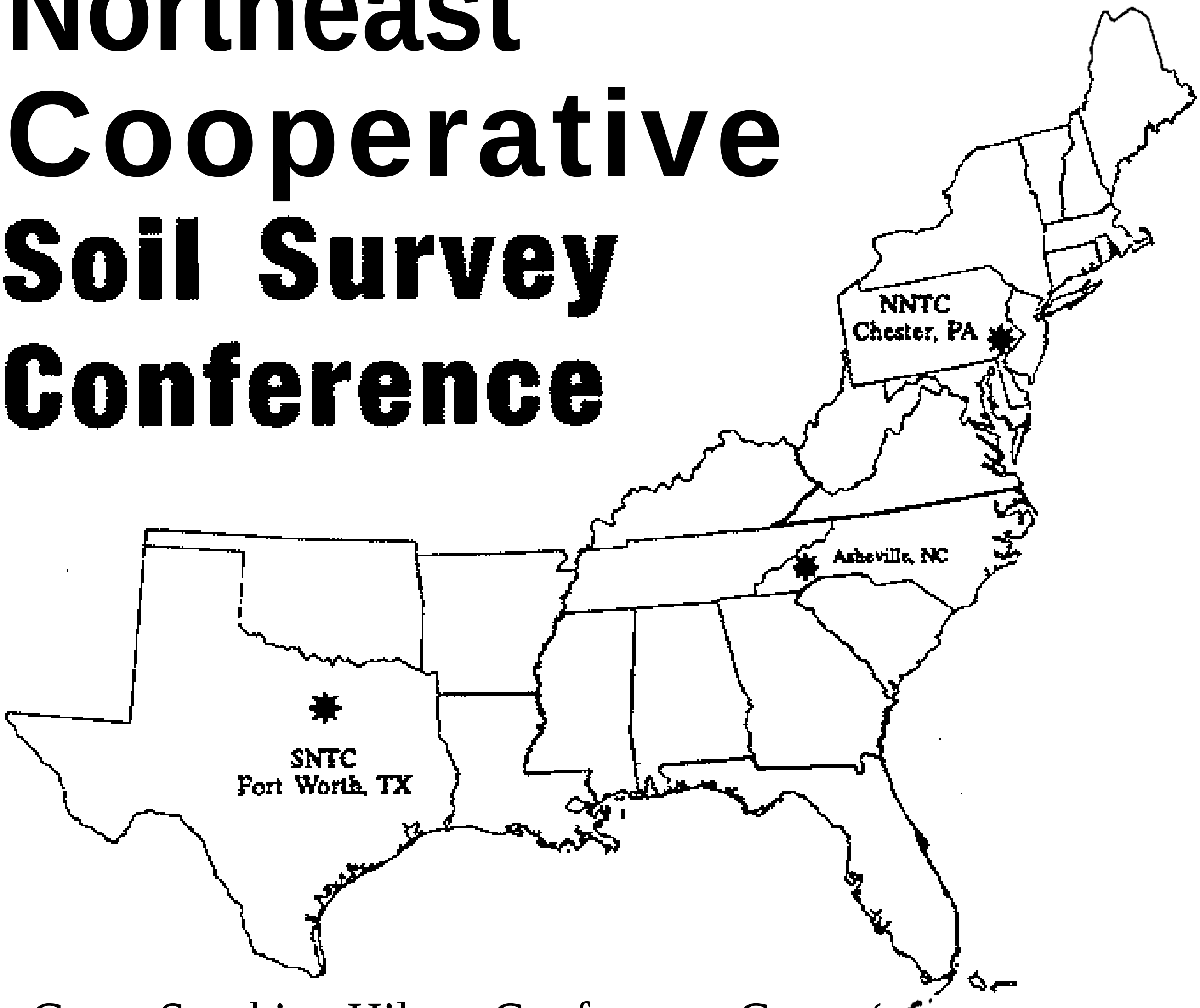
NATIONAL COOPERATIVE SOIL SURVEY

South and Northeast Regional Conference Proceedings

Asheville, North Carolina
June 14-19, 1992

Proceedings Of The Joint Session Of The

South And Northeast Cooperative Soil Survey Conference



Great Smokies Hilton Conference Center
Asheville, North Carolina

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OF THE

SOUTH

AND

NORTHEAST

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Sponsored by

National Cooperative Soil Survey - South
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Assembled by

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SOUTH-NORTHEAST COOPERATIVE SOIL SURVEY CONFERENCE
GREAT SMOKIES HILTON CONFERENCE CENTER
ASHEVILLE, NORTH CAROLINA
JUNE 14-19, 1992

AGENDA

SUNDAY AFTERNOON, JUNE 14

O'Henry Suite, Room 167

3:00-6:00	Registration and Mixer	

MONDAY MORNING. JUNE 15

O'Henry Suite, Room 767

8:00-12:00	Registration	
	Mt. Mitchell Room	Horace Smith, Moderator
9:00-9:10	Introductions and Announcements --------	Horace Smith State Soil Scientist SCS, Raleigh, NC
9:10-9:35	Welcome/Overview of North Carolina's Soil and Water Conservation Program ------------------------	Bobbye J. Jones State Conservationist SCS, Raleigh, NC
9:35-9:45	Purpose and Objectives -----------------------	Joe D. Nichols Head, Soil Interp. Staff SNTC, Ft. Worth, TX
9:45-10:40	Opening Remarks------------------------------------	William W. Cobey, Jr. Secretary NCDEHNR, Raleigh, NC Everett R. Emino Adm. Advisor, SRSSWG University of Florida, Gainesville, FL Eugene J. Kamprath Head, Dept. of Agronomy NCSU, Raleigh, NC Bjorn Dahl Forest Supervisor USDA-FS, Asheville, NC

10:40-11:10	Break	
11:10-11:40	Regional Perspectives	
	Northeastern States	Arthur B. Holland, Director NNTC. Chaster, PA
	Southern States	Paul F. Larson, Director SNTC, Ft. Worth, TX
11:40-12:00	National Cooperative Soil Survey--A National Perspective	Richard W. Arnold, Director Soil Survey Division SCS, Washington, DC
12:00-1:00 p.m.	Lunch	

<u>MONDAY AFTERNOON, JUNE 15</u> MI. *Mitchell Room* John C. Sencindiver. Moderator

1:00-1:20	Soil Resource Inventory Program--USDA Forest Service	Randy Moore Soil Scientist USFS, Washington, DC
1:20-1:40	Report from the 1890 Universities	Burleigh C. Webb Dean, NC A&T SU Greensboro, NC
1:40-2:00	Report from the National Society of Consulting Soil Scientists	Dennis J. Osborne Past President, NSCSS Washington, DC
2:00-2:20	Report from the National Soil Survey Center	C. Stephen Holzhey Director, NSSC Lincoln, NE
2:20-2:40	Break	
2:40-3:00	USDA/SCS Global Climate Change Activities	John M. Kimble Research Soil Scientist NSSL, Lincoln, NE
3:00-3:20	Soil Correlation Issues	Berman D. Hudson Sup. Soil Scientist NSSC, Lincoln, NE
3:20-3:40	National Cartographic and GIS Center--Support for Soil Survey	Richard W. Folsche, Head NCG, Ft. Worth, TX
3:40-4:00	Status of Policy on Hydric Soils end Wetlands	Maurice J. Mausbach N'tl. Ldr., Tech. Soil Services SCS, Washington, DC
4:00-5:00	Committee and Task Force Meetings (Breakout Rooms)	

O'Henry Suite (Room 167)

5:00-6:45 Mixer

TUESDAY MORNING, JUNE 16 — *Mt. Mitchell Room* — Carroll Pierce, Moderator

8:00-8:20 World Soil Resources----------------- David Yost
Soil Scientist
World Soil Resources
SCS. Washington, DC

8:20-8:40 Feasibility of Using Satellite-------------Carter A. Steers, Asst. Director
Imagery in Soil Survey — NCG, Ft. Worth, TX

8:40-9:55 Panel Discussion-SCS Academic Requirements and Hiring Procedures for Soil Scientists

Academic Requirements and -----------Melvyn H. Goldsborough
Hiring Procedures — Head, Special Examining Unit
SCS, Washington, D.C.

University Curriculum Changes -----Joe Kleiss
Assoc. Professor
NCSU, Raleigh, NC

Soil Science Curriculum, ---------------- Peter L. M. Veneman
Present and Future Needs — Assoc. Professor
U of Mass., Amherst, MA

SCS National Headquarters ----:------James H. Ware
Soil Survey Division Role — Soil Scientist
SCS, Washington, D.C.

Broad Duties of an SCS Rater----------F. Dale Childs
Asst. State Soil Scientist
SCS. Morgantown, WV

9:55-10:15 Break

10:15-12:00 Committee and Task Force Meetings [Breakout Rooms)

12:00-1:00 p.m. Lunch

TUESDAY AFTERNOON, JUNE 16 — Mt. *Mitchell Room* — Jerry Ragus, Moderator

1:00-1:30 Recent Developments------------------John E. Witty, N'tl. Ldr.
in Soil Taxonomy — Soil Classification, NSSC
Lincoln, NE

1:30-2:00

Status of NSSL Investigations in
the South and Northeast

Northeast ------------------------- Laurence E. **Brown**
Research Soil Scientist
NSSL, Lincoln, NE

South ------------------------------------Warren Lynn
Research Soil Scientist
NSSL, Lincoln, NE

Classification of Soils of the---------Stanley W. **Buol,** Professh 1 0 17à 4esÿ

Break

THRUDSAY AFTERNOON, JUNE 18	*Breakout* Rooms	James C. Baker, Moderator
1 :oo-3:oo	Agencies and Experiment Stations Meetings by Regions	
3:00-3:15	Break	
	Mt. Mitchell Room	
3:15-4:00	Task Force Reports	
	Task Force 1 -Soil Survey and Management of Forest Soils	James Keys, Jr. Soil Scientist USFS, Atlanta, GA
	Task Force 2--Soil Temperature and Moisture Regimes	Edward J. Ciolkosz Professor, PSU University Park, PA
4:oo	Adjourn	
THURSDAY EVENING, JUNE 18	*Mt. Pisgah/Mt. Pilot Rooms*	Bobbye J. Jones, Moderator
6:00-9:00	NCSS Banquet	
	'Evangelists, Scholars, Historians, Lab Types, Computer Buffs, Map Makers, and Auger Pullers in the Soil Survey'	Ralph J. McCracken SCS Deputy Chief (Retired) Greensboro, NC
RIDAY, MORNING, JUNE 19	*Mt. Mitchell Room*	*Betty* McQuaid, Moderator
8:00-9:30	Committee Reports	
	Committee I--Soils of the Northeastern United States	Ronnie L. Taylor State Soil Scientist SCS, Somerset, NJ
	Committee 2--Soils of the Southern States and Puerto Rico	Larry West Asst. Professor UG, Athens, GA
	Committee 3--Classification, Mapping and Interpreting Disturbed Lands	John T. Ammons Assoc. Professor UT, Knoxville, TN
	Committee 4-National Cooperative Soil Survey and Private Sector Cooperation	John C. Meetze State Soil Scientist SCS, Auburn, AL

	Committee 5--Representative Taxa for Modeling	Ray B. Bryant Assoc. Professor Cornell University Ithaca, NY
	Committee 6--Extrapedonal Investigations	William J. Edmonds Professor, VPI & SU Blacksburg, VA
9:30-9:45	Closing Comments	Karl H. Langlois, Jr. Head, Soil Interp. Staff NNTC, Chester, PA
9:45	Adjourn	

It is with a great deal of pleasure that I open this joint Northeast-South Region Soil Survey Conference here in Asheville, North Carolina.

The soil survey is critical and a base foundation to all that we do in the Soil Conservation Service. It is also critical to all publics as they deal with our natural resources, whether planning, developing, conserving or preserving those resources.

I have planned for you, today, a slide presentation covering the state of North Carolina. It will provide you with an opportunity to see the complexity of the state and to see the importance of soils as we make decisions relative to our resources here in North Carolina.

Before I present the overview, I want to take this opportunity to recognize a few of our cooperators and partners in conservation. My recognition is for those that I work closely with from day to day. I realize that most have already been recognized.

First of all, I am pleased to recognize and consider a real friend of ours, Secretary Bill Cobey. When I first met Secretary Cobey, he was U.S. Congressman Cobey. I am now most pleased to be able to work with him as Secretary, North Carolina Department of Environment, Health, and Natural Resources.

The next person is a close friend and partner in conservation, David Sides. David is the Director of the Division of Soil and Water, North Carolina Department of Environment, Health and Natural Resources.

I also want to recognize Horace Smith and his staff for putting together all of the arrangements for this meeting. A job well done. To the Steering Committee, I want to say thanks for your hard work. And, to all the Soil Conservation Service employees in this area, under the leadership of Jacob Crandall, a hearty thanks, also.

I am especially pleased to see those of you from other states that I have met, previously, and worked with. Especially, I see Dr. James Baker from Virginia Tech University.

Opening Remarks by Bobbye J. Jones, State Conservationist, North Carolina, at the Joint Northeast-South Region Soil Survey Conference, Asheville, NC, June 15-19, 1992.

It is especially gratifying to see Dr. Stan Buol, our own here in North Carolina. My special recognition could go on and on, and, you always run the risk of not mentioning someone that you should have mentioned.

Maybe the last few that I would make mention of would be Dr. Dick Arnold of our National Headquarter. Good to have Dick here. And, from the 2 National Technical Centers, we have Art Holland, NE National Technical Center, and Paul Larson, South National Technical Center.

Well, it is so good to have all of you here. you have an outstanding program planned. If there is anything we can do for you while you are here, please do not hesitate to ask some of us from North Carolina.

The uniqueness of this group is Federal, State, and local governments working together in a National Cooperative Soil Survey effort. Not many endeavors could be as successful as this effort. I compliment you all.

May I present to you an Overview of North Carolina. Thank you!

Purpose and Objectives of the 1992 Conference

Joe D. Nichols

The purpose of our work planning conference, according to our bylaws is as follows:

> "To bring together southern States Representatives of the National Cooperative Soil Survey for discussion of technical and scientific questions. Through the actions of the committees and conference discussions, experience is summarized and clarified for the benefit of all; new areas are explored: procedures are synthesized; and ideas are exchanged and disseminated. The Conference also functions as a clearing house for recommendations and proposals received from individual members and State conferences for transmittal to the National Cooperative Soil Survey Technical Work-Planning Conference."

This conference allows us to get acquainted, to discuss general problems and to conduct side conferences. The coffee breaks and meal times offer possibilities to discuss the merits of certain sharpshooters or the newest computers. This is communication at the practical level.

The field trips are important in that they allow us to see different soils. The mountain soils that will be seen on this trip allowed the state, local, and laboratory people a chance to show their latest techniques and findings. I think you will be pleased with the results:

A study of the committee assignments for this conference offers a history into the problems and opportunities of that time. Much of the important work of the Cooperative Survey has been through conference work. I suspect that each of you have favorite projects that you like to remember. I think the development of the interpretation record with the guides, was one of the biggest accomplishments.

We made an important decision when we combined the Northeast and Southern conferences for this year. We hope the reasons will be more apparent to you as the conference progresses. "one soil survey" is not accomplished without effort. The state general soils maps (STATSGO) will test our commitment.

We have well thought out committee and task force assignments. Some are finishing up projects and one new committee is designed to stretch our thinking. It may "spin-off" into other future committees.

We are being challenged to update soil surveys to keep them as current as possible. We are being asked to interpret the soil surveys for more and varied uses. We must learn how to best use soil surveys with GIS and with the many models that seem to spring up almost daily.

It is good that we have a week to reflect and to try to solve some of our problems. Have a good conference.

SECRETARY COBEY'S REMARKS
SOUTH/NORTHEAST COOPERATIVE SOIL SURVEY CONFERENCE

I'm happy to address the South and Northeast Cooperative Soil Survey Conference, because it gives me an opportunity to brag about our North Carolina program to those who understand the business of soil surveys and the value of a cooperative spirit. Just over 80 percent of the land area of North Carolina is mapped. This fortunate circumstance is the result of the dedicated effort of many people over decades. The solid partnership among the Cooperators in North Carolina provides the basis for an effective soil survey program.

I want to especially emphasize the excellent relationship between our department and SCS in soil mapping. A true team effort is leading our common goal. In North Carolina, soil survey parties are composed of soil scientists from both agencies. The responsibility of leadership for the surveys is shared. Our department currently provides the party leader for five county surveys.

To help you understand the Cooperative Soil Survey Program in North Carolina, I'll briefly review my department's role. In 1977, the state legislature appropriated funds to establish the soil survey section in the Division of Soil and Water Conservation. Since then, division's soil scientists have mapped 5.5 million acres.

The Division of Soil and Water Conservation is beginning to shift resources toward interpretive services. Two interpretive positions now exist, one here in Asheville and the other across the state in the department's Wilmington regional office.

Our department's role in the Cooperative Soil Survey Program was somewhat shaken last summer. Like many of your states, North Carolina experienced a shortfall in revenue last year which forced the legislature to reduce state expenditures. Unfortunately, our soil survey program budget was cut in half; we lost 8 positions. Thankfully, the SCS was able to come to our assistance enabling the department to keep three productive soil scientists mapping soils. Naturally, we are very grateful to SCS in Raleigh and in Washington for helping during this tough period. With the improving economy, our hopes are to regain state funding for these positions next year.

As an outsider to many of the technical issues and administrative matters taken up this conference, I can better relate to how the soil surveys are used. Soil surveys are a "user manual" for natural resources and a necessary tool for proper land use management. The availability of soils data and the ability to relate soil parameters to land use continues to become more important.

A primary reason is the increasing demands placed on our natural resources. Therefore, the application of soil science is a key element for maintaining environmental quality.

In summary, our department is proud of the progress made in the soil survey in North Carolina and of the relationship among cooperators. The Cooperative Soil Survey is an increasingly important mission necessary to provide quality natural resource management.

On behalf of Governor Martin, I want to offically welcome you to the Great State of North Carolina. We hope you have an enjoyable and productive meeting while in Asheville. We invite you to come back with your families and experience more of "North Carolina, the variety vacationland".

Thank you!

Welcome Connnents
1992 South-Northeast Regional Soil Survey Conference
Great Smokies Hilton Conference Center
Asheville, North Carolina

Everett R. Emino, Administrative Advisor
Information Exchange Group 22, Soil Survey

It is a pleasure for me to be here with you today and add to your welcome to the 1992 South-Northeast Regional Soil Survey Conference. My role at this conference is as Administrative Advisor to the Southern Region Information Exchange Group-22 on the Soil Survey. This is my third meeting with you. As Administrative Advisor, I represent the Association of Southern Experiment Station Directors and facilitate the participation of Soil Scientists from the Southern Land-Grant Universities to this conference.

At the Southern Directors meeting in May of 1991 our proposal to renew the Information Exchange Group was approved until May 1995.

As I thought about what a non-soil scientist (myself) might say to a group of soil scientists in my welcoming remarks, I thought back to my comments in 1990. At that time the Farm Bill was filled with soil related issues such as ground water quality, sustainable agriculture, wetland protection, Acreage Conservation Reserve, and occurrence, fate, and transport of chemicals in soils, as examples. The public and Congress were tuned in to the environment and natural resources. That trend has continued.

Since that time there has been, in my perception, an ever increasing awareness of the American public that soil is a natural resource. They have come to recognize that soil is essential to the production of food, fiber and forest products and to the health and well-being of humans and animals. I would encourage you as soil scientists to emphasize that soil, along with water and air, is a basic natural resource that when poorly treated has a negative effect in addition to decreased productivity of croplands and forests, on water quality, recreation, land development potential, wildlife habitat as examples. Ed Runge, Head of the Soil and Crop Science Department at Texas A&M University advocated to you that as a soil scientist you should claim the top 2 to 5 meters of the earth surface because you have the expertise in this area and are capable of designing an effective education and interpretation program for others to utilize your expertise. The heightened awareness of the American public that soil is a natural resource and soil scientists have the expertise should help you as professionals. However, we must constantly remind the public so they do not forget.

As you go about the business of this conference and the important detail of the soil survey that fundamentally contributes to the stewardship of our soil, please also-remember the broader issues of the
in our society that the soil survey contributes to.

I look forward to continue to work with the Southern Regional Soil Survey and this year especially with the combined resources of the Southern and Northeast Regions for an outstanding conference. It is a pleasure to be with you and on behalf of the Southern Experiment Station Directors, welcome to the conference. Best wishes for a very successful meeting.

Remarks made by Eugene J. Kamprath

On behalf of the College of Agriculture and Life Sciences and the Soil Science Department at North Carolina State University I want to also welcome you to North Carolina. I have a strong attachment to soil survey since for three months after finishing my BS and starting graduate school I was a GS-4 with the Division of Soil Survey, Bureau of Plant Industry mapping soils in the Platte Valley in Nebraska. With the Earth Conference in Rio bringing attention to environmental issues, this conference is particularly pertinent. No discussion of the environment is complete without giving special attention to soils and their properties. I want to briefly discuss three activities of the Soil Science Department which relate to the use of soils and the environment.

Sustainable agricultural systems for producing food and fiber must be profitable, protect the environment and conserve our natural resources. We need to know the productive capacity of our soils and the management practices required. As an example data for corn production on several of our soil series point out the differences between soils and management practices which must be used to utilize the full productive capacity of the soils.

Table 1. Corn yields as influenced by soil productivity and soil productivity and soil management practices.

Soil	Treatment	Grain Yield
Wagram (Arenic Paleudult)	subsoil +150 lbs N/a	86
Dothan (Plinthic Paleudult)	Conventional tillage +150 lbs N/a	104
	Subsoils +150 lbs N/a	182

The Wagram is a deep sandy soil with limited water holding capacity and therefore its yield potential is limited. The Dothan is a productive Coastal Plain soil with proper tillage practices. With conventional tillage a tillage pan develops which restricts root growth and utilization of soil water in the B horizon. Soils with an E horizon are very subject to developing tillage pans particularly use of a disk. Subsoiling permits root growth into the B horizon and utilization of the soil moisture in this horizon. This kind of information is needed if our farmers are going to compete on the world market. Soil surveys provide us the profile data which enables us to group soils which respond to different soil management practices.

One of the major issues that face us is how do we get rid of the tremendous amounts of waste generated each year. Land application is considered a major alternative for disposal of organic, biodegradable waste materials. North Carolina livestock and poultry industry generate approximately 21 million tons of fresh manure each year. Animal manures can supply 21% of the N, 75% of the P and 53% of the K annual requirements for North Carolina's agronomic crops. Municipal and industrial wastes are also being applied to soils. Loading rates have generally been based on the amount of available N supplied by the waste. High rates of manure application can cause nitrate to accumulate and result in groundwater pollution. Attention now is also being given to loading rates for phosphorus and heavy metals. High concentrations of phosphorus in the surface soil can be a source of surface water contamination. The capacity of our soils to adsorb phosphorus varies considerably (Table 2).

Soil	P added lbs/a	Soil test P, ppm
Norfolk (Typic Paleudult)	114	34
Georgeville (Typic Hapludult)	348	22
Porters (Umbric Dystrochrept)	360	25

Since Coastal Plain soils are often very high in available P and have a relatively low P adsorption capacity their loading rate for P may be limited. Applications of municipal and industrial sludges are restricted based on slope, depth to groundwater and allowable heavy metal loading rates.

An extensive research program is being conducted with septic systems and on-site waste management. Fifty percent of the homes in North Carolina are on septic systems. As a consequence information on suitability of soils for on-site waste disposal is essential. Studies are underway to characterize soil solum-saprolite sequences in the Piedmont and Mountain regions with respect to their potential for on-site wastewater treatment and disposal. There is an increasing need for saprolite classification and research in order to evaluate the suitability of saprolite for on-site wastewater treatment.

Considerable attention is being given to maintaining the quality of surface and groundwater. Any successful program must take into account the soil properties which affect the movement and transport of chemicals and nutrients. In the poorly drained soils of the Lower Coastal Plain controlled drainage has reduced the amount of nitrogen efflux from agricultural fields by one-third. With better drained soils of the Coastal Plain keeping a natural buffer area at the edge of fields next to the drainage ways reduced the transport of nitrate in drainage water from 32 kg/ha/year to less than 5 kg/ha/year. The marshy nature of the natural buffer areas results in denitrification of the nitrate. Vegetated filter strips are a means for accumulating nutrients and sediment contained in surface runoff. Grass filter strips 20 feet wide at field edge have caught 90% of the nitrogen and sediment and 50% of the phosphorus transported by surface water from cultivated fields with 4 to 5% slope.

To protect our environment it is necessary that we have up to date soil surveys along with data on their chemical and physical properties. This will enable soil scientists and agronomists to make those recommendations on use of soils, nutrients, chemicals, and management practices which will safe guard our environment. We look forward to continued cooperation with the Soil Conservation Service and the North Carolina Department of Environment, Health and Natural Resources.

BJORN DAHL'S JUNE 15 OPENING COMMENTS
FOR THE
SOUTH AND NORTHEAST REGIONAL SOIL SURVEY CONFERENCE
OF THE
COOPERATIVE SOIL SURVEY

GREAT SMOKIES HILTON CONFERENCE CENTER
ASHEVILLE, NORTH CAROLINA
JUNE 15-19, 1992

Welcome to Asheville. As the only person on the agenda who resides in the Asheville area, I'd like to welcome you to the mountains of Western North Carolina. And, as the Forest Supervisor for the National Forests in North Carolina, I'd also like to invite you to visit our National Forests while you are here.

There are four National Forests in North Carolina, with a total acreage of 1.3 million acres of public land. Most of these National Forest lands are in the mountains-in fact, the one-million-plus acres of the Pisgah and Nantahala National Forests provide much of the "scenery" you see as you drive through this area. We also manage the Uwharrie National Forest in the central (Piedmont) part of the State and the Croatan National Forest on North Carolina's Atlantic coast.

In the past, these were lands nobody wanted. Now there is a great demand for their various goods and services that they can provide. For example:

> The National Forests offer a broad spectrum of recreational opportunities. Last year alone, the National Forests in North Carolina had over 35 million visitors. In addition to the more traditional recreational opportunities or uses, our several Congressionally-designated Wilderness Areas and thirteen Wild & Scenic Rivers provide opportunities that appeal to the more adventurous members of the public.
>
> The National Forests in North Carolina produce an abundance of clear, high quality water-one of our most important resources. There are thirteen multiple-use municipal watersheds and one industrial watershed on the National Forests.
>
> The National Forests provide approximately 60 percent of North Carolina's public hunting opportunities.
>
> While meeting such demands, the Forests also produce approximately 70 million board feet of timber per year.

Today, the Forest Service is an organization responding to great changes brought about by:

Scientific developments and findings. We're constantly exploring and finding new and better ways of doing things.

Our various publics' needs, desires, and values-that is, how they want their public lands to be managed.

The--often conflicting-demands and the complexities of management, i.e., commodity vs. non-commodity.

We have a Congressional mandate to protect environmental quality, while also producing goods and services that people need. We must make a conscientious effort to uphold our public trust and meet our legal mandate. You may ask how do we do that. Our approach: applying ecosystem management to the National Forest System.

Ecosystem management is a method of "balancing" multiple use management. This implies that the system, or integrated ecological unit, is the context for management rather than just its individual parts. Since it is obvious also that every acre can't be everything to everybody, we must look at landscapes and regions as we take a truly ecological approach to management.

But such an approach must be based on a solid foundation, The more we understand about those "individual parts" and their relationships, the more effective we can be in applying an ecosystem approach. Therefore, getting and applying the best soils information practicable is paramount to good, long-term management decisions. Soil survey is a key component of the integrated resource inventories needed for such an approach.

Soil Scientists in Western North Carolina already are bringing together the expressed effects of climate, vegetation, topography, and parent material into MAPPABLE units-with important implications for management. In effect, scientists and managers (soil survey users)-perhaps without even being conscious of such terms as "ecosystem management" or "integrated resource inventories"-nevertheless have taken an integrated approach to conducting recent soil surveys in this part of the country.

In this respect, the Forest Service has benefitted greatly from its long-term partnership in the National Cooperative Soil Survey (NCSS) and the joint efforts of its Cooperators. Many of the more recent and ongoing inventories here in North Carolina are on National Forest land.

We appreciate the capable efforts of the Soil Conservation Service in its role as as the lead agency in NCSS.

We value our relationships with the universities, including North Carolina State University (Raleigh) and North Carolina Agricultural and Technical State University (Greensboro).

We recognize the important role of the North Carolina Department of Environment, Health, and Natural Resources in the NCSS. With a good cadre of State-employed soil scientists, North Carolina ranks high among state governments from the standpoint of its support and involvement.

It is very good that you, as a group, are here now to pool resources; to share knowledge; to better define our respective roles in NCSS; and to plan for the future.

It's also good to see that the Forest Service is well represented. A speaker from the Forest Service's Washington Office Soil Resource Program is on the agenda this afternoon. A number of other participants-from both the National Forests (Regional Office and Forest levels) and Forest Research-are serving on several of the committees and task forces.

I am confident of our abilities. Through our joint efforts-and the synergism that evolves from working together-we will respond to the expanding and changing needs and demands from the people and environment we serve. And, in the process, we will benefit from the rapidly evolving technologies such as GIS, GPS, etc. I expect GIS to be a valuable tool in helping us further integrate, apply, and refine our inventories and information.

Out of this meeting, I am confident that we will develop recommendations that will continue to maintain a spirit of excellent public service and maintain our proud tradition of being good stewards of the land.

Once again, welcome to Asheville and Western North Carolina. Visit the National Forests in North Carolina while you're here if you have chance.

REGIONAL PERSPECTIVE – NORTHEAST

By Arthur B. Holland,
Director Northeast National Technical Center

This is a great opportunity, having the people from the Northeast and South regions of the National Cooperative Soil Survey program meeting together this week. I know that there will be ample opportunities for exchange of technology and each of you will return to your offices with additional knowledge that will make your jobs more interesting and productive.

From a Regional Perspective, I want to discuss with you your role regarding the Food Security Act of 1985 (FSA) and Food, Agriculture, Conservation, and Trade Act of 1990 (FACTA), then I have a couple of other comments on current topics that I will share with you.

-History of National Compliance Control Team

As many of you are aware, last year, the Soil Conservation Service had a three tier review of the Food Security Act (FSA) compliance plans and how they were being implemented. The field offices looked at more than 71,000 tracts or about 5 % of FSA plans and the state offices looked at 5,500 of the 71,000 (8.2% of the 71,000). These were all randomly selected. The National Headquarters also looked at 799 tracts in 561 counties using NTC staff, called the National Compliance Control Team (NCCT).

The SCS Management Report on Quality of Field Office Decisions for FSA Compliance was prepared from these reviews and published in May 1992.

Part of the reviews had to do with information available in the Field Office Technical Guide, Section II, in which soil scientists are very much involved and interested.

The information that I'm going to display came from that report and deal with the Highly Erodible Soil Map Units and the County Hydric Soil Lists.

-Highly Erodible Soll Map Unit List

First let me compliment NH, MA, RI, CT, NJ, DE, MD, NC, SC, AL, MS, AR, and OK for having Highly Erodible Soil Map Unit Lists in all the counties that the NCCT visited.

A. Policy - the Highly Erodible Soil Map Unit List will be a part of Section II of the Field Office Technical Guide (FOTG).

B. **Finding** - Fifty three counties or approximately 10% of the counties visited in 22 states reviewed by the NCCT did not have or were unable to find their Highly Erodible Soil Map

List. On the other side of the coin, 508 counties or 90% plus had the **HESML** as according **to policy.**

C Recommendation - State Conservationists, for states haying counties without the Highly Erodible Soil Map Unit List, amend their State Quality Control Plan to provide for review to determine availability of the list, Where it is missing, develop the list as required by policy. The list must be in the **FOTG** and available to all persons within the field office.

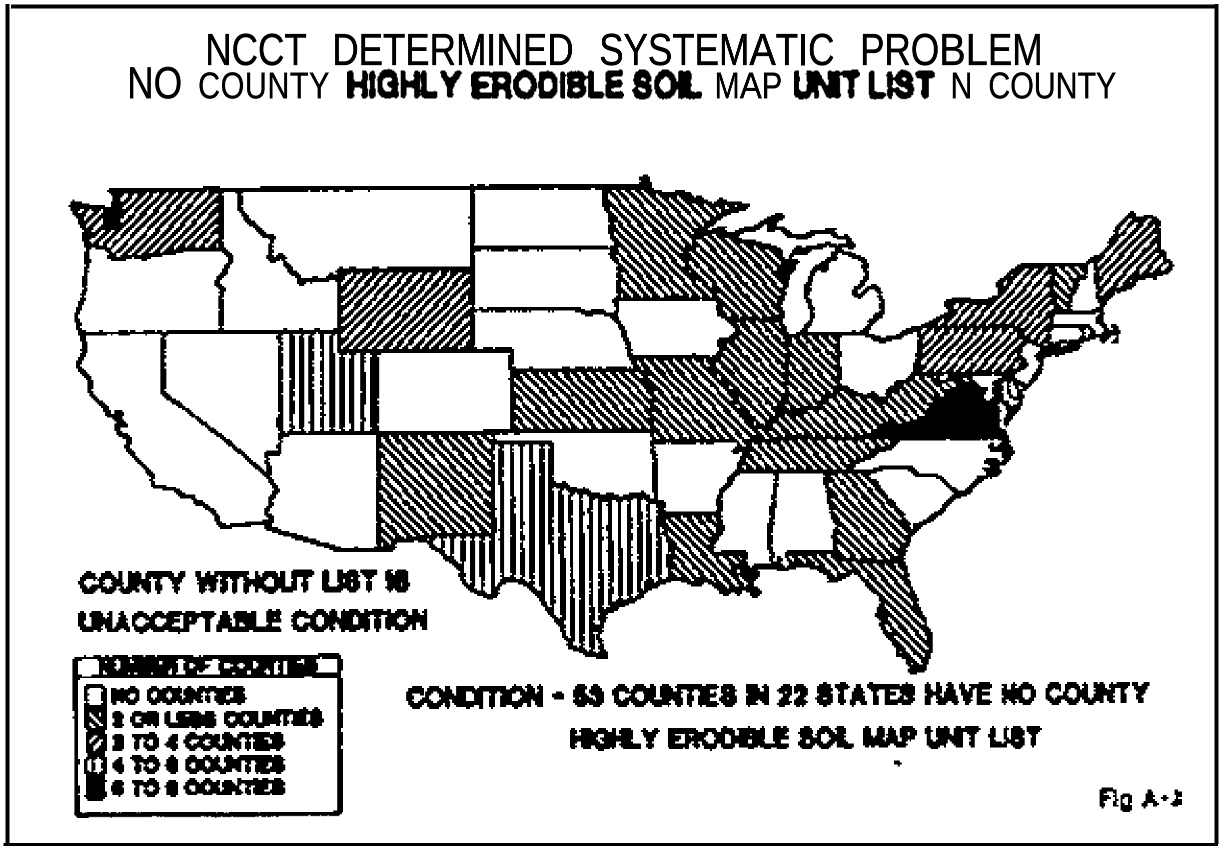


Fig A-2

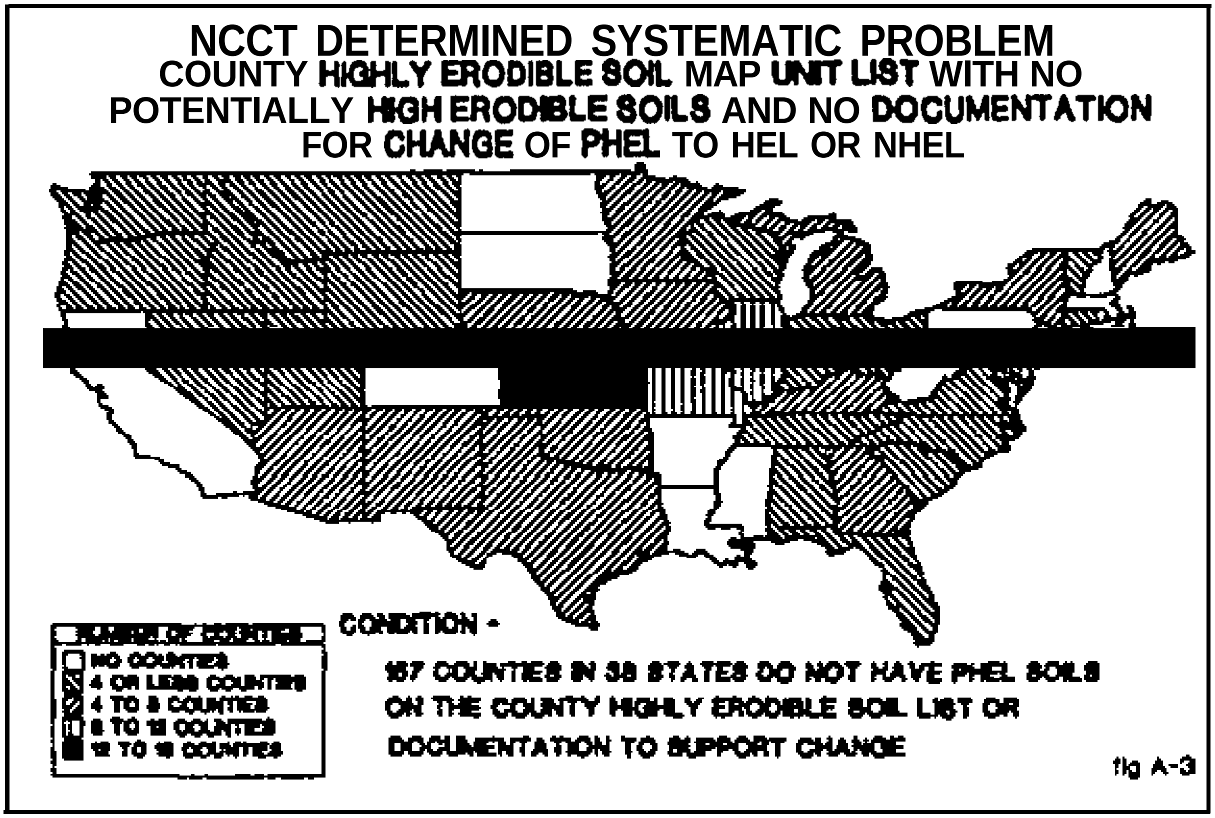
-Inclusion **of Potentially Highly Erodible Land (PHEL) Soils In The Erodible soil Map unit List**

Now let me **praise** NH, MA, RI, PA, NJ, DE, WV, MS, IA, PR and AR, for haying Potentially Highly Erodible **Soils** and Documentation for Change of PHEL to HEL or NHEL in all counties checked.

A. Policy - The Highly Erodible Soil Map Unit List includes highly erodible and potentially highly erodible soil map units in **effect** as of January 1, 1990 and remains unchanged for FSA purpose with exception of those **areas** with active soil surveys.

B. Fiidiigs - Highly Erodible Soil Map Unit Lists in 157 or 25% of field offices in 35 states did not have PHEL soils on the HEL Soils List or no PHEL Documentation to justify change to the HEL or NHEL.

C Recommendation - State Conservationists, for states identified as having more than four counties without PHEL soils on the county highly erodible soil map list or no documentation for changing PHEL to HEL or NHEL, provide a procedure in their State Quality Control Plan to restore PHEL soils to the HEL list and where documentation is insufficient to justify PHEL changes to HEL or NHEL.



- County Hydric **Soil** List

You have done best in getting Hydric Soil Map Unit Lists into the **FOTG's.** ME, NH, VT, MA, CT, NY, NJ, MD, DE, NC, SC, TN, AL, AR, PR and OK all had **Hydric** Soil Lists **in** all counties visited by the **NCCT.**

A. Policy - Maintain an official list of hydric soil map units in Section **II** of the **FOTG.**

B. **Findings** - A Hydric Soil List **was** not found in the **FOTG** and one did not exist as working copy in 35 or 6% of the field offices **reviewed** by the **NCCT.**

C Recommendation - State Conservationist provide a procedure in their State Quality Control Plan to review counties for availability of the County Hydric Soil List and where missing develop the list as required by policy. The list must be in the **FOTG** and available to all persons within the field office.

NCCT DETERMINED SYSTEMATIC PROBLEM
PERCENT COUNTIES WITHOUT **COUNTY HYDRIC SOIL** MAP **UNIT LIST**

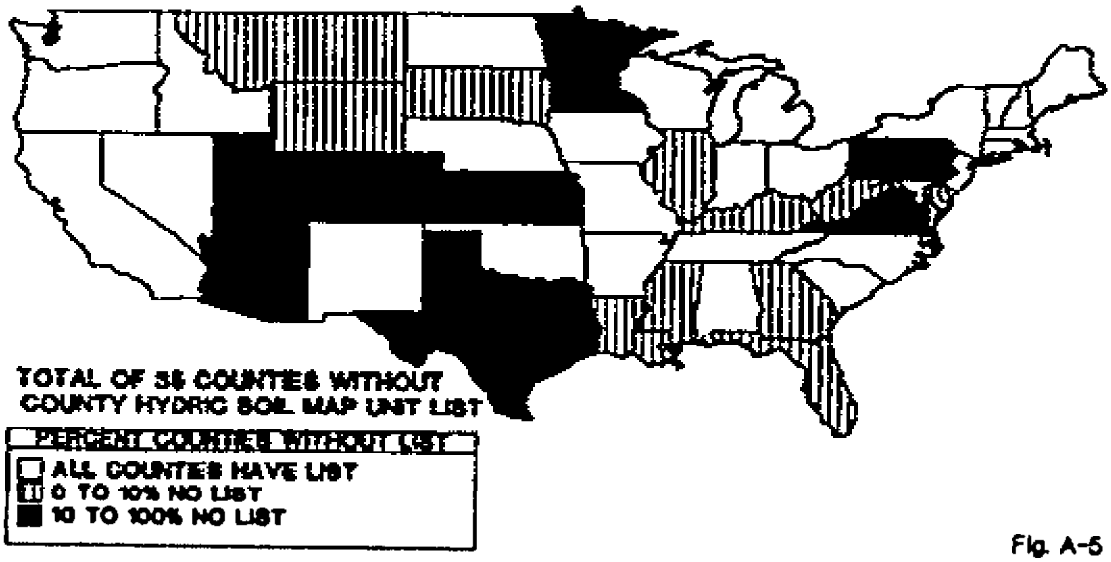


Fig. A-5

The FSA and **FACTA** are a very high priority for the Soil Conservation Service and that is why I have taken the time to show the results of the compliance checks made last year.

Let me move onto a couple of other topics **while** I have the chance.

1. *The* **FOTG** is a vital tool in assuring that our field offices can do their job and you need to help them by giving them the information they need. The Hydric Soils List can be kept current by using the Hydric Soils Module in 3SD. I understand that this is to be completed by July 1, 1992.

Section II of the **FOTG** needs to be completed as soon as possible but at least no later than Sept. **1992.** Again the 3SD module is a major data base for this information.

2. The Northeast has much of the area mapped and the **Soil** Surveys published. **However** many published soil surveys need to be updated or modernized to be usable with current technology such as **GIS.** This means using otthophotography for the Base Survey Maps etc. We also will be using an **MLRA** concept **for** *the* legends. We need to use the same legend within an **MLRA** and not let political boundaries control soil survey legends. This will allow better uniformity and more consistent soils information when working with users.

Regional Perspectives from the Southern States

Prepared for the Combined South and Northeast Soil Survey Work Planning Conference - Paul F. Larson

I am pleased to address the combined South and Northeast Regional Technical Work Planning Conference of the Cooperative Soil Survey. I understand, this is only the second such meeting and the first for the South and the Northeast.

The National Cooperative Soil Survey gives State and Federal groups an opportunity to work together for a common cause. These regional work planning conferences are a good example of this cooperative effort. We, at the South National Technical Center, understand more about cooperation than we did two years ago. We have adopted Total Quality Management as a way of doing our work. We have had training and are attempting to practice what we have learned. We believe, we are doing well, but we also realize that cooperation is not easy, but is worthwhile. Your group is to be congratulated for years of working together.

You have a full agenda of work with six committees and two task forces. This work seems geared to answer questions that we ask in the near future. Modeling is being tested to answer questions for water quality in the future. It is being coupled with (GIS), Geographical Information Systems or automated map systems. Users want and should be able to load soils data for models, tailored to the mapping unit in the county. The data may need site adjustment, but this is a good beginning.

Your committee on cooperation with the private sector indicates increased use of soils information. Early work on this opportunity should clarify objectives.

The mined soils committee has a difficult problem but the combined groups should be able to attain some answers.

The work on the two regional soils maps, comes at an opportune time to make some very worthwhile contributions to the geography of soils to a particular group of users.

The task forces are completing work from past work planning conferences to get those items into operation.

The Soil Conservation Service is making time consuming changes in our conservation management for land users. A new planning manual is being written along with a comparison training course. Our field office technical guide (FOTG) is getting a re-look with some changes. New methods of displaying the effect of treatment in soils are a part of this system. A new computerized management and planning system is "about" ready. We are counting on this to help our delivery system. The soil survey data base and the accompanying list, such as hydric soils are the key information for this new system.

We are looking ahead to the completion of this system and getting back some time to do some jobs that had to be put on hold. One of these is training soil scientists at the area level to assist users. The problem remains involving how much soil scientist time we should use to help users of soil surveys and how much time we use to update our older surveys.

THE NATIONAL COOPERATIVE SOIL SURVEY; A NATIONAL PERSPECTIVE

Dick Arnold, Director of the Soil Survey

As the premier landscape artists of America, what is America to us?

It is an unspoiled wilderness that still contains the excitement of our pioneering spirit. It is a rich agriculture striving to be in harmony with its environment - with many examples of success. It is vast grazing lands, both public and private, that expand our perceptions of natural resources. It is an overwhelming diversity of forests as they fulfill functions so vital to the growth and development of our country.

America is blessed with natural resources - soils that locally hold the world together, that regionally have intriguing patterns. Soil is the resource that gives rise to our discipline. Water resources will always be crucial to building a better future. Water quantity and water quality capture more and more of our attention.

The biodiversity of America may not quite be as great as a tropical rain forest - but WOW! We still have a lot to learn about biological niches and the future options for mankind. Animals interact with soil, water, plants and air. Be they domestic life or wildlife - animals are important components of America's natural resources. Our most common resource is air - moving across continents and oceans. Good air quality is a valuable commodity; ask anyone who must live in smog. People are also resources: they cause most of our environmental problems; and they must be responsible for their solutions.

In America, we still have some disasters that will be costly to correct. But we also have some wonderful artistry of building harmony with nature. We have many isolated domains of fragile ecosystems where the forces of nature still prevail over those of mankind. And of course, we have the hustle and bustle of cities, yet there are many who enjoy and thrive in these artificial creations.

Well, where else but in America have we such wonderful diversity, complexity, beauty, and potential? It is in this setting that the National Cooperative Soil Survey came into being and has flourished. The NCSS. Decades of working together and numerous achievements of which we are justifiably proud!

What makes us feel good? Why have we been so successful?

For one thing, we have a model of soil that has stood the test of time and permitted Pedoloqy to evolve. We recognize many separate and specific features in soils. They have many properties that can be described and measured. We have developed standards that have brought consistency to our descriptions of soils, and their use lets us correlate together similar soils. We have a system and nomenclature of soil classification that comprehends most of the soil universe. It didn't just happen. What an accomplishment, what an achievement!

We feel good when we see dramatic soils - and there are thousands of them. A mystery world beneath our feet. We use our standards to gather basic facts of Pedoloqy - they are soil descriptions. As we store more and more basic facts in information systems it makes us feel good.

We recognize that soil is a continuum but that it is easier to handle information if we divide it into more manageable segments. We feel good about our successes in understanding and mapping soil variability. We feel good about the models we have developed and use to deal with soil variability. We go into the field - we observe - we make relationships among our observations. We know that soils are "out-of-doors" objects and our understanding must be consistent with that reality.

We feel good when we verify the relationships in our models and prepare the best soil maps that we can at the time with the available resources. And we really feel good and are proud when we can provide interpretations that are relevant to the needs of our clients and customers. Sizes,. shapes, patterns - fascinating! Fascinating1

Just think of it this way -- with diversity and with the necessary skills and dedication - a team can come together and tackle huge environmental issues. They can attack the wooly mammoths of the day. Teamwork - NCSS. Teamwork - NCSS.

By the year 1992 the NCSS had progressed a long way on their journey to map and interpret the soil resources of the U.S. About 92% of the privately owned lands had been surveyed and about 75% of the whole country. You can be proud of these accomplishments. I'm proud of you!

The time to look ahead is always with us. A number of you have been hammering out ideas and issues to help guide our future. You have suggested that our mission is to provide leadership and service to produce and deliver scientifically-based soil information to help society to understand, value, and wisely manage global resources. This gives rise to a vision - the desired stated of the future where there is "quality sol resource information for science and society".

You have suggested some important principles that guide our behavior. We value our employees, colleagues, customers, volunteers, and partners. We value global resources, research authorizations, innovation and creativity. We also value professionalism, reputations and a code of ethics. Notice that 8 of these 10 items are about people , not soils.

Groups of our peers have been discussing, debating, and reaching consensus on some major issues for us to consider. Let me share nine of these issues with you.

(1) Implementing a marketing plan for NCSS
(2) Automating more of our information system
(3) Team building to help each other achieve more
(4) Balancing technical services and survey projects; personal assistance versus data collection.
(5) Building and using standards of reliability
(6) Maintaining state level program managers
(7) Soil interpretations for better environments
(8) Alternative sources of funding
(9) Developing the MLRA approach for updating soil information

These are serious issues. They are worthy of our attention. As we move ahead with strategic planning and operations, we need to keep in mind the power of teamwork, of cooperation, of sharing our talents and skills with each other.

Also keep in mind new and evolving technologies that help sustain resources; such as low pressure irrigation nozzles. Keep in mind that all knowledge is based on relationships - of things that covary. And always with differing degrees of uncertainty. A challenge exists to document and present information about our reliability.

Remember why we study, learn, work, teach and team up. It is for technology transfer; soil-related technology transfer. There is a challenge to estimate the population carrying capacity of the world's soil resources. FAO did it for Africa. We should do it for the United States.

There are new clients and customers to reach out to every day. There are really great opportunities to satisfy the needs of others. There are new cultures to understand: there are generations to bridge: there are hopes and dreams to fulfill.

I am reminded that the National Cooperative Soil Survey continuously changes. Some portions are older, perhaps more mature; some are coming into their own magnificence and there are the new comers who will flush out with time. We are a thing of changing excellence.

Each in our own way has come to understand and to believe that a conservation ethic can be a way of life. It is fundamental to stewardship. And throughout the whole wide world there is the need for, the request for, the desire for - conservation and a new way of global living.

With the strategy of the NCSS, with its solid foundation, and with its dedicated members - there is a vision of beauty for the whole world that includes our vision of quality soil resource information for science and society.

And that my friends, is the day's viewpoint of the NCSS from national headquarters, as reported by your Washington correspondent. Thank you.

SOIL RESOURCE INVENTORY PROGRAM
USDA FOREST SERVICE
June 15, 1992

RANDY MOORE

Its a pleasure to be here at the South-Northeast Cooperative Soil Survey Conference. As you all know the Forest Service has been an active partner in the National Cooperative Soil Soil Survey (NCSS) for over 3 decades, and we look forward to this same cooperative participation for future decades to come. We are going through some new but very exciting changes in the Forest Service. This change is called Ecosystem Management. What this means to the Soils Program? For one, it means we are taking a" integrated approach to how we inventory soils. Our primary focuse is soils, landform, geology, vegetation and aquatics. We invite you to become a part of this change and become more intimately involved in the correlation of this data. In order for me to stay within the time allowed on the program I would like to present a short summary of the status of the soils program as followed:

SUMMARY

A. **Status**

1. 'Once-over" inventory of soil resources is about 83 percent of the National Forest land base. Completion is impeded by a lack of skilled manpower, funding, and priorities.

2. SRI reports, inservce, and NCSS cover about 67 percent of the mapped acreage. This leaves about 50 million acres mapped but with incomplete reports.

3. Participation with SCS in the NCSS has been only partially successful in publishing FS SRI's. Cooperative data sharing and mapping efforts resulting in NCSS soil correlation of FS SRI's is routine.

B. Implementation of SRI

1. Soil inventories are being conducted under a variety of names.

2. Interpretations are based on soil taxonomy and other landscape components using specific criteria, research, and monitoring data to meet inventory objectives.

3. Map unit design is constrained only by the objectives of the inventory. The idea is to use climatic factors and components of geologic structure, landform, vegetation, and soil to delineate landscape segments important to land use.

4. FS integrated SRI's meet standards of the NCSS. Map unit definition may be nontraditional for NCSS and some interpretations go beyond interpreting the soil component. However, the soil taxonomic components and their extent are determined and map units are phased by other topographic features.

5. Quality control end testing of validity of ❑ ep units has become very important.

C. Trends

1. Increased contracting of SRI.

2. Stabilized decline of soil scientist numbers in FS.

3. Increased involvement in interagency sharing of soils date through the NCSS.

4. Increased use of DBMS and GIS to store and display soils data and information.

5. Soil inventories are being conducted es integrated inventories.

6. Interpretations are based on multiple landscape components.

7. Interdisciplinary teems require more or different kinds of data for project development and environmental assessments.

8. Concerns on long-term soil productivity from erosion, other soil disturbance, and acid deposition.

9. More precise determination of land capability to improve plan projections.

10. Increasing attention to quality of inventories.

D. Needs

1. More detailed soils information for project work end models for Forest Plan implementation. This is partly in response to increased concern for protecting soil productivity and reducing erosion for off-site effects.

2. Research data to improve interpretation of map units for productivity ratings, regeneration capability, and effects of management practices on soil quality.

3. Interpretation of soil properties for acid deposition, pesticides, and intensive management practices.

4. Soil quality standards.

5. Improved quality control measures of inventory operations.

6. Improved handling of soils information for users.

7. Training in use of soils information.

8. Use of soils information in a wider variety of management activities, i.e.. monitoring, riparian management, end bio-diversity assessments.

9. More imaginative ways to display and integrate soils information to make it more useful.

NATIONAL FOREST SYSTEM
US FOREST SERVICE
STATUS AND NEEDS FOR SOIL RESOURCE INVENTORIES 1/
(MILLIONS OF ACRES)
April, 1992

REGIONS	NF ACRE:	ORDER 2 OR : NEEDS	ACRES PRINTED NCSS	IN-SERVICE	ACRES CORRELATED NCSS
1	25.3	6.4	0.4	13.2	11.5
2	22.0.	2.7	7.1	1.9	16.1
3	20.7	12.2	3.2	8.3	3.2
4	31.8	10.0	5.3	19.9	9.3
5	19.9	7.0 (O2)	.8	3.1	19.9
6	24.6	13.0	3.6	24.6	4.5
8	12.7	12.7	6.5	5.1	9.7
9	11.8	4.5	3.8	4.1	6.0
10	22.5	3.7	0	8.0	8.0
TOTALS	191.3	72.2	30.7	88.2	88.2

REPORT FROM THE 1890 UNIVERSITIES 1/

Burleigh C. Webb, PhD 2/

I am indeed honored by the opportunity you have given me to share my thoughts as a part of the 1992 South-Northeast Cooperative Soil Survey Conference. I am pleased also to bring you greetings and best wishes from the faculty, staff and students of the School of Agriculture at North Carolina A and T State University. Thank you very much for inviting me. I have elected to spend my time on the topic I call, "Through the Years With SCS".

In 1890, the second Morrill Act was passed in response to the need to enlarge provision of the original Horrill Act of 1862, setting into place the wellknown system of land-grant colleges and universities which would provide college instruction in agriculture, mechanic arts, and other branches of learning, not to exclude military science and tactics. And government-owned land as a source of the nation's wealth was to be offered for sale and interest generated would help to support this novel educational plan the same as land associated with the Homestead Act of 1862 provided the incentive for settling the country west of the Mississippi River.

While the second Morrill Act was designed to enlarge certain provisions of the first Horrill Act, southern states wishing to benefit were required to provide opportunities for its Afro-American citizens at established land-grant institutions or to develop others to accommodate them. Thus was formed the 1890 land-grant colleges system as separate institutions with the narrow mission of teaching agriculture and mechanic arts, even though the Hatch Act establishing the Experiment Station network for research was determined to be a necessary adjunct to quality teaching in the land-grant college setting.

Today, this group of colleges and universities, like its 1862 counterparts, has through actions in the States and other events, moved well beyond the restrictive original mission and has risen within this group's 100-year history to full service; comprehensive universities offering undergraduate degrees in agriculture and a wide variety of other options, including nursing, most of the standard engineering programs, business and accounting, education, industrial technology, as undergirded by strong programs of the Arts and Sciences, and graduate degree programs including the Ph.D. in technical areas as well. As expected, most have matured, developed, and grown into full-service institutions, helped tremendously in agricultural service through the Evans-Allen Agricultural Research and the Agricultural Extension Program as provided in the Farm Bill of 1977.

1/ Delivered to the general session of the South-Northeast Soil Survey Conference June 15, 1992

2/ Dean, College of Agriculture, North Carolina A&T State University, Greensboro, NC.

Other significant events have occurred in recent years, like the Nashville Conference of a few years ago, leading to the Strengthening Grants Program and Capacity Grants Program, following In the wake of the Facilities Bills for improving agricultural research and agricultural extension, which have provided effective leverage for truly outstanding programs in agriculture and related areas. All of the 1890 universities are fully accredited by the appropriate body. Many have program accreditation (eg) the American Chemical Society, Business and Accounting, Nursing, NCATE for Education, ABET for Engineering and Technology Programs. More than fifty percent of the faculty holds the Ph.D. degree.

In many instances important, unique and non-duplicative academic offerings are evidence that the 1890 university group is worth investments made in them that should be enlarged so as to improve access for any race or creed. Alabama A&M offers the Ph.D. In Soil Science, an undergrad option in remote sensing, and a new and comprehensive forestry program. The University of Arkansas at Pine Bluff, Maryland Eastern Shore, Delaware State College, Virginia State University, Southern University are developing strength in acquaculture and marine science. Langston University, Fort Valley State, Prairie View, and Tuskegee are involved in goat production enterprises.

My own institution has an ABET-approved program in agricultural engineering offered jointly with the School of Engineering, with emphasis in hydrology, water engineering, and soil conservation. It offers the B.S. degree in Landscape Architecture and a unique program leading to the B.S. degree in Laboratory Animal Science--an animal health-oriented program. Tuskegee University offers the DVH degree and Tennessee State offers a specialty in ornamental horticulture. The uniqueness, acquired academic strengths, and commitments to excellence exhibited by this group of institutions make it possible for them to function admirably with the complex issues and events of today's world and help position these institutions for ever-increasing roles in campus affairs of the future. We've come a long way past the comparatively simpler environment of 1890. While there is considerable commonality within this group, collectively they represent desirable diversity in higher education.

In a similar sense, the Soil Conservation Service, out of sheer necessity, has evolved from the relative simplicities of on-farm concerns of the 1930s to assuming an appropriate role in non-farm global issues--evidence of the current Earth Summit in Rio--where man's industrial activities and man's agricultural activities cannot be effectively consldered In isolation and as if there were no interrelations or immediate action interface.

As pointed out in the book, Aaro Ecology, by Carroll and others, soil erosion almost as a single issue came to the nation's attention during the "dust bowl" of the 1930s when no one living in the affected areas could escape the view of skies blackened by whirling dust from over-grazed range lands and drought-affected fields. As you know, it was during this period that SCS was formed under the energetic leadership of H. H. Bennett. While SCS encouraged tree planting for shelter belts, establishing grass waterways, planting on the contour--economic influences of farm prices, increased export of farm commodities, expanded production onto fragile and erosion-prone lands, large machinery appearing where terraces were considered to be obstructions, all led to accelerated loss of soil, even to the present. The National Resource Inventory, (or NRI) of **1961** provided a comprehensive review of sheet, rill, erosion over a **cropland** base of 413 million acres, indicating an **estimated** 6.4 **billion** tons of topsoil was washed or blown away as revealed in the United States Soil Loss Equation (USLE) or the WEE (Wind Erosion Equation), but losing sight of soil loss in gully erosion.

Here in June 1992 each day as we read our morning paper, concerns of the Earth **Summit** complicate our thinking and our peace of mind; for in global terms, ocean pollution, removal of the protective ozone layer, concern for soil loss at continental levels, global warming, population growth in affected areas In millions, desertification, are in dimensions or in an order of magnitude that will just about "blow one's mind". Yes, conditions are very much more complex than they were in the thirties when contour lines and terraces were laid out with the high technology tool consisting of the farm level--when today the technology of remote sensing, satellite photos, etc., almost render the oldfashioned aerial photograph obsolete. In addition, we find overlapping interests and sometimes mutual interests in having other agencies share the increasing load of total environmental consideration beyond that generated only by activity In agriculture, and might include EPA, NASA, NIEHS, and Forest Service, along with SCS.

We've come full circle - 1890 land grant institutions as a group have developed to the point that they can be full partners in a collaborative mode in assisting SCS, EPA and other **agencies** to address goals and objectives of their distinctly different, detailed mission. In many ways, thanks go to the soil conservation service. **In** my view, as supported by others, there has been a kind of coming together with the 1890s for mutually beneficial advantaaes. I would like to take a few minutes to bring some of these accomplishments to a proper state of enlightenment and credit.

While the Nashville Conference was sorely needed and has been quite rewarding to university and agency alike as partnerships are developed, my own personal experiences and those of my **colleages** put cooperative partnerships **with** SCS well **ahead of most** other agencies of USDA and--at least for the last 30 years--well ahead of Nashville.

As institution and SCS agency have improved over the historical span of their existence, as their respective missions have enlarged and become more complex over time, there is strong evidence pointing to parallel interests within the last 30 years **(1962-1992).** Accordingly, I would like to cite firsthand some favorable **interventions** of SCS in response to institutional requests or overtures.

1. As a recently hired dean in 1962, I was appointed by Secretary of Agriculture Orville Freeman to his Advisory Committee on Soil and Water Conservation and later to the Advisory **Committee** on Rural Areas Development (RAD) where I received useful insights of value to fledgling programs in soil science and agronomy, underway at my institution.

2. Later on I was able to establish acquaintance with Mr. Llnstrom and Mr. Novac of SCS to negotiate cooperative education or summer tralneeshlps for our students.

3. In the mid-60s Mr. Wllllams, then Administrator of SCS., helped us establlsh a plant materials lab on campus, enabling us to assist SCS in evaluating different cultlvars for erosion contact potential. The laboratory-nursery is still in operation.

4. In the latter 60's faculty were given short-term assignments durlng summer months, assisting SCS in land use planning activities.

5. A three-year IPA assignment from SCS personnel, a post-doctoral assignment from an SCS scientist, and collaborative activity with the Purdue University Soil Erosion Lab helped a great deal in winning ABET accreditation for our program in agricultural engineering.

6. Locally situated demonstration plots for conservation practices have been underway for several years as conducted by at least one SCS assignee. as is the case at present.

7. Assistance from the office of Jim Tatum is identifying special expertise to help in conservation research.

a. In the interest of getting an accurate picture for the past 30 years of involvements between 1890 institutions and SCS, I did a-survey of these universities. Of the ten questions which were raised with the university representative as listed below, results indicated that eight of the ten questions provided a "yes" answer:

(1) Assisted in establishing a plant materials lab for evaluating plants with erosion control?

(2) If yes, is the lab still operational?

(3) Carried out cooperative soil conservation demo/research projects?

(4) Engaged students in cooperation education, summer work assignments, or other form of experiential learning opportunities?

(5) Provided expertise through IPA assignments of SCS personnel?

(6) Provided summer experience for Agricultural faculty with SCS?

(7) Provided visits of faculty/administrators to SCS Centers?

(8) Employed graduates in permanent positions?

(9) Provided soil mapping, etc., for University farmland?

.(10) Write other activities in which your institution has become involved with SCS as a partner.

In terms of other involvements in the near future, we welcomed the suggestion made a few months ago when SCS personnel attended a conference on telecommunications held on the A&T campus and wish to follow up on the notion that the distance learning and telecommunication capacity my university and others are expected to have In place shortly for uplink satellite transmission, as well as downlink receiver capacity, will facilitate jointly developed and jointly managed in-service training for SCS personnel in the field, and advanced graduates on campus. We believe, too, that the future could hold promise for a jointly developed Center of Excellence stemming from a combination of Agricultural Engineering and Civil Engineering on our campus, with SCS field personnel. Centers involving other 1890s might focus on conservation cropping systems, improvements in no-till operations, flood control, remote sensing, sustainable production, etc.

In conclusion, let me say that while the mission, purpose and capacity of the 1890 universities have improved tremendously, as they certainly should have; and though the mission, purpose and service parameters of SCS have improved as well, we anticipate a more extensive "coming together" from these resources leading in the long term to a more satisfactory human environment, and a safer and more productive agriculture. New technologies will come to the forefront, especially in terms of water quality, recycling water for agricultural and industrial use, water storage and delivery, while concern for environmentally compatible land use will continue at an accelerated pace where scientists of SCS, or its new or more inclusive title, will operate at more demanding and more sensitive global levels. The 1890s would want to be a part of this exciting trip into the future.

We believe surface soils and underlying geologic strata can be identified suitably for solid waste disposal outside the community of black folks--such that environmental toxins will not be harbored there at the exclusion of other places, certainly a desirable role for soil survey.

We believe the special interest the 1890s have in those of limited resources will remain at a high level; that the concept of the family farm justifies expenditures from public coffers. However, the greater issue confronting the small farmer today is as much land loss in terms of acres in farm ownership as in terms of loss of soil washed or blown away; or loss in spirit or loss in hope lest this farm operator group becomes an endangered species. For we believe there can be strength in the diversity of human activity as there may be strength in biological diversity in the environment; and the 1890s would join SCS and similar agencies in giving serious attention to this premise.

Thank you for listening, and I wish you continued success for the remainder of your conference. Your work in soil survey is an important part of urban planning, regional planning, and certainly important to rural development and environmental management in general. You are to be conended.

REPORT FROM THE NATIONAL SOCIETY OF CONSULTING SOIL SCIENTISTS

TO TNE

1992 SOUTH-NORTHEAST COOPERATIVE SOIL SURVEY CONFERENCE

BY DENNIS J. OSBORNE, Ph.D.*

Both personally and as a representative of the National Society of Consulting Soil Scientists (NSCSS) I want to thank the Organizing Committee of this 1992 South-Northeast Cooperative Soil Survey Conference of the National Cooperative Soil Survey (NCSS). I am quite pleased to have this opportunity to acquaint some of you in the NCSS audience with NSCSS and to explain to you some of our goals and objectives.

All of us here have worked in creating meetings such as this, so we all know that when thing5 run smoothly and seemingly effortlessly, that someone did a lot of planning and coordination. Especially then I want to thank Horace Smith, his staff, and the local field staff who prepared our pits. I know they must have worked quite hard and we see the results1

In this matter of productive work I'm reminded of how one day Professor Buol, passing through our Soil Genesis Laboratory at North Carolina State University early in the morning, as he did every morning, saw me busily doing some task. Be asked what I was doing and I replied in the vein that I was "busy at so-and-so". He replied, "Well, I can see you're busy, but what are you trying to do?"

I've kept that in my thoughts over the years, because what I and many of us can often be seen doing is being busy, but exactly what we are doing isn't readily apparent1 So what have I as last year's President and our other officers and members who constitute the National Society of Consulting Soil Scientists (NSCSS) been doing?

I could summarize by saying that over the past four years we created an organization, stated long and short term goals as an organization, developed a most thorough and rigorous Code of Ethics, a National Registration Program for Professional Soil Scientists, a Board of Examiners to support that program, published a newsletter, have held five annual meetings, and the list could continue.

However, our time and the valuable contributions to be offered by others on the program limit how much I could "go on" as we say here in the South, so I wish to focus on the general rather than the particular.

*Past President, National society of Consulting Soil Scientists and President, Dennis J. Osborne and Associates, Box 5064, Raleigh, NC 17650

In addition, because our organization (NSCSS) like yours (NCSS) is ultimately an organization of individual men and women working with a common goal from relatively similar educational and experiential backgrounds, I want to speak from the personal case and urge you to extrapolate to **your** particular case and imagine the NSCSS membership not here today is actually just like anyone in this room.

consider that **I am a** processor of information. Relatively little of **my time is** spent conducting field soil surveys or laboratory analyses. While I certainly can do these and enjoy them, by far the greater call for my skills is to be an **interpreter** of basic or detailed soils data.

If I make my full or part-time living charging for this activity I am a consultant. Isn't this the same as in your Field, State, and National office? Do you think that because you are salaried you are not a consultant7 Of course you are and of differences between private sector and agency "consultants" I see but one: an agency "consultant" avoids downside risk at the expense of upside potential.

If we have common cores in experience and skills would you not expect that we would have common core problems too? We do indeed and these problems are what NSCSS deals with in an effort to minimize downside risk.

The National Society of Consulting Soil Scientists is a business organization composed of businesses engaged in the Professional Practice of Soil Science. We are a lobbying, educational and professional networking organization.

Why do you think Professional Engineers as a group are so "strong"? As a registered group they are not too old; here in North Carolina they gained registration in the **1960's,** I believe. So how did they become so recognized?

Simply put, they demanded to be recognized. As a trade association NSCSS demands recognition of the unique skills Soil Scientists bring to a problem. We bring the strength of numbers to bear on issues, and the strength of our commonly bound funds to spend on our activities.

Management of these activities is what separates NSCSS from most state societies or from an individual's efforts. We have a central office, and Executive Secretary, a Board of Directors, which meets twice yearly, and a group of officers elected on merit and past performance in the cause. Our President this year is Laurel Mueller, a lively lady with a wide-ranging business headquartered in **Penns** Park, Pennsylvania.

President Mueller has traveled to Indiana, New England, and the Midwest to explain this year what NSCSS does and to help form local organizations. Because we have a national membership, we have held annual meetings in Washington, Atlanta, St. Louis, Denver, and Newport Beach, California, so that we could meet with local soil scientists. Our meeting in January of this year was in California and was held as a joint meeting with PSSAC, the Professional Soil Scientist's Association of California. We were honored to have Dr. Bill McFee, President of the Soil Science Society of America address us and attend the meeting.

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Natlonal Soil Survey Center Report
South and Northeast Reglonal Soil Survey Conference

June 15-19, 1992
Prepared by James Ft. Culver and C. Steven Holzhey[1/]

We appreciate the opportunity to share some highlights of current Natknal Soil Survey Center activities.

Today's challenges are both exciting and demanding. As concerns of tight budgets dash with the excitement of new opportunities, we must look carefully at ourselves. our priorities, our products. and expectations of our customers. As a viable, dynamic Cooperative Soil Survey we must adjust to change, and we must market ourselves to changing clientele.

One step la to develop a strategic vision of where we are now and where we are going. This needs to be In a form that allows us to share our visions and expectations among ourselves and with others. Coordination of a strategk plan is one of the current activities In the Natknal Headquarters and the National Soil Survey Center. Through several sessions this year, involving the Soil Survey Division, Technical Centers and the States, we began formalizing a strategic plan for our soil survey of the future.

A wide variety of excellent items on strategk planning have been identified and discussed In each of these sessions. A brkf summary on the demand for more products and services by three broad categories is as follows:

Demand for more:

Activities related to data

-- Current data
-- Electronic data
-- Soil research
-- Soil monitoring
-In-house model
-- Levels of generalization of our soils Informatlon

Activities related to assistance

-- Training for users
Accessibilitv of expert knowledge
-- International activities
-- Consultations
-Multiple discipline Invdvement

Activities relat ed to quality soil survey
-- Maintaining soil surveys (MLRA)
-- Quality of our soil maps and data
-Kinds of soil interpretations

1/ Presented by C. Steven Holzhey, Assistant Director, Soil Survey Division, Natlonal Soil Survey Center, Lincoln, NE. James R. Culver is National Leader, Soil Survey Quality Assurance Staff, National Soil Survey Center, Llncdn, NE

Discussions covered several broad strategic Issues related to future demands for products and services. These include: program responsiveness and flexibility; staff technical capabilities: delivery and automation systems; international responsibility; and funding altematkes.

As a start, a plan Is In preparation which will outline *the Sol* Conservation Service - USDA perspective. Some of the factors and developments In this process are outlined below.

SOIL SURVEY IN THE FUTURE:

The concept of "finishing the once-over' no longer fits what we are dolng for at least three reasons:

(1) the once-over keeps changing as human activities change,

(2) dder soil surveys do not always meet current needs for data and interpretations (They wear out at accelerating rates.), and

(3) there Is Increased need for continuity of map joins and interpretations between survey areas.

Dr. Randy Brown, University d Florida, wrote an Interesting article

In a more graphic sense, the soil scientist must carry the **knowledge** across the interface between us and our customers in partnerships somewhat as fdlcws:

(1) **Soil** Survey production **(soil sclentlst** with knowledge of customer needs),

(2) Interface to customers (soil **sclentlsts/customers** in **partnership)** to assure transfer of **approprlate** knowledge In approprlate media and **formats, and**

(3) Customers reaching through the interface to obtain the information and knowledge they need.

We need people who know the patterns and processes **behind** the property data, people who know our information systems and how to use them, people who know the **quality** control procedures, and people who know the languages of customers We have to be Increasingly more knowledgeable about applications of Information. and **will** have to work In teams **with** others **outside** of **soil** survey to **remain** acquainted with needs of customers

SOME IMPORTANT FACTORS

-- The way we do buslness (Focus on total **quality** In terms of customer **expectations.).**

-- Greater **competltion** for funds.

-- **Maintalning** or **modernlzing** soil surveys by **MLRA** Instead of by county.

-- **Geographlc** Information Systems.

-- Documentation and **valldation** of **Informatlon.**

-- Global **perspective** to environmental concerns.

NATIONAL SOIL SURVM CENTER

Location: Uncdn, Nebraska **Established: 1988**

Personnel: Roughly **100** Full-Time Employees (Roughly 43 soil scientists and 55 other)

staffs:
- Quality Assurance - Roughly **40**
- Laboratory - Roughly **40**
- **Classification ***
- interpretations *
- **Soil** Geography and **Information** Systems •
  - Roughfy 20 total among the fast 3 staffs above

Facilities:
- **Soil characterization** laboratory
- **Editorial section** w/desktop **publishing**
- Access to university mini and mainframe computers
- Offices for visitors
- Training facilities
- Databases, **GIS**
- **Statistical** packages

Prime **responsibilities include:**

1. **Technical quality** of the National **Cooperative Soil** Survey

   - Making **soil** surveys
   - **Maintaining** and updating the soil survey information base
   - **Delivering** knowledge about how to use **soil** Information

2. Technical **evolution** of the National Cooperative Sol Survey

   - Defining and orchestrating needed change **(maintaining** the **scientific** and **technical capability** to orchestrate needed change)
   - Logistical and **organizational** support to the processes of technology transfer, research and development, impfementatbn

3. Sdvfng technical probiems **involving** soil resources **(international,** natlonai, and **SCS** priority)

   - **Interdisciplinary** and interagency consultations, research and development. techndogy transfer
   - **International** consultations, technology transfer

The Natlonai **Soil** Survey Center is a very busy **place, with** a wide **variety** of concurrent **activities** at all stages of development. Shared **seminars,** Interaction **with various** staffs, a stream of visitors and cdlaborators, and **cooperative** work on projects present excellent **opportunities** to Improve **professional skills** in **producing quality** products.

Activities at the National Soil Survey Center can be broadly grouped as **follows:**

DOCUMENTS
- National Soils Handbook
- Soil **Survey** Manual
- Keys to **Soil** Taxonomy
- **Guide** to Authors d **Soil Survey** Manuscripts
- Field Procedures Manual
- Laboratory Procedures Manual
- **MLRA** Handbook

MLRA
-- 20 plus MLRA's with some activity
-- Numerous multiple state sessions to develop MLRA MOU plans

CORRELATION
-- Eroded Mollisols
-- Dense Till
-- Andisols
-- Fraglpans

NASIS
-- Programming at Ft. Collins
-- Soil Survey Business Analysis Group. Interaction among Soil Sur. Dk.. NTCs, states and Ft. Collins
-- Conversion of Data to Informix Format
-- Soil Survey Schedule
-- SoilNet
-- Hydric Module

ADVISORY GROUPS
-- State Conservationists
-- National Cooperative Soil Survey
-State Soil Scientists - Futuring Group
-- Numerous Project Groups within the National Soil Survey Center - i.e., transects

LABORATORY DATA
-- Soils-8: Excellent Progress Poward Completion
-- Soil Investigation and Sampling Projects

RESEARCH AND DEVELOPMENT
-- Soil Genesis
-- WEPP, DRAINMOD, etc.
-Water Measurements and Studies
-Analytical Methods
-- Field Characterization of Ephemeral and Use-Dependent Properties

GLOBAL PROJECTS
-- Monitoring Sites
-Wet Soils
-- EMAP
-- National Soil Moisture and Temperature Map
-- Geomorphdogy Studies, MLRA 77

PUBLICATIONS
-- Cdor Photographs
-- Manuscript Tables Prepared from Edited 3SD
-- Two(or three)-part Manuscript

BUDGET INITIATIVES
-- Aerial Photographs
-- Computers - Project Soil Survey Offices

TECHNICAL - INTERPRETATIONS
-Water Quality
-Crop Yield Models
-- Hydric Soils
-- FOCS

SOIL GEOGRAPHY
-- STATSGO
-- MLRA update map

TRAINING
-- Soil Correlation
-- Basic Soil Survey - Field and Lab
-- Laboratory Data and Use
-- National Soil Correlation Workshop
-State Soils Workshop
-- Soil Scientists to NSSC
-- 3SD and Databases

CONCLUDING COMMENTS

A draft of Soil Survey Division priorities for Fiscal Year 1993 is included as a handout Based on current staffing and budget projections, several activities will have to be dropped or delayed. Such decisions require fairly intense communications, during the next few months, amongst the groups represented at this conference. The National Soil Survey Center has an excellent mix of professional staff collectively working toward a set of common goals. As these are adjusted, we want to be sure the adjustments are In accord wfth and complimentary to the goals of the National Cooperative Soil Survey at large.

Schedules for next fiscal year are now solidifying. This past year our Soil Survey Quality Assurance Staff accelerated the shift from traditional field assistance on final field reviews to more emphasis on soil survey operations in the early part of the project soil survey, special field studies, and multiple state MLRA activities. If you concur with this shift, we will appreciate your help in giving priority to those services through requests for assistance.

Please visit with our staff on any issues where we may be of assistance. We want to know how to better serve in these times when a day's quality service becomes ever more precious.

I have enjoyed sharing some thoughts with you today and am looking forward to a productive conference. The organizers deserve our compliments for succeeding In arranging this joint conference In which regions can Interact and In arranging a fine agenda and field trip.

USDA/SCS/Global Climate Change Activities

by John M. Kimble

Global change is more than a greenhouse driven change. It includes interactions among our climate, soils, water, air biological, and man-related factors

The Soil Conservation Service is involved primarily because of its leadership in the National Cooperative Soil Survey (NCSS). Soils are key factors in: (1) carbon cycling and sequestration; (2) desertification, productivity, and plant succession; (3) nutrient cycling and hydrologic processes, storage, transmission and transformation of environmental contaminants. The objective is to build links between the spatial/attribute data of soil survey and the teams working on global change and modelling global balances.

Soil physical, chemical, biological, and mineralogical properties are impacted by climate change and the activities of man. These have major impacts on the listed items.

SCS in cooperation with other partners in the National Cooperative Soil Survey (NCSS) are mapping soil carbon sources and sinks around the world, this includes carbonates and organic carbon.

Maps are being made of paleosols that are benchmarks of past vegetative shifts and climates regimes. These will help in making determinations of the possible effects of future climate changes based on earth systems history.

SCS and the NCSS are developing process models of soil genesis to evaluate impact scenarios of climate change on soil properties and landscapes.

Soil maps at the county, state, major land resource areas, or national scales are being developed. SCS is developing small scale digital soil geographic data bases for the United States to support global circulation models (GCM's). As well as developing maps, SCS is updating the clarifications of all the pedons in its data base and getting all of them georeferenced.

A national SCS soil moisture/temperature pilot project is underway to measure soil moisture and temperature and other atmospheric measurements at selected sites using meteor burst communications.

SCS is working with the University of Alaska and Agriculture Canada to gather information on permafrost affected soils. This is one of the largest potential sinks or sources of soil carbon if there are global climate changes. It is also an area with the least understanding.

SCS is working with its NCSS partners actively studying wetland processes in Texas, Louisiana, Oregon, Alaska, Minnesota, North Dakota, Indiana, and New Hampshire. These are long-term projects that will provide a better understanding of the wetlands and the genetic process in development of redoxomorphic features in soils.

SCS is working with universities to organize and hold meetings on soil modeling, wet soils, permafrost affected soils, and carbon dynamics. These meetings contribute to the increasing data base needed to understand possible climate change effects.

SCS is providing soil characterization and mapping support to the Long Term Ecological Research Network (LTER's).

The activities of SCS fall under the following science elements of the overall global change work: Climate & Hydrologic Systems: Biogeochemical Dynamics: and Earth System History.

SOIL CORRELATION ISSUES

Berman D. Hudson

June 1992

In about the year 2001 the last once-over soil survey on private land will be completed - probably somewhere in Michigan or Georgia. However, the approaching end of the once-over soil survey is already affecting us. For example, a number of things we once took for granted are now open to question. Most of us who have worked during the last 20 years or so have had a pretty comfortable, predictable existence. This is because those who came before us made some major decisions. When starting a new soil survey, we did not worry that much about the kind and scale of mapping materials we would use or how we would proceed with the soil survey.

With the advent of GIS and the emphasis on correlation throughout MLRA's, this has changed. We are now in the process of "remaking' a lot of decisions, which is forcing us to reconsider many of our assumptions and value judgments. We are also learning that decision making is not straightforward or linear, but more often involves a continuous process of backing up and re-assessing as technology changes. Decisions do not always stay made.

An example of this is mapping scale. A few years ago the decision was made that the standard mapping scale provided by SCS would be 1:24,000 orthophotoquads. If states wanted to use 1:12,000 scale, they would be required to fund the considerable difference. However, recently, USGS has developed a way to produce 1:12,000 quarterquads at about the same cost as 1:24,000 quads. This removes an economic and technological constraint, and theoretically allows us to use either 1:12,000 or 1:24,000 scale base maps for soil mapping. However, this raises additional technical issues. Are the two scales compatible? Will the mapping be so different that we cannot use the same map units at the two different scales? This forces us to rethink the relationship between soil-landscape mapping and map scale. This is done in the following issue paper titled "Map Scale in the Soil Survey." This issue paper is not presented to advocate a certain course of action. Instead, it is meant as an example of the kinds of basic re-assessment and fundamental analysis we soon may be forced to go through in many areas of the soil survey.

MAP SCALE IN THE NEXT GENERATION OF SOIL SURVEY

INTRODUCTION

Existing soil surveys in the United States are at a variety of scales. Most common are 1:20,000, 1:15,840, and more recently, 1:24,000. A number of on-going soil surveys will be mapped and compiled at 1:12,000. This scale will become increasingly common in the future. A recent policy directive mandated that all SCS soil surveys completed in the future will be compiled and published at a scale of either 1:12,000 or 1:24,000.

In meetings to plan for the regional correlation of soil surveys (i.e., MLRA update meetings), scale often is an area of discussion. Someone identifies a part of an MLRA in which a scale of 1:12,000 is needed. Someone else usually asserts that in other areas of the MLRA all important soil areas can be delineated at a scale of 1:24,000. This creates an apparent dilemma. Can both 1:12,000 and 1:24,000 scales be used for mapping and compiling soil maps in the same MLRA? If so, can the same map unit be compiled at two different scales? If only one scale is to be used, which one should it be?

The question of scale also arises when one decides to recompile existing soil surveys originally published at scales of 1:20,000 or 1:15,840 onto a new base without remapping. What scale should the new base be? Should it be the same, larger, or smaller than the original scale?

This paper examines these issues in light of our basic assumptions about soil mapping and map scale. These topics are very important as we plan for the next generation of soil surveys in the United States. This paper presents two options for dealing with map scale in the soil survey and recommends one of them.

SOIL SURVEY AND MAP SCALE

Soil scientists refer to maps at a scale of 1:24,000 as "detailed," and maps at a scale of 1:12,000 are considered detailed indeed. Since we think of our product as a "detailed map," we forget how large a piece of the actual world is condensed onto a typical soil survey atlas sheet. When represented on our 1:12,000 four) such a large leap? When placed in the entire scale contuinuum from 1:1 to 1:24,000 the change from 1:12,000 to 1:24,000 is extremely small proportionately.

The logical response to this, of course, is something like the following: "In the entire range of scale, the difference between 1:12,000 and 1:24,000 may not be so large. However, when you are working at those scales, at that particular place on the continuum, the difference is pretty great." This individual might continue, "I know that the same area on a 1:12,000 map is four times bigger than on a 1:24,000 map, so I can map a lot more detail - up to four times as much."

The last sentence above is based on an assumption that is fairly common in the soil survey. It is widely assumed that the amount of detail that will be mapped in a soil survey is highly correlated with scale. For example, assume that an individual mapped the soils in an area at a scale of 1:24,000. Then assume that another individual came in and mapped the same area at a scale of 1:20,000. The conventional thinking is that he/she would prepare a recognizably more detailed soil map. If yet another individual came in and mapped the same area at yet a larger scale, such as, 1:15,840, it is assumed that the third set of maps would have even more detail. By the time a fourth individual arrives on the scene and maps the area at a scale of 1:12,000, it is assumed that there would be much more detail than on the original 1:24,000 soil map. That is, as one progresses from 1:24,000 to 1:20,000, then to 1:15,840, and ultimately to 1:12,000, the amount of detail shown on a soils map will increase proportionately.

The scenario described above is based on the assumption that the amount of detail that will be shown on a soils map is highly correlated with scale. However, examining almost any published soil survey will provide ample evidence that this is not true. At a given scale, some parts of a soil survey will have many small delineations - "a lot of detail." However! other locations in the same survey area will have a relatively few large delineations. Just because one can cartographically delineate smaller areas on a soils map, he/she does not necessarily do so. The amount of detail on a soils map is mostly determined by the natural soil-landscape relationships in the survey area. One is not able to delineate increasingly smaller soil areas at larger scales unless these smaller, heretofore undelineated but mappable soil-landform units actually exist -- and can be identified on the photograph.

The following analysis shows what kind of soil areas might be affected as one goes from a scale of 1:24,000 to 1:12,000. The smallest delineation that can be shown on a soil map with an included symbol is about 1/4 inch by 1/4 inch, as shown here.

Table 1 shows the acreage represented by an area 1/4 inch by 1/4 inch on soil maps of different scales.

Table 1. Minimum Acreage Delineated at Various Scales

Map Scale	Acreage in 1/4 x 1/4 Inch Square (Approx.)
1:12,000	1.5 Acres
1:15,840	2.5 Acres
1:20,000	4.0 Acres
1:24,000	5.5 Acres

The information in Table 1 is informative. It tells us which soil-landform units can be delineated at a scale of 1:12,000, but which cannot be delineated at 1:24,000. These are soil areas which are larger than 1.5 acres (the 1:12,000 limit), but smaller than about 5.5 acres (the 1:24,000 limit). Therefore, going from a scale of 1:24,000 to a scale of 1:12,000 will affect only those mappable soil-landform

SUMMARY

Based on the preceding discussion, the following general propositions are offered concerning map scale in the soil survey.

1. The amount of detail that can be mapped in a soil survey area is mostly determined by the size of the naturally occurring soil-landform units. Simply going to a larger scale will not enable (nor force) one to carve increasingly smaller delineations out of existing soil-landform units.

2. Therefore, in the scale range of 1:12,000 through 1:24,000, the amount of detail that can be delineated on a soil map is not greatly affected by changing scale. Only a small proportion of total delineations will be affected in most soil surveys.

3. Changing scale from 1:12,000 to 1:24,000 will affect only those naturally occurring soil-landform units larger than about 1.5 acres (the 1:12,000 limit) but smaller than about 5.5 acres (the 1:24,000 limit). Soil-landform units larger than about 5.5 acres can be delineated at both scales. Similarly, changing scale from 1:12,000 to 1:24,000 will affect only those linear units (floodplains, etc.) wider than 250 feet but narrower than 500 feet.

RECOMMENDATIONS

Considering the foregoing discussion, there are at least two viable options for dealing with scale in the soil survey. One option is, depending upon local need or preference, to map both at 1:12,000 and 1:24,000 in the same MLRA. Most map units will not be affected. However, some smaller (1.5 to 5.5 acre) soil-landform units will be delineated at 1:12,000 and not at 1:24,000. For example, a 1:24,000 scale survey might map alluvium and colluvium in the same unit as a complex. A 1:12,000 survey with the same landform might separate them. Such situations will cause some correlation and joining problems. However, only a small proportion of map units will be affected. Reasonable correlation and joining could be achieved.

Another option is to designate 1:12,000 as the mapping scale for the next generation of soil surveys. This would involve a phase-in program so that, at the end of, for example, five years, all soil surveys would be mapped and compiled at a scale of 1:12,000. There are several advantages to this. First, 1:12,000 allows one to show small areas of contrasting soils. Although units between 1.5 and 5.5 acres in size are relatively few in number, they can be very important. For example, small alluvial areas often are either wetland or prime farmland. In soil survey areas with strong relief, most soil use and management occurs on either ridges or alluvial/colluvial areas less than 500 feet wide. It is important to use a scale that allows one to show these small areas cartographically.

Mapping soils at larger scales has been viewed with some apprehension. The biggest fear is that going to a larger scale will inevitably result in a proliferation of delineations in every landscape position. This, it is feared, would lead to reduced mapping productivity and greatly increased cartographic costs. However, in the scale range of 1:12,000 to 1:24,000, such fears have little scientific basis. Underlying soil-landscape relationships, not map scale (at the 1:12,000 to 1:,24,000 range), largely determine the detail that can be mapped. Therefore, by going to a universal 1:12,000 scale, one could delineate small, contrasting, important soil areas in the size range of 1.5 to about 5.5 acres - areas which could not be shown at 1:24,000. However, larger soil delineations would not be affected. In summary, going to a universal 1:12,000 scale for the next generation of soil surveys has the following advantages.

1. One common scale will expedite joining, and correlation among areas.

2. Much of the cartographic limitations to delineating small, but important soil areas will be eliminated. This will permit us to provide a better product by delineating small, contrasting areas where needed.

3. Most delineations (those larger than about 5.5 acres) will not be affected. Therefore, mapping rates will not decrease significantly, nor will there be a large increase in compilation time and cost.

SOUTH AND NORTHEAST REGIONAL SOIL SURVEY CONFERENCE
NCG - SUPPORT FOR SOIL SURVEY
June 15-19, 1992

W. R. FOLSCHE
HEAD, NCG

* Name change from National Cartographic Center to National Cartography and GIS Center (NCG).

* Change in Branch Chiefs - Hugh Allcon now the NCSS Branch Chief.

* Hoff Owen has been hired to coordinate SSURGO. She will work through the regional GIS person in coordinating work in states.

* NCG will provide 60 percent of the cost of digitizing to SSURGO standards for surveys sent to NCG for contracting. This is up to $100,000 (NCG's total funds for the year). First come--first served. The 60 percent is for only the first three quarters of the fiscal year.

* Future publishing on ortho will be at 1:24,000 and 1:12,000 scale.

* NCG can use map finished digitally for going directly to negatives and then to press,

* NCG is now putting the text for published soil surveys through a device (image setter) for a high quality text.

* NCG is working on a process to reduce the time on general soil maps used in soil survey publications. Plans are to provide the states with a digital formatted generalized soils map, STATSGO, and have states make any changes needed. The digital map can easily be changed and negatives can be made directly from digital products.

HEAD
Dick Fotsche

GIS & Remote Sensing Branch
Emil Horvath

- Geographical Data Bases
  Vacant
- ADP Section
  Ed Morgan (Temporary)

Map Construction Branch
Lee Sikes

- Planning/Tech Publishing
  Dennis Gaster (Temporary)
- Water Resources
  Don Rejda
- Automated Mapping
  Jill Schuler

NCSS Branch
Hugh Alicon

- Aerial Surveys/Photobase
  Victor McWilliams
- Negative Prep
  Marsha Reed
- Map Finishing/Contracting
  Don Deal

Operations & Reproduction Branch
Dennis Darling

- Operations
  Harold Tallmon
- Reproduction
  Don Talley

April 1992

Status of Policy on Hydric Soils and Wetlands
Prepared By
Maurice J. Mausbach
For Presentation at the South/Northeast and West Regional Work Planning Conferences

Introduction: I find myself repeating things when reporting on hydric soil and wetland issues. One of the things I keep saying is that the hydric soil definition and criteria are a continuing issue especially with respect to the public comment on the Federal Manual for Identifying and Delineating Jurisdictional Wetlands. Special interest groups on both sides of the wetlands fence are keenly interested in how we in the National Cooperative Soil Survey (NCSS) manage and control the quality of the hydric soil lists. Some groups just plain do not trust us. Other groups are very interested in the scientific basis for the hydric soil definition and criteria and will perhaps challenge the National Technical Committee for Hydric Soils (NTCHS). In this report, I will discuss a brief history, organization, and activities of the NTCHS, some current issues concerning hydric soils, and some issues on the Federal Wetlands Manual and our agency's National Food Security Act Manual.

Background: The Soil Conservation Service (SCS) began work on a hydric soil definition in 1977 at the request of the Fish and Wildlife Service (FWS). Blake Parker, a soil scientist, was working with FWS to develop a definition of hydric soils. Keith Young was assigned the task to work with Blake on developing a defintion of hydric soils and a list of hydric soils for use in the FWS National Wetlands Inventory. From 1977 to 1981 definitions were developed and tested in field studies. In 1981 the NTCHS began as an ad hoc group with the charge to develop a definition and criteria for hydric soils and a list of hydric soils. Dr. Guthrie chaired the group which consisted of Keith Young, Blake Parker, Keith Schmude, Carl Thomas, Arville touchet, Paul Johnson, and Del Fanning. In October of 1981 the first national list of hydric soils was distributed for state and NTC review. This list generated many comments both from SCS and the Land Grant Universities.

In early 1985 the present National Technical Committee for Hydric Soils was organized by the SCS Deputy Chief for Technology and the Corps of Engineers (CE); Environmental Protection Agency (EPA), and FWS were invited to assign permanent members to the committee. Dr. Guthrie also invited experts from the university community to join the committee. Keith Young replace Dr. Guthrie as chair of the NTCHS shortly after the committee was formed. It was under his leadership that the criteria were developed. In 1985, I replaced Keith as chair.

In 1985 congress passed the Food Security Act (FSA) which cited the hydric soil criteria as part of the definition of wetlands as part of Swampbuster legislation. Also in 1985, the committee published the first edition of Hydric Soils of the United States. The NTCHS published the second edition in 1987 and the third edition in 1991. The 1987 wetland manuals of the CE and EPA also required the use of hydric soil lists.

National Technical Committee for Hydric Soils: The NTCHS is an interagency, interdisciplinary committee. Its functions are to:

- Develop and improve hydric soil definition and criteria

- Publish a national list of hydric soils

- Respond to comments on hydric soil criteria

- Provide technical consultation on hydric soils to other technical groups

- Investigate new technology for defining hydric soils

The committee representation includes 7 from the Soil Conservation Service (SCS), 5 from universities, and one each from EPA, FWS, CE, Bureau of Land Management (BLM), Forest Service (FS), and a private consultant. Of the 18 total members we have 13 soil scientists, 4 biologists, and 1 engineer. The SCS members include:

- Maurice Mausbach (Chairperson)
- Ray Miles (West representative)
- C. L. Girdner (Midwest representative)
- De Wayne Williams (South representative)
- H. Chris Smith (Northeast representative)
  (State soil scientist representative)
- Billy Teels (National Biologist)

The other members are:
- D. Fanning, University of Maryland
- Richard Guthrie, Auburn University
- W. Patrick, Jr., Louisiana State University
- R. W. Skaggs, North Carolina State University
- J. Richardson, North Dakota State University
- P. Reed, FWS
- R. Theriot, CE
- W. Sipple, EPA
- C. Voigt, BLM
- P. Avers, Forest Service
- W. Blake Parker, private consultant

The committee is chaired by SCS. Committee membership has gradually grown to the present 18. Avers, Voigt, and Richardson have been added in the past year.

The committee usually meets once a year to review comments on the hydric soil definition and criteria. They often meet in an area to study hydric soil issues in the field. The next meeting is scheduled for Fargo, North Dakota in August. The committee will tour the hydric soil research sites in the pothole area.

Hydric soils: The most recent changes in the hydric soil criteria added frequency to the saturation criterion to require frequent saturation (more than 5 out of 10 years). This change matches frequency criteria for flooded and ponded soils. Duration for saturation was increased to more than two weeks during the growing season. This change reflects current research that shows, on average anaerobic conditions occurring after 10 to 20 days of continuous saturation. These changes do not affect the list of hydric soils as our soil property record is not specific enough to distinguish between 1 or two wekks of saturation. The NCSS definition of a seasonal high water table is:

> "A zone of saturation at the highest average depth during the wettest season. It is at least 6 inches thick, persists in the soil for more than a few weeks, and is within 6 feet of the soil surface."

The NTCHS revised the criterion for depth of water table in sandy soils to occur above 0.5 feet instead of 1.0 feet. Sandy soils have sand, coarse sand, or fine sand textures in the upper 20 inches. This requires the water table at the surface for these sandy soils. This change is supported by the thickness of the capillary fringe in these soils. The major affect of this change is for sandy soils on the lower Atlantic Coastal Plain.

The current hydric soil definition and criteria are given in the appendix. The SCS publishes a national list of hydric soils for the Umted States. The list is computer generated by matching the criteria to soil properties on the Soil Interpretations Record (SIR). Soils are added and deleted from the national list only buy changing the estimated properties on the SIR. The national list contains taxa at the series level of Soil Taxonomy. The third edition was published in June 1991. This publication is in high demand by wetland delineators and other users of the information. This national list is maintained on computer file and can be subdivided by state.

The local or field office lists of hydric soils are the most specific for use in wetland determinations. They are generated using the specific information in the state soil survey database for the soil survey area by matching the criteria with soil properties of the map unit components. The software also allows for adding information about included soils. The lists contain information on the landscape position of the hydric component of the map unit. It is extremely important that the sod property records for components of map units are of the highest technical quality because these lists are coming under extreme scrutiny.

Hydric soil issues: The major issue for hydric soils is our quality control and quality assurance procedures on the soil properties used in the hydric soil criteria as they reflect changes in the hydric soil lists. I emphasize that we must document any changes that affect a soil either being added or deleted from the list of hydric soil map units or hydric soil series. The NTCHS has a subcommittee drafting proposals for the kind and amount of documentation. I know that Florida has already developed a system to track and document changes in hydric soils. I believe the South National Technical Center has circulated this system to all states for comment. Other National Technical Centers (NTC's) are doing the same. We have been asked by outside groups to monitor these changes at the National level, but have been able to respond that our NTC's and National Soil Survey Center Quality Assurance staffs are performing this function.

Some individuals are suggesting that the NTCHS publish changes in hydric soil criteria in the Federal Register for public comment. We presently file notice of change. We have been able to thwart these suggestions but the pressure remains. These same individuals think we should publish for public comment changes to the lists of hydric soils. It is extremely doubtful that this will happen, but if it did it would impact most of what we do in soil survey. Because of these issues, we must be extremely attentive to our quality assurance of the soil property record and of changes to the hydric soil lists.

The NTCHS continues to review our understanding of soil processes in wet soils. The period of saturation, flooding and ponding necessary for a soil to become anaerobic is a crucial issue. In this respect, I am working with Dr. Jimmy Richardson, North Dakota State University, to review the literature on the biogeochemical processes in wet soils. One of my goals is to develop a generalized kinetics framework from which to deal with time needed to develop anaerobic conditions. Major factors are organic matter content, soil temperature, soil wetness characteristics, pH, and the kind of organic matter available to the microorganisms.

Depth to water table and saturation in the capillary fringe are continuing issues with the hydric soil criteria. Saturation in the capillary fringe is part of the current water table definition. The criteria now read that water tables are less than a certain depth such as 1.5 feet. By our database convention, this in fact means that the water table is at 1.0 feet, because we only record water table depths by 0.5 foot increments. There is a difference of opinion as to the capillary fringe and development of anaerobic conditions. There are some reports in the literature of reducing conditions in the wetter part of the capillary fringe.

In an effort to resolve some of the issues, the SCS in conjunction with the CE has extended the wet soils research projects. In addition to the sites in Louisiana and Texas, we are contracting with Dr. Richardson, North Dakota State University; Dr. Huddleston, Oregon State University; Dr. Ping, University of Alaska; Dr. Franzmeier, Purdue University; and Dr. Veneman, University of Massachusetts to study water tables, oxidation reduction potentials, and other soil processes. The information will help in understanding soil processes in these wet soils, help to support or refine hydric soil criteria, and assist in defining aquic conditions in soils. The study in Alaska will also help refine biological zero in cold soils.

Federal Wetlands Manual: The first edition of the Federal Manual for Identifying and Delineating Jurisdictional Wetlands was published in 1989. During 1990 the CE and EPA held a series of public hearings on the manual. The interagency committee responsible for the manual has redrafted the manual addressing the concerns of the public and wetland delineators. The revised manual was then revised by the National Council for Competiveness which is chaired by the Vice President. These revisions were then published in the Federal Register for public comment. We received over 80,000 comments, which the EPA is now summarizing. The interagency technical committee is reviewing the technical comments and are making technical recommedations to the Vice Presidents committee on the Federal Manual. The soils section of the Federal Manual needs major reviewions regardless how the hydrology criterion develops.

Changes in the 1989 manual include:

- The hydrology criterion is separate from hydric soils and requires 15 days of inundation to the surface and/or 21 days of saturation at the surface.

- The growing season for hydrology is the interval between 3 weeks before average date of last killing frost in spring to 3 weeks after average date of first killing frost in fall.

- Specifies the use of hydric soils criteria and minimizes the use of hydric soil (morphological) indicators but requires field verification of hydric soils.

- Emphasizes that all three criteria must be met for an area to qualify as wetland.

- Allows for the use of wetland hydrology indicators to determine hydrology under certain circumstances.

The hydrology criterion remains the major stumbling block and it is anybody's guess at what it will be. I can guarantee you that it will be different from what we are presently using in the National Food Security Act Manual (NFSAM).

The wetland delineation community has asked us to develop wetland hydrology (hydric soil) indicators for saturated soils. Hydrology from saturation is the most difficult criterion to measure and evaluate in the field. Measurements must be made over a multiyear period when weather is close to normal. Therefore, soil characteristics that correlate to wetland hydrology are extremely important in identifying wetlands in the field. We started out by trying to have a national list of indicators, but have now decided to develop lists of indicators on a regional or perhaps a state basis with the NTC's monitoring their development and approving the use of the indicators. Florida has set develop an excellent set of indicators which may work in other states. One of the key problems in developing indicators is that non soil scientists use and sometimes misuse of them. Most of the indicators are very technical and require a soil scientist's expertise. It is my believe that one of the main problems with the 1989 Federal Wetlands manual was the misuse of the hydric soil indicators.

Summary: Hydric soil and wetland issues are at the forefront, politically and scientifically. We in the National Cooperative Soil Survey are being asked to better quantify are information on soil saturation, flooding and ponding and to further develop our knowledge on genetic soil processes in wet soils. We must develop documentation to support our technical decisions to change soil properties that impact the hydric soil status of a soil series or map unit delineation. We must also have quality assurance and qualify control procedures in place and operating to be albe to respond to public question on the changes in the lists.

APPENDIX
DEFINITION OF HYDRIC SOIL

A hydric soil is a soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part. The following criteria reflect those soils that meet this definition.

CRITERIA FOR HYDRIC SOILS

1. All Histosols except Folists, or

2. Soils in Aquic suborder, Aquic subgroups, Albolls suborder, Salorthids great group, Pell great groups of Vertisols, Pachic subgroups, or Cumulic subgroups that are:

a. Somewhat poorly drained and have a frequently occurring water table at less than 0.5 ft from the surface for a significant period (usually more than 2 weeks) during the growing season, or

b. poorly drained or very poorly drained and have either:

(1) a frequently occurring water table at less than 0.5 ft from the surface for a significant period (usually more than 2 weeks) during the growing season if textures are coarse sand, sand, or fine sand in all layers within 20 in, or for other soils

(2) a frequently occurring water table at less than 1.0 ft from the surface for a significant period (usually more than 2 weeks) during the growing season if permeability is equal to or greater than 6.0 in/h in all layers within 20 in, or

(3) a frequently occurring water table at less than 1.5 ft from the surface for a significant period (usually more than 2 weeks) during the growing season if permeability is less than 6.0 in/h in any layer within 20 in, or

3. Soils that are frequently ponded for long duration or very long duration during the growmg season, or

4. Soils that are frequently flooded for long duration or very long duration during the growmg season.

Revised NTCHS 9/27/90

Peaaibility of Using
Satellite Imagery in Soil Survey

Carter A. Steers

The intent of my presentation is to cover three topics:

1. Examples of satellite imagery,
2. Uses of this imagery in soil survey and resource monitoring, and
3. Project test of Wet Area Classification and Wetland Maps.

I often feel we have exaggerated the use of multi-scanner data for resource surveying and monitoring; and then comes along a project in which satellite imagery is an extremely beneficial tool. Most all resource scientists have seen examples of satellite imagery and all of these imageries have been used or tested for various resources survey and monitoring with varying successes.

The following Table 1 compares satellite imagery scenes. Examples that have been sent to field from the National Cartography and Geographic Information Systems Center (NCG) are a LANDSAT scene from northern Alabama, a TM scene from Lawton, Oklahoma, and a SPOT scene from the Dallas/Fort Worth area, Texas.

Use of satellite imagery for soil mapping has been limited. Minor uses have been made where color infrared (CIR) imagery has been used as a tool to aid in delineating soil map units, especially where vegetative changes or surface moisture differences are obvious on CIR imagery and inseparable with black and white photography. Also, LANDSAT imagery has been used as base source data for general soil maps of states or regional size area, such as the State Soil Geographic Data Base (STATSGO).

We have recently tested, and are still testing, SPOT panchromatic lo-meter imagery for field base maps or for compilation base for digitizing STATSGO. These tests include Polk County, Iowa; Benton County, Arkansas; Stone County, Mississippi; and Greenbriar County, West Virginia. The tests in these states have proved satisfactory for soil compilation and digitizing. Image quality has been appraised by the states form very poor to acceptable. In the Polk County, Iowa, test, which included a scale blow-up to 1:20,000, image quality was very poor but coordinate accuracy was acceptable. Arkansas and West Virginia are making good use of SPOT quads in re-compilation and field compilation at a scale of 1:24,000. Stone County, Mississippi, is updating a soil survey using 1:24,000 SPOT quads and has plans for publishing a survey on such images.

Quadrangle information, such as streams, contour, and transportation, have been photographically reproduced on the SPOT quad to enhance the base map for field work or map compilation. SPOT quads are not meant to be a replacement for orthophoto quads, but may be a substitute when no geo-referenced photobases are available.

Wetland and wetland maps are of great interest to most of us who deal with topics of the present farm bill. NCG has been involved in an 8 state Remote Sensing Wetland Recertification Project, to test the use of this same imagery in detecting land cover change, as a part of a review and update process.

As source data, 3 to 5 digital scenes from TM or SPOT were acquired and Soil Conservation Service (SCS) and U.S. Fish and Wildlife Service (FWS) wetland maps were digitized. The objective was to test SPOT 20-meter and TM 30-meter data to detect land use changes and wet surface areas. One scene from each site was selected for use as the standard for dry surfaces, minimum plant growth, or dormant season. Additional scenes were selected to represent wet periods after an average runoff rainfall had drained from the surface.

I have limited the results of this presentation to Delaware County, Indiana; Webster County, Georgia; and Moyock Quadrangle, Virginia; because of the time involved and the fact that these are a good representation of study results. *Table 2* gives a percentage of the area of agreement of FWS and satellite imagery classifications with SCS delineated wetlands.

There are three comments I would like to make about the findings:

1. water areas were not included as wetland in SCS wetland maps,
2. water and riparian areas were the sources of wetlands for most of the FWS wetland maps, and
3. remote sensing classifications included most water, wet surface soils, and native hydric vegetation, and remote-sensed areas were consistently higher in total acreage in map presentation.

A high degree of accuracy was accomplished for land-use changes, in areas of native vegetation to open or cropped areas, but the process requires multi-images classification in some instances. Multi-image classification increased the accuracy assessment of water, wetness, and vegetation and, in the the instance of Delaware County, Indiana, SPOT scenes were merged to create a multitemporal hybrid image for accuracy improvement. When this hybrid image was classified, the following accuracies were assessed, using photo interpretation as a qualifier. Water areas were 100 percent correct, woody vegetation 100 percent correct, and wet or saturated soil was 86 percent correct.

Based on the study, the following recommendations would be made:

- Ground truth should be built into the process with close cooperation with field offices.
- Multitemporal satellite image data should be a part of planning.
- Use of late spring and early fall imagery are best scenes for this work.
- Limit imagery use to only LANDSAT and TM data because of cost, availability, and number of spectral bands.

Table 1.
Satellite Remote Sensing for Resource Management
Comparison of LANDSAT to SPOT

Platform	LANDSAT-4,5		SPOT-1,2	
Altitude	705 km (438 mi)		832 km (516 mi)	
Instrument package	Single mode instruments -Nadir only		Dual mode-twig instruments-off Nadir to 23 possible	
	Multi-spectral Scanner (MSS)	Thematic Mapper (TM)	Multi-spectral Scanner (XS)	Panchromatic Scanner (PAN)
Area imaged, per scene	180 by 180 km (112 by 112 mi) (8 million acres)		At Nadir:	60 by 60 km (37 by 37 mi) (889,000 acres
Pixel ground resolution	80 by 80 m 262 by 262 ft	30 by 30 m 98 by 98 ft 120 by 120 m 394 by 394 ft	20 by 20 m 66 by 66 ft	10 by 10 m 33 by 33 ft
Number of bands	4	7	3	1
Spectral sensitivity of bands	l-green 2-red 3-low near IR 4-low to upper IR	l-blue 2-green 3-red 4-near IR 5-mid IR 6-thermal 7-mid IR	l-green 2-red 3-near IR	l-combined green, red, near IR

Table 2.
Percentages Agreement in Test Quadrangles
with SCS Delineations

	Indiana	Georaia	Viroinia
FWS	21 %	__	82 %
SPOT	69 %	__	--
TM (1986)	__	67 %	82 %
TM (1991)	__	63 %	74 %

The academic requirements for the entry level (GS-5/7) soil scientist positions are: A degree in soil science or a related discipline which includes thirty (30) semester hours, or equivalent biological, physical or earth science, with a minimum of fifteen (15) semester hours in such subjects as soil genesis, pedology, soil chemistry, soil physics and soil fertility.

--- O R ---

A combination of education and experience with courses equivalent to a major in soil science or a related discipline which includes at least thirty (30) semester hours in the biological, physical, or earth sciences. At least fifteen (15) of these semester hours must be in the area of the above stated courses, plus appropriate experience or additional education. (The quality of the combination of education and experience must have been sufficient to demonstrate that the applicant possesses the knowledge, skill and abilities required to that normally acquired through the successful completion of a full four (4) year course of study in soil science or a related discipline).

The requirements for GS-9 and above are as following:

In addition to meeting the basic entry qualification requirements, applicants must have either specialized experience or directly related education in the following:

	EDUCATION	SPECIALIZED EXPERIENCE
GS-9	Two (2) full years of graduate level education or master's or equivalent graduate degree	One year at least equivalent to GS-7
GS-11	Three (3) full years of graduate-level education or Ph.D. or equivalent graduate degree	One year at least equivalent to GS-9
GS-12 and above		One year at least equivalent to next lower grade

Classification Standards and Qualification Requirements are revised by OPM. Recommendations for revision may be issued from SCS, Human Resources & EEO Division, through USDA, Office of Personnel, to OPM for approval/disapproval. The soil scientist Qualification Requirements were revised on October 1990. The soil scientist Classification Standards have not been revised recently, and I am not aware of any plans to do so in the near future. However, if you have questions or concerns regarding the soil scientist Classification Standards, you may wish to contact the;Classification and Evaluation Branch, Human Resources and EEO Division, in Washington, D.C.

The hiring procedures for vacancy soil scientist positions at the entry level (GS-5/7) are made through the SEU registers. Employing offices submit requests to SEU to fill their vacancy positions. SEU submits the top qualified applications by score order to the requesting office(s), and that office or state makes the selections for the vacancy position(s). For GS-9 and above, selections may be made through the merit promotion procedures within SCS.

1992 South-Northeast
Cooperative Soil Survey Conference

Panel Discussion on
SCS Academic Requirements and Hiring
Procedures for Soil Scientists

Comments on University Curriculum Changes by:

H. J. Kleiss
N. C. State University

Nearly thirty years ago as I was embarking on a B.S. degree program in Soil Science, the career opportunities, that I was aware of, included work with the Soil Conservation Service or other federal agency or perhaps a state agency with land resource responsibility. The other major career goal was for university research or teaching and of course required an advanced degree. Curricula dealing with soil science were fairly narrowly focused and certainly maintained a strong agriculture orientation. It was about this time, however; that the dramatic environmentalmovementheightened concerns for land use planning, promulgated sweeping regulations and mandated environmental impact assessments. Demands for improving waste disposal focused attention on septic systems and land application of municipal sludges and other wastes.

It was in this context of a changing role for soil scientists that, twenty years ago, armed with a Ph.D. in Soil Science, I was hired by an environmental and geotechnical consulting firm. Soil Scientists had not quite made the transition to the private sector, at least not by title, because my title was Ecologist. A Soil Scientist was still seemingly an unknown profession in those circles at that time.

It is clear that the twenty years since have seen great changes in the role of soil scientists in the private sector. Soil scientists have had to expand their understanding of soil properties and of how soils are distributed across the landscape. The making of a soil map and preparation of a good inventory **of soil properties** no longer satisfied employer needs. This included the Soil Conservation Service. More than a strong basic science approach to soils was desired in our B.S. graduates. At least at N.C. State, students with degrees in our agronomy curriculum or our natural resource based conservation curriculum seemed to be more competitive in the job market than graduates with a pure B.S. degree in Soil Science. Our soil science curriculum was very strong in math, chemistry and physics. While this may have been appropriate as preparation for graduate school, it apparently did not serve the B.S. level graduate. Decreasing student numbers in our soil science curriculum prompted us to drop this B.S. degree track in 1984 and to emphasize the soil science options within our agronomy curriculum and the conservation curriculum.

The past 3 or 4 years have seen a very Significant resurgence in environmental interest. students from very diverse backgrounds and many with an urban perspective are seeking curricula in "environmental science". This became very evident at N.C. State when we proposed to change the name of our conservation curriculum to natural resource curriculum. Campus wide interest resulted in restructing this curriculum and increasing to seven the number of concentrations within the new natural resource curriculum. Two of these options or concentrations are focused on soils. One is called Soil Resources and the other is entitled Soil and Water Systems.

As these changes have occurred over the past 20 years, it is interesting to note that the basic soil science core courses have remained relatively stable. Following our introductory soils course, we still include a course on soil fertility, one on physical properties, one on genesis classification and mapping, one dealing with water management and a capstone course called soil and crop management. Two newer additional courses entitled " Alternative Agricultural Systems" and "Role of Soils in Environmental Management" illustrate expanded applications of the traditional core.

The changing focus of soil science related curricula is most vivid not in the soils courses themselves, but in related courses that complete the curriculum package. We now include opportunities to take courses in hydrology, hydrogeology, waste management, environmental economics and environmental law. Unfortunately, needs and demands have generally outpaced our ability to develop and offer new courses especially in a period of diminished faculty, staff and resources.

The challenge facing Soil Science teaching programs is illustrated by the diversity of students in our introductory soils course. Out of 130 students in one semester, 35-40 different curriculum options may be represented. These range from geology and engineering to botany and animal science. Providing a distinct focus for teaching the application of soils knowledge is certainly difficult with this many unique interests. It also seems that today's students exhibit less tolerance for subjects that aren't narrowly confined to their immediate needs and application.

Reviewing and hopefully improving our courses and curricula is a continuous albeit sometimes slow process. Regular reviews require input from alumni and from employers as to the appropriateness of our programs. Curricula must be justified in terms of the training and preparation provided. The concern for the training of soil scientists now has national attention. This Fall at the Soil Science Society of America annual meeting in Minneapolis, a one-day symposium entitled "Soil Science Education: Philosophy and Perspectives" is planned. Some of the concerns and challenges that I have mentioned are to be discussed.

As Universities strive to improve our teaching programs and satisfy employer and professionals needs, your input is certainly necessary. We ask for your assistance and cooperation in preparing future soil scientists.

SOIL SCIENCE CURRICULUM, PRESENT AND FUTURE NEEDS

Peter L.H. Veneman
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The needs of the modern soil science student are different from those several decades ago. Most of the students in the past either came from a farm background or had considerable exposure to the agricultural aspects of society. In general, the student's future was clearly identified: most would end up mapping, researching, or teaching in agriculturally related fields. Their training was strongly rooted in the physical sciences including geology. Some actually were trained in geography or geology before gaining an interest in soils. Whatever the student's background, the typical soil science curriculum some 15 to 20 years ago consisted of en introductory soils course fortified with additional courses in fertility, chemistry, physics, and morphology and classification. Depending on the institution, the student also may have taken courses in mineralogy and forest soils. Additional courses were required in agronomy, plant physiology, plant nutrition, geology, geomorphology, and air-photo interpretation.

With changing times, the educational and social background of the students has changed es well. Especially in the more "urbanized" states, students with a non-agricultural background dominate. Agricultural knowledge, in the past assumed to be common, now needs to be acquired. In our agronomy course et the University of Massachusetts, for example, we have to spend several class and laboratory hours teaching about farm machinery. While the lack of a farm background by itself may not be detrimental, most of the modern students lack the special bond with agriculture. Instead, they often have a strong interest in the environment. This change in direction is a reflection of the changing market place. Most of our graduates will be working outside the traditional areas of employment like government agencies and universities. Just like the role of the soil scientist wihin the Soil Conservation Service is changing from a mapping to a service mode, modem soil science students should have a curriculum reflective of the maturing of soil science as a profession. A modern soil science curriculum still requires the broad background in the biological and physical sciences, however, additional courses in computers, GIS, remote sensing, hydrology, and modeling are needed to prepare our students adequately for the outside world.

Although there always will be a place for students educated in the traditional fashion, a modern curriculum has to reflect the changes occurring in society. Even the role of the soil scientist consultant is continuously changing. Initially, most of the private soils consultants were retired SCS personnel who had strong backgrounds in the procedures of the National Cooperative Soil Survey. Many of our younger private soils consultants often lack this SCS tradition, and certainly lack the soil surveying experience.

soil science education of the future should incorporate the points discussed above. There also is a great need for continuing education programs to train the working professional. In the regular 4-year program we should require courses in hydrology, computer science, remote sensing, and GIS. Team-taught courses discussing the fate of chemicals in the soil environment should be seriously considered as well. Our traditional course* should not just get a facelift by changing the name, but it should be accompanied by changes in content reflective of the actual needs of the future soil scientist professional. New courses need to be created to provide a strong soil science-based knowledge of processes affecting the quality of our environment. The curriculum of the future needs to be more quantitative. General statements do not suffice any longer but need to be quantified. With ever diminishing resources at most state institutions, we may even consider creating regional courses. A good example is the Northeast Regional Soils Fieldtrip, which allows students a better appreciation for the regional variability in soils. A similar program perhaps can be created in soil survey through a regional summer camp.

In addition to the above suggested changes in our educational approach, we should provide up-to-date training for working professionals. Soil scientists are not the only professionals interested in the vadose zone. Whether we like it or not, many non-soil scientists are eager to move into this area of expertise if the products of educational programs are not meeting the needs of the real world. Geologists. engineers, biologists, and environmental scientists generally have some soils background but require additional training to adequately function as a soil scientist. In New England, we have established a regional soil science certificate program. Students can take soil science courses at any of the New England landgrant institutions and are granted a certificate upon completion of 15 credits in soil science. Most courses are offered at night or during weekends. These are standard university courses taught by regular university faculty. During the past 2 years some 32 students enrolled in the program, 9 of which have been issued a certificate of completion.

The next few years will be quite challenging. Reorganizations at most educational institutions will result in fewer soils faculty who have to teach more courses to a more demanding clientele. This shift in resources seems ironic at a time when interest in soil science is rapidly increasing and the profesional opportunities are probably greater than ever before. Only if we are willing to change our curriculum in anticipation of future needs of our graduates, can we assume that Soil Science will be a viable profession for years to came.

SCS ACADEMIC REQUIREMENTS AND HIRING PROCEDURES FOR SOIL SCIENTISTS.

A PANEL DISCUSSION - NHQ, SOIL SURVEY DIVISION ROLE

JAMES H. WARE, SOIL SCIENTIST, SCS

SOUTH AND NORTHEAST REGIONAL SOIL SURVEY CONFERENCE
ASHVILLE, N C
June 14-19, 1992

As my part in the panel discussion, I have been asked to discuss the SCS interactions with OPM and the Personnel Division, to provide some insight into the information that goes into job announcements for soil scientists, and to give some perspective for courses in soil science in the future. I can best accomplish these objectives by presenting some information in two overheads. (See Attachments # 1 and # 2.)

The first overhead summarizes roles that the Soil Survey Division plays in the process of job announcements for soil scientist positions and the various other groups with which we interact. I will discuss these briefly.

POSITION STANDARDS AND QUALIFICATION REQUIREMENTS - This will be discussed in detail by Mel Goldsborough. I will not go into detail about this role, other than to say that from time to time we are called upon to work with the Special Examining Unit/OPM to re-evaluate the position standards and qualification requirements for soil scientists. These are contained in the "Classification Standards for the Soil Science Series, GS-470", and the "Supervisory Grade Evaluation Guide (SGEG)".

CLASSIFICATION CRITERIA/POSITION DESCRIPTIONS - We work closely with the National Headquarters Classification Branch on a continuing basis to ensure that positions are properly classified according to the classification standards and the position descriptions for various grade levels contain the appropriate duties for the grade and for the position. A major effort was completed in cooperation with the Classification Branch with the publication of National Bulletin No. 360-l-61 in July 1991. This document titled "Personnel Administration Guidance for Soil Scientist Positions" consists of position descriptions, evaluation statements, job analyses, KSA's, and performance elements and standards for GS-9 thru GM-13 positions. It has been well received across the country.

POSITION VACANCIES/POSITION DESCRIPTIONS - Before a soil scientist position at the GS-12, and above, grade level is approved for advertising, the Employment Branch usually asks the Soil Survey Division to review the job announcement package. We pay particular attention to the Knowledge, Skills, and Abilities (KSA's) portion since this is where the major duties of the position are reflected, and they are what the applicants must respond to in writing when applying for the position.

RATING CRITERIA FOR KSA's - For each KSA in a vacancy announcement, numerical rating criteria must be developed and used when more than ten (10) qualified people apply for a position. The Employment Branch considers Soil Survey Division personnel as the "Subject Matter Experts" (SME) who should identify and develop the KSA rating criteria.

EVALUATION OF CANDIDATES - The Employment Branch requests that NHQ Soil Survey Division personnel evaluate and rate qualified candidates who apply for position vacancies. When ten (10) or less individuals apply for a position, the Alternative Evaluation Procedure is used. This requires one SME to review the experience, education, and training documented in the individual's application and determine if the candidate meets the evaluation criteria. When more than ten (10) qualified candidates apply for a position, two SME's must evaluate each candidate using the numerical rating criteria and must agree on a numerical rating for each candidate.

CANDIDATE AVAILABILITY - Upon request from selecting officials, we will assist in soliciting potential candidates to apply for vacancies and/or advise them of individuals who may be interested in a particular vacancy. I emphasize the words "upon request".

The second overhead provides some insight into the information that goes into job announcements in SCS, especially the Knowledge, Skills, and Abilities (KSA's) portion. I have listed the KSA's that are directly stated or implied in most vacancy announcements from the GS-9 thru the GM-13 grade levels. The six (6) that are highlighted and have an asterisk are the "common threads" that become especially important at supervisory and managerial positions. These elements are listed on the overhead.

The second overhead also reveals some insight into areas of knowledge that soil scientists will need to expand in order to function into the future. In addition to a solid foundation in soil science and related natural resource disciplines, the areas of computer science and database management of soils information and soils interpretations will be essential for almost all soil scientist positions. As professionals we must also increase our managerial and supervisory skills as well as our abilities to effectively communicate in writing and orally. These are some of the areas that should have expanded emphasis in curriculums across the country.

ROLE of SOIL SURVEY DIVISION - NHQ

SOIL SCIENTIST POSITIONS
&
VACANCY ANNOUNCEMENTS

- POSITION STANDARDS AND QUALIFICATION REQUIREMENTS
(Special Examining Unit/OPM)

- CLASSIFICATION CRITERIA/POSITION DESCRIPTIONS
(Classification & Evaluation Branch)

- POSITION VACANCIES/POSITION DESCRIPTIONS/KSA's
(Employment Branch)

- RATING CRITERIA FOR KSA's (SME)
(Employment Branch)

- EVALUATION OF CANDIDATES (SME)
(Employment Branch)

- CANDIDATE AVAILABILITY (Upon Request)
(Selecting Officials)

ATTACHMENT # 2

COMMON KNOWLEDGES, SKILLS, & ABILITIES (KSA's) in SOIL SCIENTISTS VACANCY ANNOUNCEMENTS

1 *KNOWLEDGE OF SOIL SCIENCE

2 KNOWLEDGE OF DISCIPLINES RELATED TO SOILS

3 ABILITY TO MAP, ANALYZE, & INTERPRET SOILS

4. SKILLS/KNOWLEDGE - CARTOGRAPHIC PROCEDURES

5 *KNOWLEDGE OF NCSS POLICIES AND PROCEDURES

6 KNOWLEDGE OF SCS PROGRAMS AND POLICIES

7 *ABILITY TO MANAGE - SOIL SURVEY PROGRAM

8 *ABILITY TO WORK WITH OTHERS

9 *ABILITY TO SUPERVISE - DIVERSITY

10 *ABILITY TO COMMUNICATE - ORALLY, ETC.

11 *ABILITY TO COMMUNICATE - WRITING

12 KNOWLEDGE OF SOIL DATABASES & INTERPRETATIONS

13 KNOWLEDGE OF COMPUTER-BASED SOIL OPERATIONS

South-Northeast Cooperative
Soil Survey Conference
Asheville, NC
June 16, 1992

Presentation By:
F. Dale Childs
Asst. State Soil Scientist
Morgantown, WV

Good Morning,

I am going to discuss:

1. Broad duties of an SCS rater.
2. Interaction between an SCS rater and universities.
3. Creditable soil courses.

I. SCS raters have a rather unique role. We are SCS employees but must operate within the guidelines and regulations of the Office of Personnel Management (OPM). Raters cannot discuss the rating process or the rating criteria with anyone except another rater or the Special Examining Unit (SEU). Raters develop and maintain a list of creditable courses for all colleges/universities within their state.

The rating process requires that the rater:

A. Determine basic eligibility of applicant.

1. Degree in soil science or related area.
2. Thirty semester hours in biological, physical or earth sciences.
3. Fifteen semester hours in soils, or
4. Combination of education and experience plus 2 and 3 (above).

B. Review SF-171.

1. Review work experience.
2. See if degree is awarded.
3. Evaluate college transcript.

4. Note membership in professional organization.

5. Note membership in honor societies.

6. Less than 120 semester hours, use experience plus education.

7. Check for scholastic achievement.

8. Complete worksheet.

C. Rate applicant for grades 5 and 7, if applicable.

D. Use rating procedure that will give the highest rating.

E. Assign extra points in accordance with the standard procedure.

F. Return application to Special Examining Unit (SEU).

II. I suspect that the interaction between SCS and the universities within a particular state are, for the most part, very good. Raters may consult the universities regarding subject matter covered in specific courses. However, raters are not permitted by OPM regulations to discuss rating criteria, the rating schedule, or the rating process.

III. Do Universities know what courses qualify for the 15 semester hours in soils? Answer: probably not. At least they (universities) should not know the specifics because course listings are confidential. Announcements for the 470 series list such subjects as soil genesis, pedology, soil chemistry, soil physics, soil fertility, etc. Thus, one can get a good idea what courses would likely be credited by raters.

IV. I want to share a few comments that Ed White (Pennsylvania) sent me regarding his philosophy of the rating process. Ed was originally scheduled to be on this panel, but was unable to attend the conference. I have paraphrased Ed's comments so he wouldn't recognize them:

A. What kind of educational background do we want in a soil scientist today? Has the need changed over the years? Are the 15 semester hours in soils an absolute necessity? I am certain most raters have had to declare an applicant "not qualified" because they lacked one course or one semester hour. We need to find ways to prevent good students from falling through the rating system cracks. Perhaps students need a constant reminder of the basic requirements for a soil scientist.

B. Ed goes on to say, "We need scientists today with expertise in soils." To put it another way, we need soil scientists well versed in the sciences. Most of all, we need to let colleges and universities know what kind of educational background we want in soil scientists. We cannot delegate this responsibility to our personnel people. We, you and I, need to be involved! We seem to be getting only a few soil scientist applications today. We need to encourage more people to get into soils, or at least get more to qualify for the 470 series.

RECENT DEVELOPMENTS IN SOIL TAXONOMY

Soil Classification Staff
John E. Witty
June 1992

During the past year the chairs from three international committees: ICOMAQ, ICOMOD, and ICOMERT; submitted their recommendations to Dr. John Witty, National Leader for Soil Classification. The charges and summary of the major changes from each committee are outlined below.

ICOMAQ

The International Committee on Aquic Moisture Regime (ICOMAQ) was established in 1982 and chaired initially by Frank Moormann, then by Johan Bouma (since 1985). The main classification problems which the committee undertook to solve were the inadequate definition of the term aquic soil moisture regime, the lack of distinction between soils with perched and ground watertables, and the question of wetness induced by rice culture (paddy soils).

The following is a summary of the major changes in terminology proposed by ICOMAQ that will be implemented by the soon to be released amendment, NSTH issue 16:

1. The concept of aquic conditions will replace that of the aquic moisture regime. Aquic conditions in a soil or horizon require saturation, reduction, and redoximorphic features. The new term aquic conditions has a wider range of application than the term aquic moisture regime and will be used extensively in Soil Taxonomy.

2. Use of the term mottles that have chroma of 2 or less will be discontinued, and so is the use of the term mottles, with few exceptions. The following terms are introduced as replacements:

    a. Redoximorphic features, which essentially includes all wetness mottles:

    b. Redox concentrations, which are concentrations of Fe and Mn and include the high-chroma wetness mottles;

    c. Redox depletions, which represent low-chroma wetness mottles (mottles with a chroma of 2 or less) where Fe and Mn have moved out; and

    d. Reduced matrix, which represents reduced soil materials that change in color when exposed to air.

3. **The new term endosaturation means the saturation of a** soil with water in all layers from the upper boundary of saturation to a depth of 200 cm or more from the mineral soil surface.

4. Episaturation means a saturation with water of one or more layers above a depth of 200 cm from the mineral soil surface in a soil that also has one or more unsaturated layers below the saturated layer.

5. The term anthric saturation characterizes a variant of episaturation which is associated with controlled flooding, e.g., of rice paddies.

Also included are changes in criteria for acid sulfate soils. Although ICOMAQ has not emphasized the revision of acid sulfate soils, Circular Letter No. 4 presented an update following the third International Symposium on Acid Sulfate Soils held in Senegal in January of 1986. The revisions included in this amendment were reviewed by the International Symposium on Acid Sulfate Soils held in Ho Chi Minh City, Vietnam, in February 1992, and included in a paper "Fanning, D.S., and J.E. Witty. 1992. Revisions of Soil Taxonomy for acid sulfate soils," which was presented by Fanning at that symposium.

ICOMOD

The International Committee on Spodosols (ICOMOD) was **established in 1981 and chaired initially by F. Ted Miller, then by Robert V. Rourke (since 1986). The committee's mandate was to:**

1. **Evaluate chemical criteria for defining spodic horizons;**

2. **Evaluate thickness requirements;**

3. **Improve the classification of Aquods;**

4. **Propose criteria that would adequately distinguish Spodosols from Andepts (Andisols); and**

5. **Recommend changes in the classification of Spodosols and define appropriate taxa as well as the diagnostic properties required for their definition.**

The following is a summary of the changes proposed by the committee that will appear in the next National Soil Taxonomy Handbook issue:

1. The new criteria adds emphasis to the spodic morphology. Most soils presently classified as Spodosols will meet the new morphology, pH, and organic carbon requirements.

2. The albic horizon is used to separate most Spodosols from Andisols.

3. Spodic materials are introduced to allow more flexibility in defining the spodic horizon.

4. Iron and aluminum extracted by ammonium-oxalate rather than pyrophosphate and dithionate-citrate are used for the chemical criterion.

5. The "Al" great groups of Aguods and Orthods are added to capture the soils with low ammonium-oxalate-extractable iron contents.

6. The suborder of Cryods is added and "Trop" great groups are deleted.

ICOMERT

The International Committee on Vertisols (ICOMERT) was established in 1980, with Juan Comerma serving as chair. The objectives of the committee were to:

1. Identify those criteria in the classification of Vertisols that have resulted in taxa with misleading or vague definitions or very few identifiable soils;

2. Propose improvements in the classification of Vertisols, considering both genetic and practical implications; and

3. Test the proposals and submit recommendations to the Soil Conservation Service for improving the classification of Vertisols in Soil Taxonomy.

The following is a summary of the major changes proposed by ICOMERT and that will appear in the next amendment to Soil Taxonomy:

1. Establishment of two new suborders, Aquerts and Cryerts, and their respective great groups and subgroups;

2. Introduction of new great-group and subgroup criteria to provide better interpretive groupings:

3. Elimination of the pell and chrom great groups because of the questionable value of the resulting classes: and

4. Redefinition of the vartic subgroup criteria to include rore toils with high shrink-swell potential. In addition to the changes mentioned above, the Fifth Edition of "The Keys to Soil Taxonomy" has had an English edit and should be easier to use. The Fifth Edition should be available in the fall.

Other Committees

The International Committee on Aridisols (ICOMID) has submitted their recommendations to John Witty. The Soil Classification Staff will evaluate these recommendations later this summer and early this fall. The International Committee on Families (ICOMFAM) made excellent progress this spring and should have their final recommendations available in about a year. The International Committee on Soil Moisture and Temperature Regimes (ICOMMOTR) has one of the biggest challenges and has made good progress. However, this committee will need a couple years to complete their task.

July 14, 1992

Soil Survey Laboratory
Laurence E. Brown, SCS, Lincoln, Nebraska

The number of soil samples received at the Soil Survey Laboratory in Lincoln from the South and Northeast Regions was 23% of the total for FY 1991. Slightly larger percentages were received from both the West and Midwest Regions. Most of the samples from the South and Northeast were for complete characterization, whereas many samples from the other regions were reference projects requiring only a few analyses per sample. The university laboratories have provided analytical services for many soil surveys in the South and Northeast Regions, thereby reducing the requests for both reference samples and complete characterization. Unfortunately, funds for these other laboratories have decreased in some states; This trend has already increased our analytical workload in Lincoln and is expected to increase for the foreseeable future.

The number and different kinds of analyses have been increasing each year. This is due in part to changes in Taxonomy requiring more laboratory data. This is part of the overall historical trend of increasing demand for hard data to support soil ratings and interpretations.. Some people have suggested that the number of soil samples will decrease in areas where soil surveys have been completed. To the contrary, the requests for laboratory services have increased in many of these states.

We know that a faster turn-around time is needed for laboratory analyses, and we are trying to provide better service. Substantial increases in production at the lab have been countered by equivalent increases in the volume of samples submitted. Preliminary distribution of data before all the analyses for a project are completed has helped provide information as it becomes available.

The Soil Survey Laboratory Methods Manual, Soil Survey Investigations Report No. 42 has been completed. This new manual replaces SSIR No. 1. Presently, we have a limited number of copies. Additional copies of this manual will be available in October. By formatting to a smaller print and using two columns per page, we are substantially reducing the number of pages. We hope that SSIR No. 42 provides better documentation to our analyses and better describes the procedures for duplication in the laboratory.

Status of Soil Survey investigations - South

Report to South-Northeast Soil Survey Work Planning Conference, Asheville, NC, June 15-19, 1992 by Warren Lynn, SCS - Soil Survey Laboratory.

The teaching season at the NSSC for Soils courses has just concluded. Approximately 150 participants attended formal training sessions.

Basic Soil Survey - Field and Laboratory: Two sessions of two weeks each, with 24 participants from SCS and 6 from other agencies.

Soil Laboratory Data - USE: Three sessions of one week each for (50) participants from SCS and (10) from other agencies.

Soil Correlation: Three sessions of one week each for over 60 participants.

The effort to update soil surveys by MLRA and the interpretive need to examine materials below a depth of 2 meters should naturally compliment each other, and have done so, recently, in practice.

MLRA 77/72, High Plains: Carolyn Olson and crews have sampled transects of deep cores between the Arkansas and Cimarron Rivers to examine stratigraphy and buried soils.

MLRA 131/134, Southern Mississippi River alluvium/Loess Hills: Doug Wysocki participated in sampling of a ioess section in Tennessee in conjunction with USGS and SCS soils staffs. The USGS is commensing a project to correlate the ioess and alluvium stratigraphy in the lower Mississippi River Valley.

Soil pedon characterization data base.

The Soil Survey Laboratory pedon characterization data base of 18,000 to 19,000 pedons is to be available on CD-rom in July 1992

The Soil Survey Lab has been concerned for some time about collating University data with SCS-SSL data. Please contact Benny Brasher for details or discussion.

There is an eternal spark in soil scientists to unravel a small piece of the soil puzzle. Some of these sparks are kindled in the southern region.

St. John: Henry Mount/Bruce Dubee/John Davis have instailed soil moisture and temperature sensors in the Virgin islands National Park, a cooperative effort with the National Park Service. One wish is to learn the connection between tropical soils and tropical dry forest vegetation with the help of forester, Gary Ray.

Alabama-Mississippi Vertisols: With the urging of DeWayne Williams, we gathered John Meetse, David Jones, Dave Pettry, Ben Hajek, and others around and in soil pits on the Black Prairie of Alabama and Mississippi - to help us unravel the mystery of vettisols.

North Carolina - western mountains - near Asheville: Soil characterization sampling sites demonstrated that mineralogy can vary from one rise to the next, but left me with the question, Why?

St. Croix: John Davis. Evidence of faunal activity in soils is impressive. Included was a concentration of ‘chitin-looking’ material that Entomologists tell us is not from an insect - still hanging with a ‘What?‘.

Kentucky Inner Bluegrass: Tasos Karathanasis/ John Robbins/ Bill Craddock/ Mike Wilson. Soils on phospatic Ordovician limestones are prized for nourishing strong bones in young Thoroughbred horses, but raise a Taxonomic question, ‘Can we separate these soils from soils with Anthropic Epipedons?

Classification of Soils of the Southern Blue Ridge
Challenges and Opportunities

Abstract and References

S. W. Buol

The Southern Blue Ridge is an excellent area to study soil formation on acid igneous, mainly gneiss and schist, bedrock. The area is udic to perudic, and mostly forested.

Timber harvests have deforested almost all of the area two or even three times since European settlement. The lower slopes and floodplains have been utilized for farming using slash and burn techniques until the early part of the 20th century when fertilizer enabled more permanent agriculture.

Taxonomically, most of the soils classify as Dystrochrepts and Hapludults with some Haplumbrepts at the higher elevation. The definitions of argillic and cambic horizons are constantly tested in classifying pedons. Rather recent studies have revealed several features that challenge further pedological research. Most of the soils have remarkably uniform particle size distribution that centers on the fine-loamy to coarse-loamy family particle size class separation of 18% clay. Gibbsite is a mineralogical component of most of the soils, especially the Dystrochrepts, apparently forming from alteration of feldspar. The gibbsite appears to attract silica in the more stable landscape positions and become kaolinite. All the soils on the steep mountain sides appear to be formed in friable material that has been and is subjected to colluvial and movement creep. Few, if any, profiles appear to be truly residual.

Deep saprolite underlies most profiles on the steep slopes and probably under the deep colluvial deposits near the toe of the steep slopes.

The low clay contents, high gibbsite contents and moderate iron oxide contents cause many pedons, regardless of higher category placement, to qualify as oxidic mineralogy families according to the present definition. Some pedons have high mica contents and classify into micaceous families. Also, many of the higher elevation soils have oxalate extractable Al and Fe contents that place them in Andic subgroups with some as Andisols, although they differ in several properties normally attributed to these taxonomic terms. It is probable that the amorphous properties result from processes active in Spodosols rather than those associated with Andisols but further studies are needed.

Almost all of the soils are acid in reaction and base saturation decreases with depth. Although usually well supplied

with exchangeable potassium, probably the result of mica weathering, they are extremely low in content of exchangeable calcium. There appears to be practically no calcium in most of the saprolite and total elemental analyses often find calcium contents below detectable levels. What this deficiency may mean *to* tree growth and future generations of the forestry industry is not known.

REFERENCES

Calvert, C.S., S.W. Buol, and S.B. Weed. 1980. Mineralogical characteristics and transformations of a vertical rock-saprolite-soil sequence in the North Carolina Piedmont: II. Feldspar alteration products-their transformations through the profile. Soil Sci. Soc. Am. J. 44:1104-1112.

Daniels, R.B., H.J. Kleiss, S.W. Buol, H.J. Byrd, and J.A. Phillips. 1984. *Soil systems* in North Carolina. North Carolina Agric. Res. Serv. Bull. 467.

Daniels, W.L., C.J. Everett, and L.W. Zelazny. 1987. Virgin hardwood forest soils of the southern Appalachian Mountains: I. Soil morphology and geomorphology. Soil Sci. Soc. Am. J. 51:722-729.

Graham, R.C., R.B. Daniels, and S.W. Buol. 1990. Soil-Geomorphic relations on the Blue Ridge Front: I. Regolith types and slope processes. Soil Sci. Soc. Am. J. 54:1362-1367.

Graham, R.C., and S.W. Buol. 1990. Soil-Geomorphic Relations on the Blue Ridge Front: II. Soil Characteristics and Pedogenesis. Soil Sci. Soc. Am. J. 54:1367-1377.

Graham, R.C., S.B. Weed, L.H. Bowen, and S.W. Buol. 1989a. Weathering of iron-bearing minerals in soils and saprolite on the North Carolina Blue Ridge Front: I. Sand-size primary minerals. Clays Clay Miner. 37:19-28.

Graham, R.C., S.B. Weed, L.H. Bowen, D.D. Amarasiriwardena, and S.W. Buol. 1989b. Weathering of iron-bearing minerals in soils and saprolite on the North Carolina Blue Ridge Front: II. Clay mineralogy. Clays Clay Miner. 37:29-40.

Harris, W.G., J.C. Parker, and L.W. Zelazny. 1984. Effects of mica content *on* engineering properties of sand. Soil Sci. Soc. Am. J. 48:501-505.

Losche, C.K., R.J. McCracken, and C.B. Davey. 1970. Soils of steeply sloping landscapes in the southern Appalachian Mountains. Soil Sci. Soc. Am. Proc. 34:473-478.

McCracken, R.J., R.E. Shanks, and E.E. Clebsch. 1962. Soil morphology and genesis at higher elevations of the Great Smoky Mountains. Soil Sci. Soc. Am. Proc. 26:384-388.

Rebertus, R.A., and S.W. Buol. 1985a. Intermittency of illuviation in Dystrochrepts and Hapludults from the Piedmont and Blue Ridge provinces of North Carolina. Geoderma 36:277-291.

Rebertus, R.A., and S.W. Buol. 1985b. Iron distribution in a developmental sequence of soils from mica gneiss and schist. soil Sci. Soc. An. J. 49:713-720.

Rebertus, R.A., and S.W. Buol. 1989. Influence of nicaceous minerals on mineralogy class placement of loamy and sandy soils. Soil Sci. Soc. Am. J. 53:196-201.

Schumacher, B.A., and H.F. Perkins. 1987. Soil genesis in a developmental sequence of soils formed in sillimanite mica schist residuum. Soil Sci. Soc. An. J. 51:1238-1242.

GENESIS AND CLASSIFICATION OF BOREAL FOREST SOILS OF THE SOUTHERN APPALACHIANS

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ABSTRACT

The Late Pleistocene/Early Holocene periglacial environment on the high peaks of the southern Blue Ridge resulted in widespread slope instability and mixing of parent materials on all landscape positions. Following warming conditions and the relatively recent establishment of the boreal forest cover (-10 ka), podzolization has been the dominant pedogenic process occurring in most of these high-elevation soils, regardless of the presence or absence of distinct eluvial/illuvial features. Based on the presence of classic Spodosol weathering trends, and the translocation of both Fe and Al within most soil profiles, we recommend establishment of a spodic subgroup of Haplumbrepts rather than classification of these soils as Andic Haplumbrepts.

INTRODUCTION

Boreal forests of the Southern Appalachians are isolated from related northern vegetation and are confined to elevations above -1450 m on the higher mountains of eastern Tennessee, western North Carolina, and southwestern Virginia. The influence of elevation has had a dramatic effect on the nature of the weathering environment in these areas, and as a result, rocks from areas with diverse bedrock al. (1991b) provided evidence suggesting that podzolization was the dominant pedogcnic process occurring in most soils of the frigid zone despite lack of distinct E/Bhs horizonation. Many soils with Haplumbrept morphology in this and another study (Feldman et al., 1991a) were in fact re-classified as Typic Haplorthods, based on the criteria of both the Soil Survey Staff (1990) and newer proposals (ICOMOD, Circular no. 10, 1991). More recently, considerable controversy has evolved regarding the distinction between soils with andic vs. spodic properties in these areas.

Our objectives in this paper are to: 1) discuss the influence of Late Pleistocene/Early Holocene geomorphic processes on parent material emplacement in the southern Appalachians, 2) outline dominant weathering and pedogenic mechanisms in the modern environment, and 3) review and recommend criteria for taxonomic placement of these soils. Our discussion will include data from a developmental sequence of four soils ranging from those having distinct spodic field morphology (E plus Bhs horizons), to soils with either minimal (weak E horizons) or no spodic character (umbric epipedons/cambic horizons). Sampling site description, geologic setting, and analytical methods are detailed in Feldman et al. (1991a,b).

GEOMORPHOLOCY OF THE SOUTHERN BLUE RIDGE

Palynological evidence demonstrates that alpine tundra vegetation occupied the high-elevations of the southern Appalachians as recently as 16,500 yr B.P. (Delcourt and Delcourt, 1984, 1986; Shafer, 1984) during which time periglacial processes had a marked influence on landscape development and soil parent material formation. Patterned ground, in the form of sorted stripes, nets, and polygons, is considered unquestionably diagnostic of past periglacial environments (Mills and Delcourt, 1991), and has been extensively documented in the unglaciated Appalachians (Clark, 1968; Michalek, 1968; Richter, 1973; Torbett and Clark, 1985; Connors, 1986; Clark and Ciolkosz, 1988; Braun, 1989). During full-glacial times (20-16.5 ka), intense freeze-thaw processes on exposed mountain slopes resulted in fracturing of rock, development of block streams, and accelerated transport and churning of sediments. The colluvial deposits that blanket the steep sideslopes and even low-gradient summits in the southern Appalachians are largely the result of frost creep, gelifluction, and saturated mudflows which have transformed residuum on all parts of the landscape into mixed congeliturbate or congelifractate parent materials. From 16.5 to 12 ka, increases in mean annual temperature and precipitation resulted in continued gelifluction and subsequent invasion of boreal forests across the high peaks (Fig. 1). Fluvial incision, gravity-driven colluvial processes, and mass-wasting events have been the dominant geomorphic processes in these areas since -10 ka, when continued establishment of boreal and temperate forests began to stabilize the hillslopes.

MINERALOGY, WEATHERING, AND PEDOGENESIS

Although bedrock lithologies are quite diverse throughout the southern Blue Ridge (Feldman et al., 1991a), many soil characteristics such as field morphology, degree of profile development, and clay mineralogy are quite similar (Table 1), owing both to the physical mixing of parent materials derived from these rocks during the Late Pleistocene, and to the dynamic interaction between modem climate, vegetation, and landscape stability (or lack thereof). These factors create a unique weathering environment which contrasts sharply with climatic conditions at adjacent lower elevations.

Average annual rainfall in the area exceeds 2000 mm with evapotranspitation exceeding precipitation only in rare drought years. Cool temperatures and continually moist conditions enhance the accumulation of organic matter and cause intense leaching which results in conditions favorable for the cheluviation of Fe and Al to lower horizons and rapid removal of base cations and Si from the profile. Lack of wet/dry cycles also restricts neoformation, illuviation, and flocculation of fine clays thus inhibiting argillic horizon development in the -10 ka since the establishment of forest cover.

The four soils selected for detailed analysis in this study were classified in the field as loamy-skeletal, mixed, frigid Typic Haplumbrepts with the exception of pedon GSM-14 which exhibited distinct spodic morphology and was field-classified as a member of the coarse-loamy, mixed, frigid family of Typic Haplorthods (Table 1). Pedon GSM-5, with only minimal E horizon expression, met the chemical requirements for a spodic horizon while pedons BM-17 and MR-7, which lacked any evidence of an E horizon, failed to meet this requirement. Although GSM-14 had well-expressed E/Bhs horizonation, it failed to meet the spodic criteria because the pyrophosphate Fe + AI to clay ratio was <0.2.

All soils exhibit mineralogical trends that exemplify the classic weathering profile of Spodosols (Kodama and Brydon, 1968; McKeague et al., 1983). Upper horizons are dominated by expansible 2:1 layer silicates while gibbsite, kaolinite, hydroxy-interlayered vermiculite (HIV), and mica commonly increase with depth (Table 2). Regularly interstratified mica/vermiculite (RMV) predominates in surface horizons of all pedons, decreasing with depth. This mineral, which gives diffraction peaks at both 24Å and 12Å, is particularly well-crystallized in the E horizon of GSM-14 (Fig. 2A). The abundance of RMV in surface horizons progressively increases in soils which have more well-expressed E horizon morphology (Fig. 2A) and thus appears to be related to podzolization processes. Its presence in other soils that lack spodic morphology (Fig. 2B-D) suggests that podzolization is a common genetic pathway occurring in the majority of these soils, regardless of morphology.

In contrast to surface horizons that are dominated by more reactive clay minerals, gibbsite and HIV characteristically increase with depth. Gibbsite comprises >30% of all subsoil clay fractions with the exception of MR-7, which is dominated by kaolinite (Table 2). Hydroxy-interlayered vermiculite is nearly absent in surface horizons (Fig. 3) and is inversely related to vermiculite in each profile, reflecting both the mobility of Al-organic complexes out of surface horizons and the inability of hydroxy-Al interlayers to form in the presence of organic acids (Huang and Keller, 1971; Vincente et al., 1977). Successive heat treatments of K-saturated samples from the E horizon of pedon GSM-14 resulted in complete collapse of vermiculite x-ray diffration peaks to 10Å with heating to 110°C (Fig. 3). Diffractograms for the Bw horizon of this same pedon show the resistance of vermiculite to collapse, indicating that mobile Al is fixed in clay interlayers in lower horizons (Fig. 4).

Whereas the mineralogy of sand and silt fractions reflects inheritance from parent materials (Feldman et al., 99[illegible] peak. Vermiculite either weathers to a high-charge smectite phase in surface horizons, or, as discussed previously, becomes interlayered with mobile hydroxy-Al phases lower in the profile. The lack of a conspicuous 7Å peak in these grains (Fig. 5) also demonstrates that biotite kaolinization is not an important weathering mechanism in these soils, in contrast to conditions observed in most Piedmont, Coastal Plain, and low-elevation Blue Ridge soils (Harris et al., 1985; Rebertus et al., 1986; Daniels et al., 1987; Norfleet and Smith, 1989). In contrast to the trends observed for biotite, unaltered muscovite grains from this same horizon show that this mineral is relatively resistant to weathering in this environment (Fig. 5).

Gibbsite occurs in nonclay fractions of all soils indicating that its formation is primarily the result of rapid reprecipitation of Al after feldspar dissolution and therefore not a reliable index of either relative soil age or weathering intensity. Coexistence of gibbsite and HIV in the same horizon commonly occurs in these subsoils. The occurrence of these two minerals in the same profile has also been noted by others (Daniels et al., 1987; Norfleet and Smith, 1989) who have raised questions regarding the efficacy of Jackson's (1963) 'antigibbsite effect' in mountain soils of the southern Blue Ridge. We believe, however, that conditions responsible for gibbsite formation in these soils are independent of mechanisms of HIV formation. Our data suggest that gibbsite precipitation is inhibited by organic acids and low pH in surface horizons and by vermiculite/HIV in subsoil horizons. The low degree of interlayer filling by hydroxy-Al polymers suggests that vermiculite/HIV continues to be an important sink for Al in these soils, inhibiting the formation of pedogenic gibbsite. The majority of Al transported to subsoils is apparently fixed by vermiculite/HIV whereas the bulk of existing gibbsite is the result of in *situ* geochemical alteration of feldspars.

SOIL CLASSIFICATION

Soils with boundaries intermediate between Spodosols and Andisols pose a unique taxonomic problem, particularly with the elimination of the requirement of an E horizon in the Spodosol concept (ICOMOD, 1991). Of the soils we studied, pedons GSM-14 and MR-7 meet the proposed criteria for spodic materials (ICOMOD, 1991) while pedons GSM-5 and BM-17 qualified as Andic Haplumbrepts (Fig. 6).

The concept of translocation of Fe and Al within pedons is the critical feature that distinguishes Spodosols from Andisols which are otherwise thought to result from the weathering of aluminosilicates in-place. Pedons GSM-14 and MR-7, which meet the requirement for spodic materials (Fig. 6), clearly show increasing trends in organic-bound Fe and Al with depth (Fig. 7). However, pedon BM-17, shows a dramatic increase in pyrophosphate-extractable Fe (Fep) which denotes translocation of a soluble organic-Fe phase. Pyrophosphate-extractable Fe is also greater than Alp in the upper horizons of these soils, whereas the opposite is true in lower horizons, suggesting that organic-Al complexes are more mobile than organic-Fe complexes in these soils and/or that Fe is biocycled preferentially over Al in surface horizons. Similar trends in elemental mobility were reported by Johnson and McBride (1989) for Adirondack Spodosols and by Singer et al. (1978) for Spodosols of the Pacific Northwest.

CONCLUSIONS

Soils in the frigid zone of the southern Appalachians were influenced by Late Pleistocene/Early Holocene periglacial weathering processes which have transformed residuum to the mixed colluvial parent materials that occupy all landscape positions throughout the area. Because soils on even 'stable', low-gradient summits are only rarely underlain by saprolite (usually well below the solum), the concept of residuum as a parent material in these high-elevation soils should be dismissed.

Podzolization has had a direct role in the genesis of these soils following the establishment of the modern boreal forest cover. This observation is supported by the relatively high color values of soil B horizons which contrast with published reports of andic soils (Parfitt and Clayden, 1991), and the presence of classic Spodosol mineralogy in soils both with and without E/Bhs horizonation. This conclusion is also corroborated by a pilot soil survey conducted in 1984 in the area between Clingman's Dome and Newfound Gap in the Great Smoky Mountains National Park, in which map units delineating ridgetop positions were described as being comprised primarily by Haplorthods (C. McCowan and M. Sherrill, USDA-SCS, Nashville, TN and Raleigh, NC, personal communication). Regardless of morphology, however, most soils are dominated by high-charge 2:1 phyllosilicates in surface horizons, and by gibbsite and HIV in subsoil horizons. This common trend, and data shown for both pyrophosphate- and oxalate-extracts, indicate that soluble Fe and Al phases are translocated and immobilized lower in these soil profiles.

Soils with well-expressed eluvial/illuvial features commonly meet the new proposed spodic criteria. Soils that lack E horizons typically have morphological umbric/cambric horizon sequences and meet the chemical requirements for either 'spodic soil materials', or for Andic Haplumbrepts. None of the soils we examined, however, had sufficiently high levels of oxalate-extractable Fe and Al to meet the higher requirements for andic soil materials (Fig. 6) in these areas where volcanic glass deposits are not recognized (Mills and Delcourt, 1991).

Based on these mineralogical trends and the redistribution of Fe and Al within most soil profiles, we recommend establishment of spodic subgroups of Haplumbrepts to accomodate soils that lack distinct spodic morphology, rather than placement of these high-elevation soils of the southern Appalachians into andic subgroups of Inceptisols. Additionally, our data, and the field data of McCowan and Sherrill (1984, personal communication) overwhelmingly support the placement of these soils into families with loamy-skeletal particle-size control sections.

LITERATURE CITED

Braun, D.D. 1989. Glacial and periglacial erosion of the Appalachians. Geomorphology 2:233-256.

Clark, G.M. 1968. Sorted patterned ground: New Appalachian locatities south of the glacial border. Science 161:355-357.

Clark, G.M. and E.J. Ciolkosz. 1988. Periglacial geomorphology of the Appalachian Highlands and Interior Highlands south of the glacial border-A review. Geomorphology 1:191-220.

Conners, J.A. 1986. Quaternary geomorphic processes in Virginia. p. 1-22. *In* J.N. McDonald and S.O. Bird (ed.) The quaternary of Virginia-A symposium volume. Virginia Division of Mineral Resources Pub. 75, Charlottesville, VA.

Daniels, W.L., C.J. Everett, and L.W. Zelazny. 1987. Virgin hardwood soils of the southern Appalachian Mountains: II. Weathering, mineralogy, and geomorphology. Soil Sci. Soc. Am. J. 51:730-738.

Delcourt, H.R., and P.A. Delcourt. 1984. Late Quaternary history of the Spruce-Fir ecosystem in the southern Appalachian mountain region. p. 22-35. In P.S. White (ed.) The southern Appalachian Spruce-Fir ecosystem: It's biology and threats. Research/Resources Mgt. Rept. SER-71, U.S. Dept. of the Interior-National Park Service, Atlanta, GA.

Delcourt, H.R. and P.A. Delcourt. 1986. Late Quaternary vegetational changes in the Central Atlantic states. p. 23-35. In J.N. McDonald and S.O. Bird (ed.) The quaternary of

Virginia-A symposium volume. Virginia Division of Mineral Resources Pub. 75, Charlottesville, VA.

Feldman, S.B., L.W. Zelazny, and J.C. Baker. 1991a. High-elevation forest soils of the southern Appalachians: I. Distribution of parent materials and soil-landscape relationships. Soil Sci. Soc. Am. J. 55:1629-1637.

Feldman, S.B., L.W. Zelazny, and J.C. Baker. 1991b. High-elevation forest soils of the southern Appalachians: II. Geomorphology, pedogenesis, and clay mineralogy. Soil Sci. Soc. Am. J. 55:1782-1791.

Harris, W.G., L.W. Zelazny. J.C. Baker, and D.C. Martens. 1985. Biotite kaolinization in Virginia Piedmont soils: I. Extent, profile trends, and grain morphological effects. Soil Sci. Soc. Am. J. 49:1290-1297.

Huang, P.M. and W.D. Keller. 1971. Dissolution of clay minerals in dilute organic acids at room temperature. Am. Mineral. 56:1082-1095.

ICOMOD, 1990. Changes in spodic materials defmition. ICOMOD Circular no. 10, USDA-SCS, Linclon, NE.

Jackson, M.L. 1963. Aluminum bonding in soils: A unifying principal in soil science. Soil Sci. Soc. Am. Proc. 27:1-10.

Johnson, M.G. and M.B. McBride. 1989. Mineralogical and chemical characteristics of Adirondack Spodosols: Evidence for Para- and noncrystalline aluminosilicate minerals. Soil Sci. Soc. Am. J. 53:482-490.

Kodama, H., and J.E. Brydon. 1968. A study of clay minerals in Podzol soils in New Brunswick, Eastern Canada. Clay Mineral. 7:295-309.

Lietzke, D.A., S. Crownover, J. Groton, M. Morris, and A. Torbett. 1984. The mineralogy of soils with spodic morphology in the southern Appalachians. Agrn. Abs. 76:274.

Lietzke, D.A., and G.A. McGuire. 1987. Characterization and classification of soils with spodic morphology in the southern Appalachians. Soil Sci. Soc. Am. J. 51:165-170.

McKeague, J.A., F. DeConinck, and D.P. Franzmeier. 1983. Spodosols. p. 217-252, In N.E. Smeck and G.F. Hall (ed.), Pedogenesis and soil taxonomy. II. The soil orders. Elsevier Science Publ., Amsterdam.

Michalek, D.D. 1968. Fanlike features and related periglacial phenomena of the southern Blue Riege. Ph.D. Diss., Univ. of North Carolina, Chapel Hill, NC.

Mills, H.H., and P.A. Delcourt. 1991. Quaternary geology of the Appalachian Highlands and Interior Low Plateaus. p.61 l-628, In R.B. Morrison (ed.), Quaternary nonglacial geology: Conterminous U.S., The geology of North America v. K-2, Geol. Soc. Am., Boulder, CO.

Norfleet, M.L., and B.R. Smith. 1989. Weathering and mineralogical classification of selected soils in the Blue Ridge Mountains of South Carolina. Soil Sci. Soc. Am. J. 53:1771-1778.

Parfitt, R.L., and B. Clayden. 1991. Andisols - the development of a new order in Soil Taxonomy. Geoderma 49:181-198.

Rebertus, R.A., S.B. Weed, and S.W. Buol. 1986. Transformations of biotite to kaolinite during saprolite-soil weathering. Soil Sci. Soc. Am. J. 50:810-819.

Richter, D.M. 1973. Periglacial features in the central Great Smoky Mountains. Ph.D. diss. Univ. of Georgia, Athens (Diss. Abstr. 72-27506).

Shafer, D.S. 1984. Late-Quaternary paleoecologic, geomorphic! and paleoclimatic history of Flat Laurel Gap, Blue Ridge Mountains, North Carolina. M.S. Thesis, Univ. of Tennessee, Knoxville, Tn.

Singer, M., F.C. Ugolini, and J. Zachara. 1978. In situ study of podzolization on tephra and bedrock. Soil Sci. Soc. Am. J. 42:105-111.

Soil Survey Staff. 1990. Keys to Soil Taxonomy, fourth ed., SMSS technical monograph no. 6, Blacksburg, VA.

Torbett, C.A., and G.M. Clark. 1985. Morphology, pedology, and origin of selected sorted patterned ground, Great Smoky Mountains National Park, Tennessee/North Carolina. Feol. Soc. Am. Abstr. 17:139.

Vincente, M.A., M. Razzaghe, and M. Robert. 1977. Formation of aluminum hydroxy vermiculite (intergrade) and smectite from mica under acidic conditions. Clay Mineral. 12:101-107.

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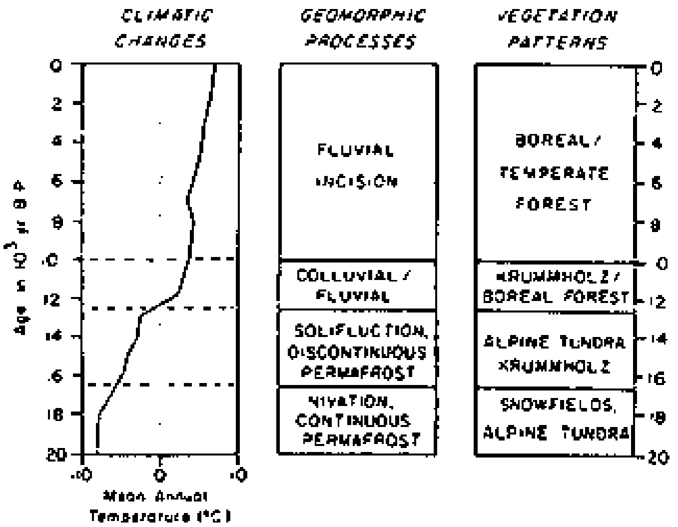


Fig. 1. Late-Quaternary climatic, geomorphic, and vegetational history above 1,500 m in the southern Blue Ridge Province (after Mills and Delcourt, 1991).

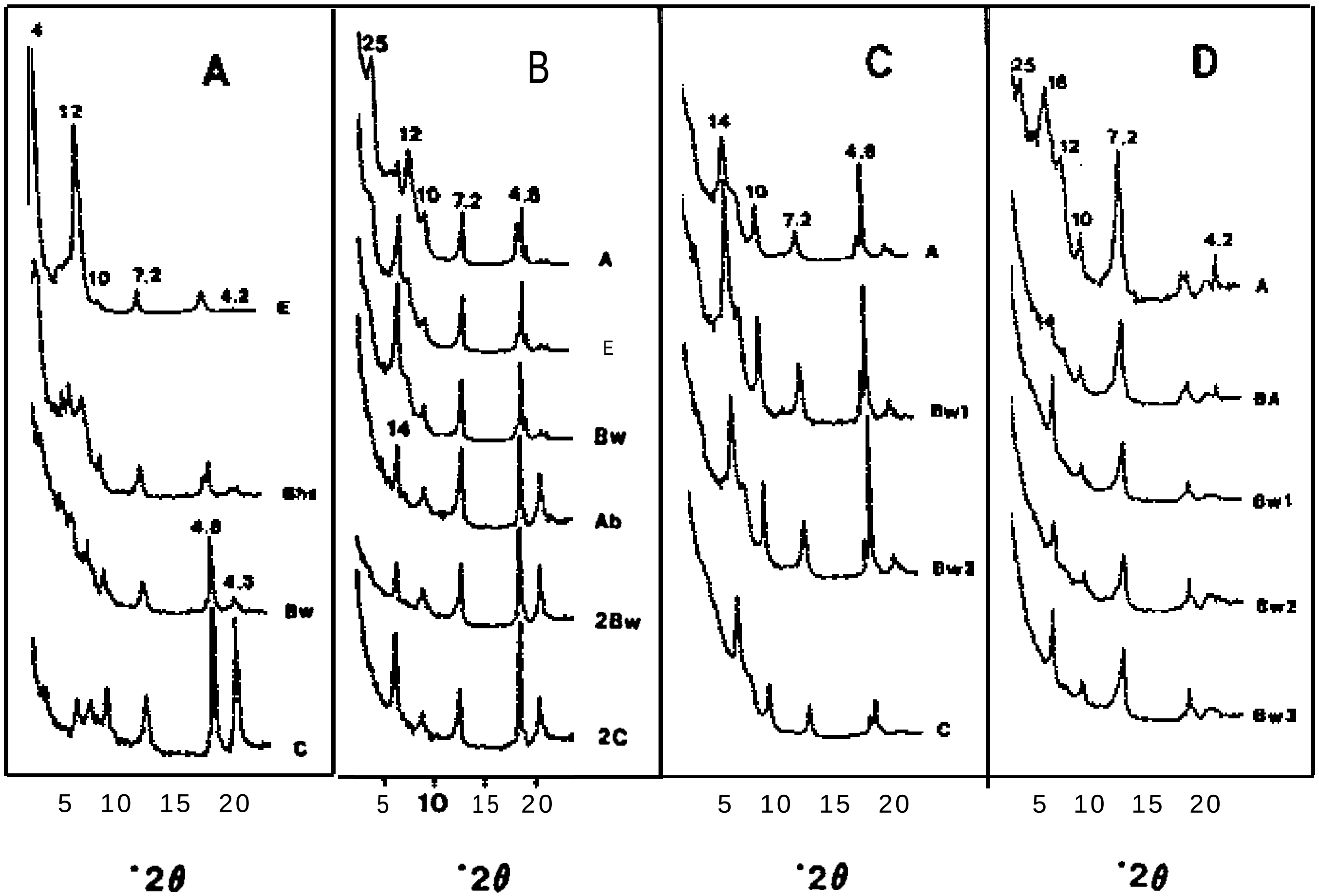


Fig. 2. X-ray diffractograms of Mg-gly (25°C) clay fractions from pedons GSM-14 (A), GSM-5 (B), BM-17 (C), and MR-7 (D). A) has distinct spodic morphology (E and Bhs horizons), B) has minimal spodic morphology (weak E horizon), and both C) and D) have no spodic character (umbric/cambric horizons). Note the well-crystallized RMV in surface horizons, and gibbsite. HIV, and mica increasing with depth. Peak positions are labeled in Å.

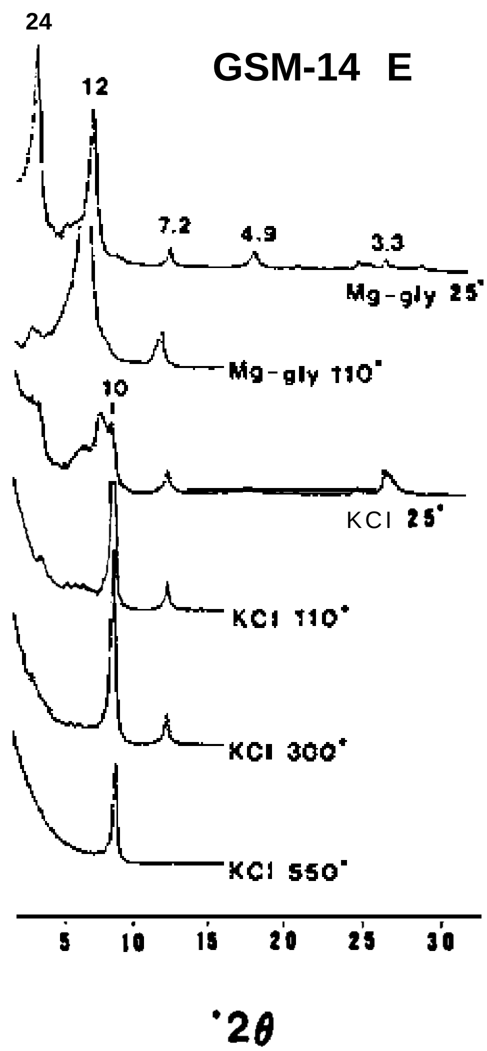


Fig. 3. Successive heat treatments of Pedon GSM-14 E horizon clay fraction showing XRD peak collapse to 10Å after K-saturation (KCl) and heating to 110°C. (Mg-gly is Mg saturated, glycerol solvated.)

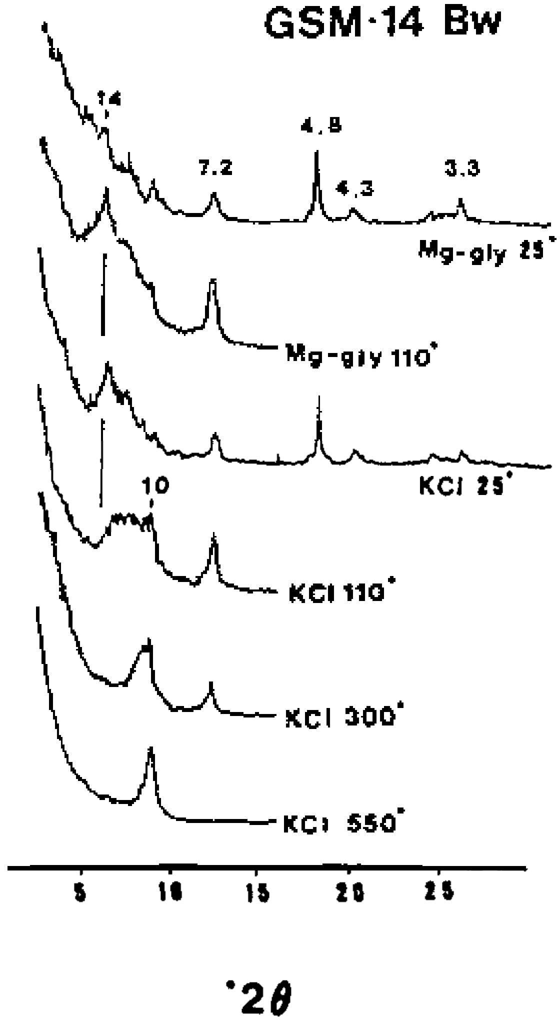


Fig. 4. Successive heat treatments of Pedon GSM-14 Bw horizon clay fraction showing increased hydroxy-Al interlayering of vermiculite in subsoil horizons. Peak positions are labeled in A. (Mg-gly is Mg saturated, glycerol solvated.)

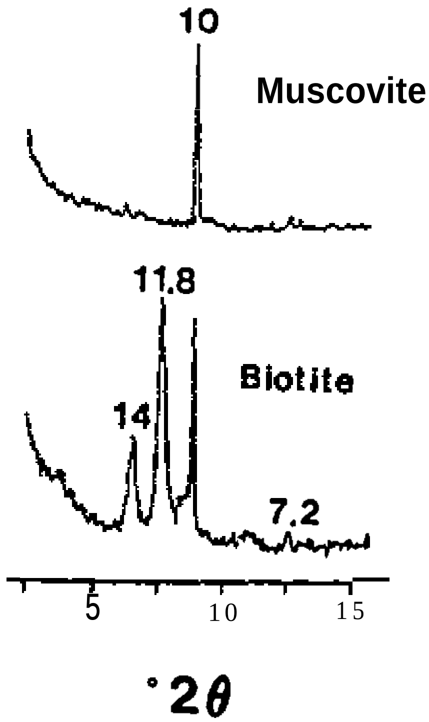


Fig. 5. X-ray diffractograms of representative muscovite and biotite single grains from the Bw horizon of Pedon GSM-14. Note the pseudomorphic transformation of biotite (10Å) to both hydrobiotite (11.8Å) and vermiculite (14Å), and the relative stability of muscovite.

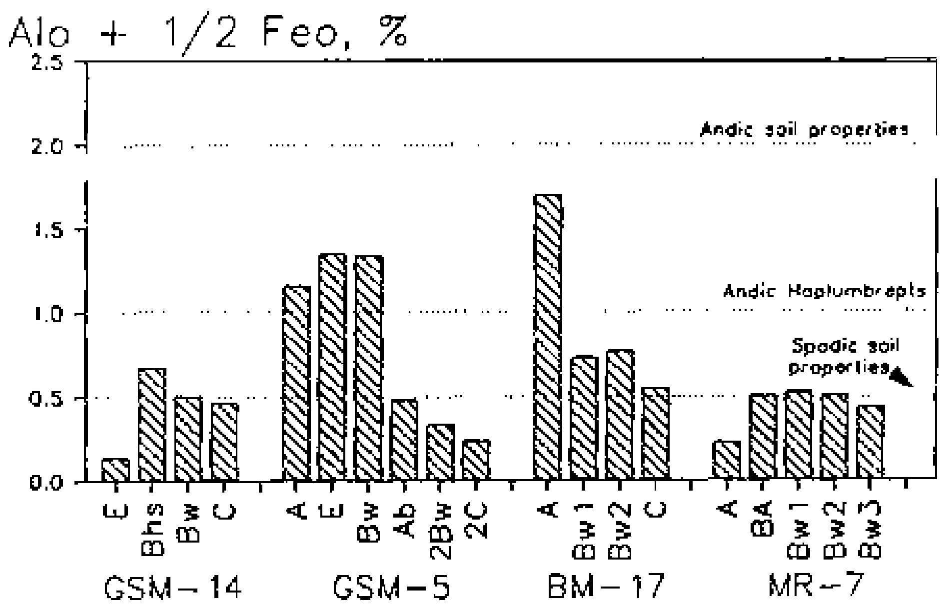


Fig. 6. Oxalate (o)-extractable-Fe and -Al criteria for classification of Pedons GSM-14, GSM-5, BM-17, and MR-7.

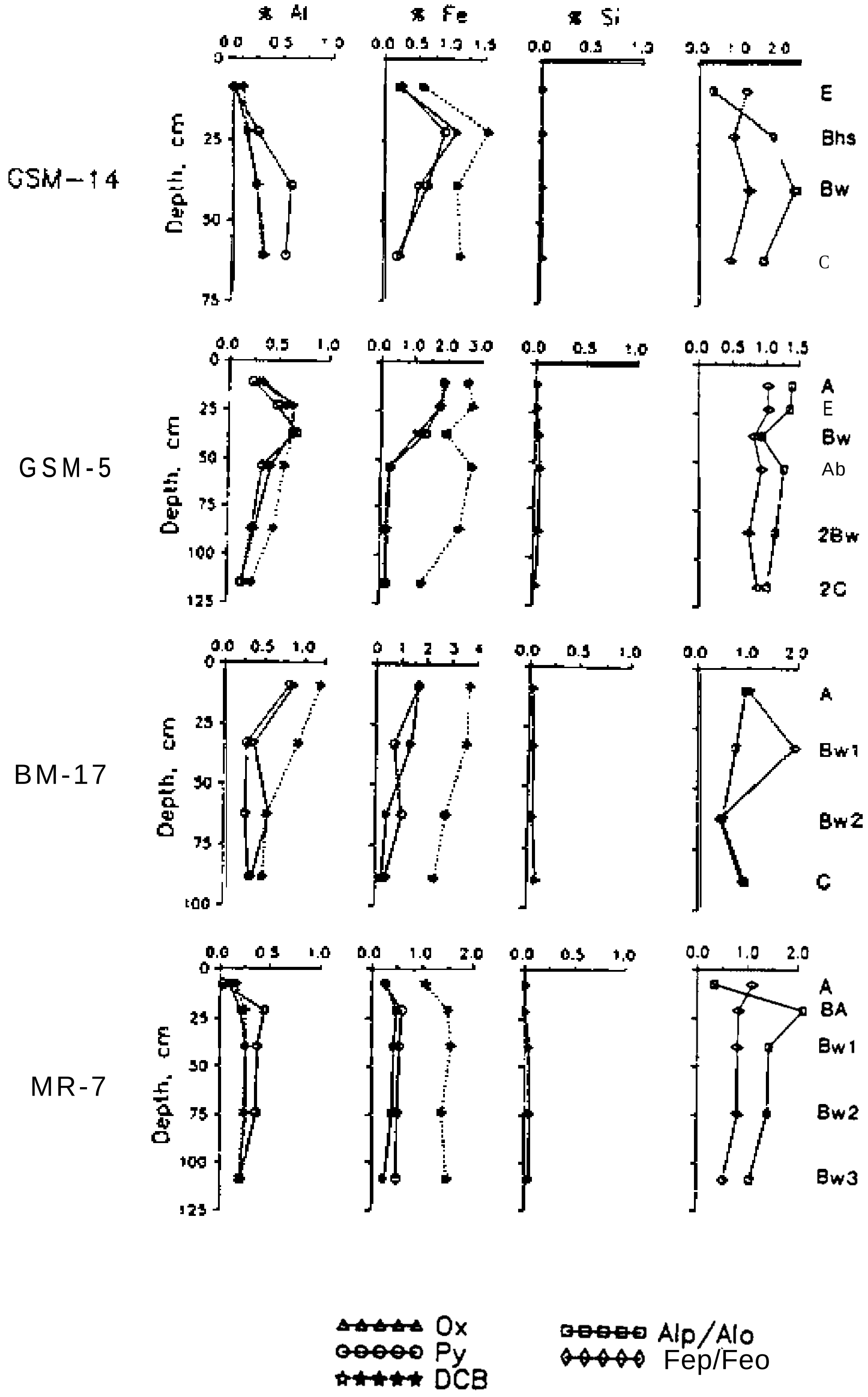


Fig. 7. Oxalate (ox)-, pyrophosphate (py)-, and dithionite-citrate-bicarbonate (DCB)-extractable-Al, -Fe, and -Si levels for Pedons GSM-14, GSM-5, BM-17, and MR-7. Ratios of Alp/Alo and Fep/Feo are also shown.

Table 1. Site characteristics, soil classification and morphological properties, and critical values for spodic horizon determination.

Land-scape	Elev-	Moist		% Pyro. Fe + Al	% Pyro. Fe + Al	Index of
		fr	cs			
		fm	--			

Table 2. Mineralogy of the clay (<2 μ) fraction and whole soil (<2 mm) gibbsite content.7

Horizon	KK	VR	SM	HIV	CHL	MI	RMV	QZ	GI	FD	WSGI
	%										
					GSM 14						
E	5	--	8	—	—	5	78	2	2	--	Tr
Bhs	11	6	5	6	--	9	46	2	15	--	I
Bw	11	--	--	15	--	11	30	—	33	--	5
C	1i	--	--	5	--	10	10	—	63	--	14
					GSM 5						
A	14	5	10	--	3	20	32	3	13	--	2
E	14	12	5	--	3	23	23	3	15	--	6
Bw	13	9	Tr	10	46	32	15	1	24	--	5
Ab	24	—	--				5	1	36	2	20
2Bw	18	--	—	5		18	3	1	45	3	19
2c	18	—	—	15	42	2323	Tr	Tr	36	4	II
					BM 17						
A	11	12	—	5	Tr	21	20	2	29	—	5
Bw1	13	—	—	16	Tr	30	15	I	25	—	7
Bw2	16	--	--	14	Tr	28	10	Tr	32	—	8
C	9	--	—	35	--	40	7	—	9	—	6
					MR 7						
A	37	8	‘4 ,	—	—	12	18	7	2	2	1
BA	38	—	8	16	--	16	10	7	2	3	1
Bw1	38	--	2	23	2	16	5	4	7	3	1
Bw2	43	—	—	19	4	16	2	4	10	3	2
Bw3	45	—	—	14	4	18	2	3	11	3	2

† KK = kaolinitc; VR = vermiculite; SM = smectite; HIV = hydroxy-intcrlaycrcd vermiculite; CHL = chlorite; RMV = regularly intcrstratificd mica/vermiculitc; QZ = quartz; GI = gibbsitc; FD = feldspar; WSGI = whole soil gibbsite.

GIS SUPPORT FOR SOIL SURVEY AND RESOURCES INVENTORIES

Presented by Darlene Monds, USDA-SCS
Northeast National Technical Center (NNTC)
Northeast/South Cooperative Soil Survey Conference
June 14-19, 1992

As most of us already know it is quite cumbersome to analyze large volumes of data in hard copy form. Coupled with the need to analyze two or more data layers, the task becomes at the least, frustrating. Increasing need for electronic data (both tabular and spatial) began the evolution of Geographic Information Systems (GIS) within SCS and soils data was the driving force. Soils data, in particular, has become one of the most valuable and sought after data layers for use in natural resource GIS databases. No longer are we getting requests for copies of the published soil surveys. Electronic copies are now the preferred format.

In response to this need, SCS has established 3 soil geographic data bases at differing levels of detail. A brief overview of each of these will follow, however, this presentation will focus mainly on the uses of STATSGO.

The three databases include the National Soil Geographic Data Base (NATSGO) at 1:7,500,000 scale; the State Soil Geographic Data Base (STATSGO) at 1:250,000 scale; and the Soil Survey Geographic Data Base (SSURGO) at 1:24,000 scale. Interpretations are made differently for each data base to be consistent with the level of detail expressed. Data User's Guides are being developed for use with these data bases.

All three databases are composed of map unit components which are linked to an attribute data file, the Soil Interpretations Record (SIR) data base. For each major layer for approximately 18,000 soil series, the SIRs contain data for more than 25 soil properties such as available water capacity, bulk density, reaction, and cation exchange capacity. The proportionate extent and properties of the component soils are identified through this linkage to the computerized attribute data. The data base also contains interpretations for numerous uses such as sanitary facilities and woodland.

SSURGO was designed to be used at the local level for landowner, township, and county natural resource planning. The source mapping scale usually ranges from 1:12,000 to 1:31,680. The data is captured digitally at 1:12,000 or 1:24,000.

In general, the more detailed the map and the larger the map scale the fewer the number of map unit components. For example, SSURGO contains 1 to 3 map unit components which are each linked to Soil Interpretation Record (SOI-5). Most SCS soil interpretations have been made using the most limiting soil component, not the dominant component. GIS technology allows us to query each map unit component'for a particular criterion. Then the percentage of components are aggregated for each category (slight, moderate, or severe) by map unit id (muid). A map and a report can then be generated for each category with a legend showing the percentage of map units (not delineations) that meet the criteria. Instead of the entire map unit being rated as severe for septic field suitability, now only a percentage is rated severe.

STATSGO was established for use at the multi-county, state, and regional level. Soil delineations were generalized from more detailed soil survey maps. Map unit composition was determined by transecting the detailed soil maps. Where detailed soil maps were not available, other soil data, geology, topography, vegetation, and climate were used in the development of STATSGO map units.

A STATSGO map Unit may contain up to 21 map Unit components. It is most difficult to decide on a dominant or most limiting component. Just as in SSURGO, one can use GIS to query each map unit component for a criterion. The percentage of components are aggregated for each category (slight, moderate, or severe) by map unit id (muid). A map and a report can then be generated for each category with a legend showing the percentage of map units that meets the criteria.

NATSGO is primarily used for national resource planning, monitoring, and appraisal. The Major Land Resource Area (MLRA) boundaries were developed primarily from state general soil maps and were used as the spatial data for NATSGO. Presently, NATSGO map unit composition was determined by sampling done as part of the 1982 National Resources Inventory (NRI), therefore, the attribute data comes from the NRI and SOI-5s. When all the STATSGO data is available for the U.S., a new NATSGO will be developed by aggregating STATSGO map units.

SCS has written GIS interfaces for STATSGO and SSURGO. These GRASS interfaces help the agency overcome inexperience in GIS and assure consistent, accurate interpretations. User's manuals have been developed also.

Our staff is beginning to utilize preliminary STATSGO data for the Northeast for a variety of applications. Regional, state, and multi-county soil pesticide leaching potentials, shallow bedrock, and erosion potential maps are but a few of the interpretative products that can be generated from STATSGO.

Some of these preliminary products have been generated for regional projects such as the Chesapeake Bay watershed. This watershed covers 64,000 sq. miles and has been targeted for 40 percent nutrient reduction (nitrogen and phosphorus) by the year 2000. Only approximately 15 percent of the watershed has SSURGO data available and much of the watershed needs varying degrees of soil survey updates. STATSGO is an excellent soils database for a project of this size and could be used to prioritize more detailed soil survey activities in the watershed.

The integration of STATSGO with other data'can be a useful tool for identifying areas that are most vulnerable to ground and surface water contamination. STATSGO products can be integrated with Agricultural Census data, for example. Agricultural Census data is county level data that is collected every five years and is used by Congress to assist with farm program management. GIS is a superb mechanism for analyzing and displaying the data that traditionally has been distributed as volumes of tables in hardcopy format.

This year, our staff worked very closely with NNTC soil scientists, agronomists, water quality specialists, nutrient management specialists, and economists on the integration of 1987 Agricultural Census data with STATSGO. We used Pennsylvania STATSGO as the prototype and have plans to expand the project over the entire Northeast. Interpretative maps and reports were generated to identify soil areas in Pennsylvania that are most vulnerable to leaching. This digital map was overlain with counties that have high manure production and/or high chemically treated cropland.

STATSGO is also proving to be an excellent correlation tool and check for data quality. We are presently generating products for use in addressing concerns importdnt to mapping, correlating, and interpreting soils in the glaciated Northeast. This geographic area is Land Resource Area R, which covers six New England states and parts of New York, New Jersey, Pennsylvania, and Ohio. Some of the STATSGO products will include maps and reports showing the extent of dense till, spodosols, temperature regimes, and fragiaquepts. The GIS will also make it more apparent where there are data gaps or data quality problems in the attribute data.

Additional resource data should be analyzed with soils information in a GIS to better define those areas that have been contaminated and those with the greatest potential for ground and surface water pollution. I am in no way advocating using only one or two layers of information to identify and assess the water quality of an area. However, when you do not have readily available digital resource data such as specific chemical application rates, geology, topography, hydrography, land use and land cover, precipitation, atmospheric data, water quality monitoring data, and population data, then why not utilize what is available? Chances are that many good resource management decisions would better be made utilizing only a few databases than none at all. Of course, there is never any substitution for the information that a cadre of technical specialists from many disciplines can offer in performing the most accurate interpretations.

In addition to using GIS for the generation of soil survey end products, GIS may also be used as the "front end" to soil survey. In some instances, GIS may be useful in making soil surveys as conveyed in a paper prepared by Bruce Stoneman, SCS-VA and Maxine Levin, SCS-CA. The paper entitled "Ideas for Using GIS to Enhance, Expedite, and Improve Soil Survey Activities", emphasizes the use of present soil line work, if available, with digital slope, aspect, elevation, geology, precipitation, and other available data.

In conclusion, SCS has established three soil geographic databases to meet the needs of our soil survey users. There are countless GIS applications utilizing geographic soils data. Our foremost use of digital soils data and GIS is as; a tool in making soil surveys; the mechanism by which interpretations are generated and displayed thus allowing users to make more informed resource management decisions: and assist with soil correlation.

GIS SUPPORT FOR SOIL SURVEY AND RESOURCE INVENTORIES

Javier E. Ruiz

The use of GIS in soil survey can be categorized into four areas, they are:

- New Surveys
- Survey Updates
- Special Studies
- Technical Soil Set-vices

New Surveys

Examples of data that can be used includes:

DEM Data
TIGER Data
- STATSGO Data
- SSURGO Data

Survey Updates

Examples include:

MIADS data which serves as the basis for development of interpretive maps using the SSURGO interface.

Special Studies

Watershed projects where the area is digitized and utilized with existing MIADS, SSURGO or STATSGO data.

Masks of the data can be developed using the project outline to work only with the soils within the project.

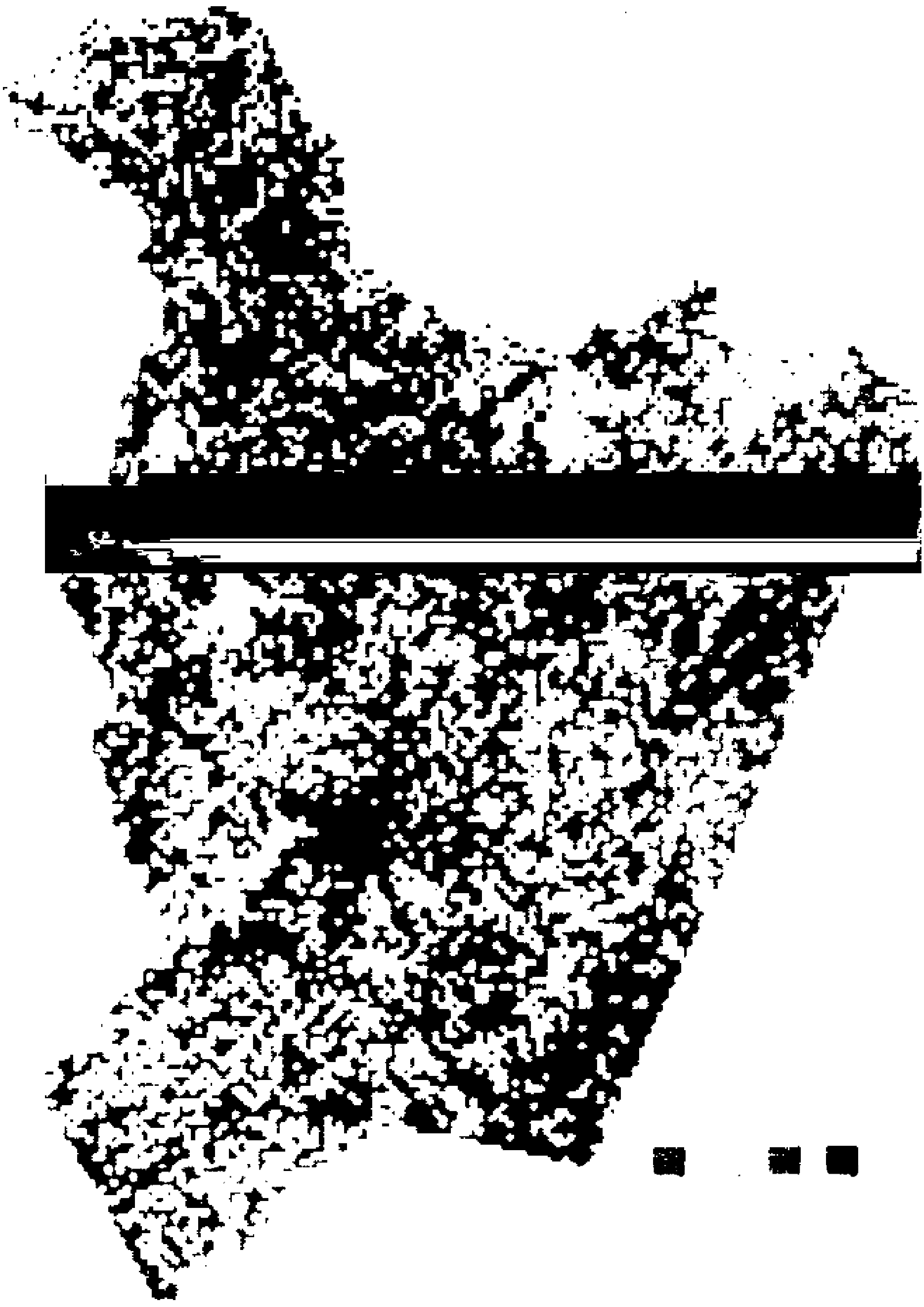
--Technical Soil Services

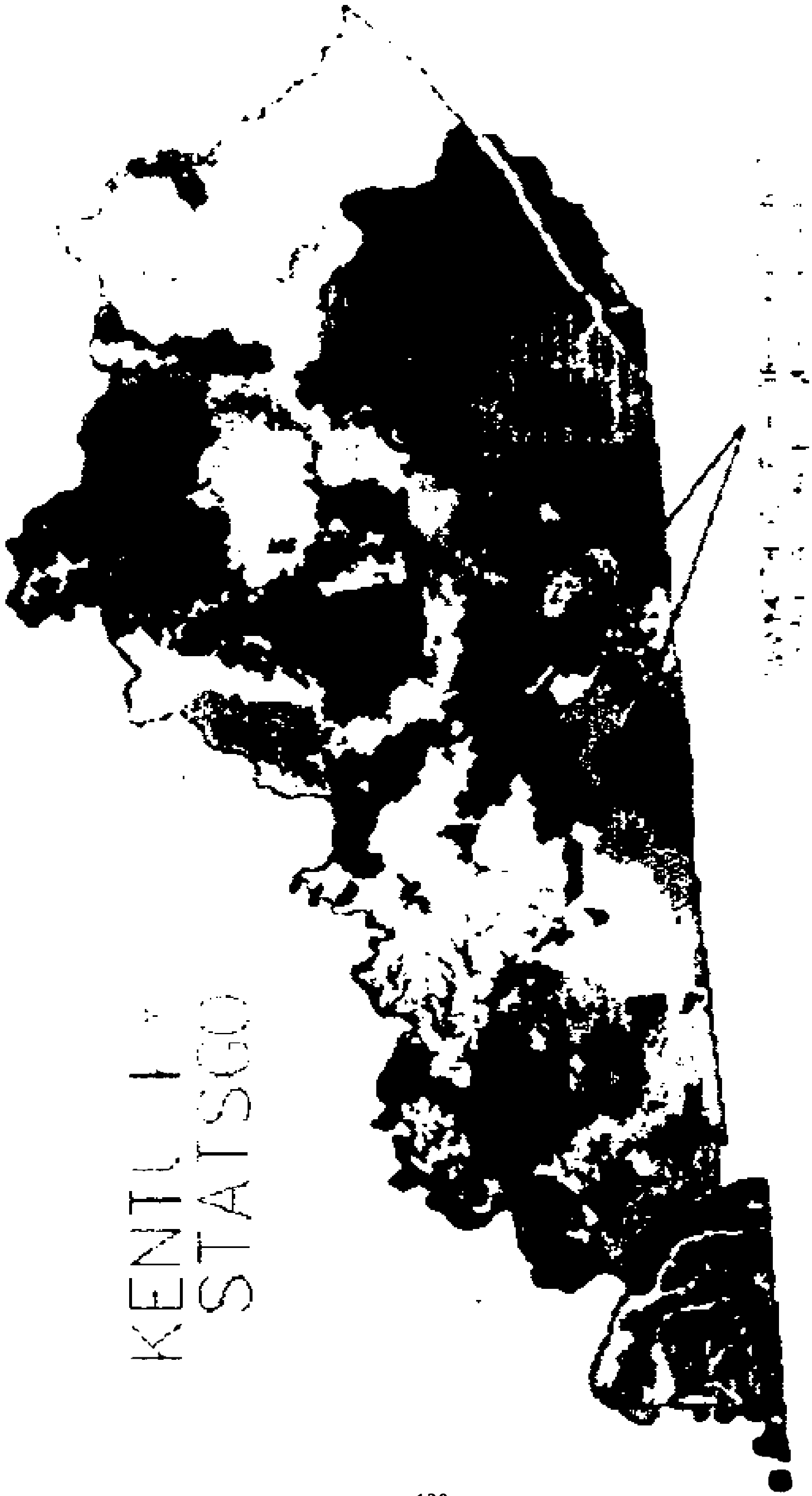
The most beneficial use of GIS is in soil survey, because it can generate the interpretations found in published soil surveys.

Relies on the use of STATSGO and SSURGO tabular data and the SSURGO and STATSGO interfaces.

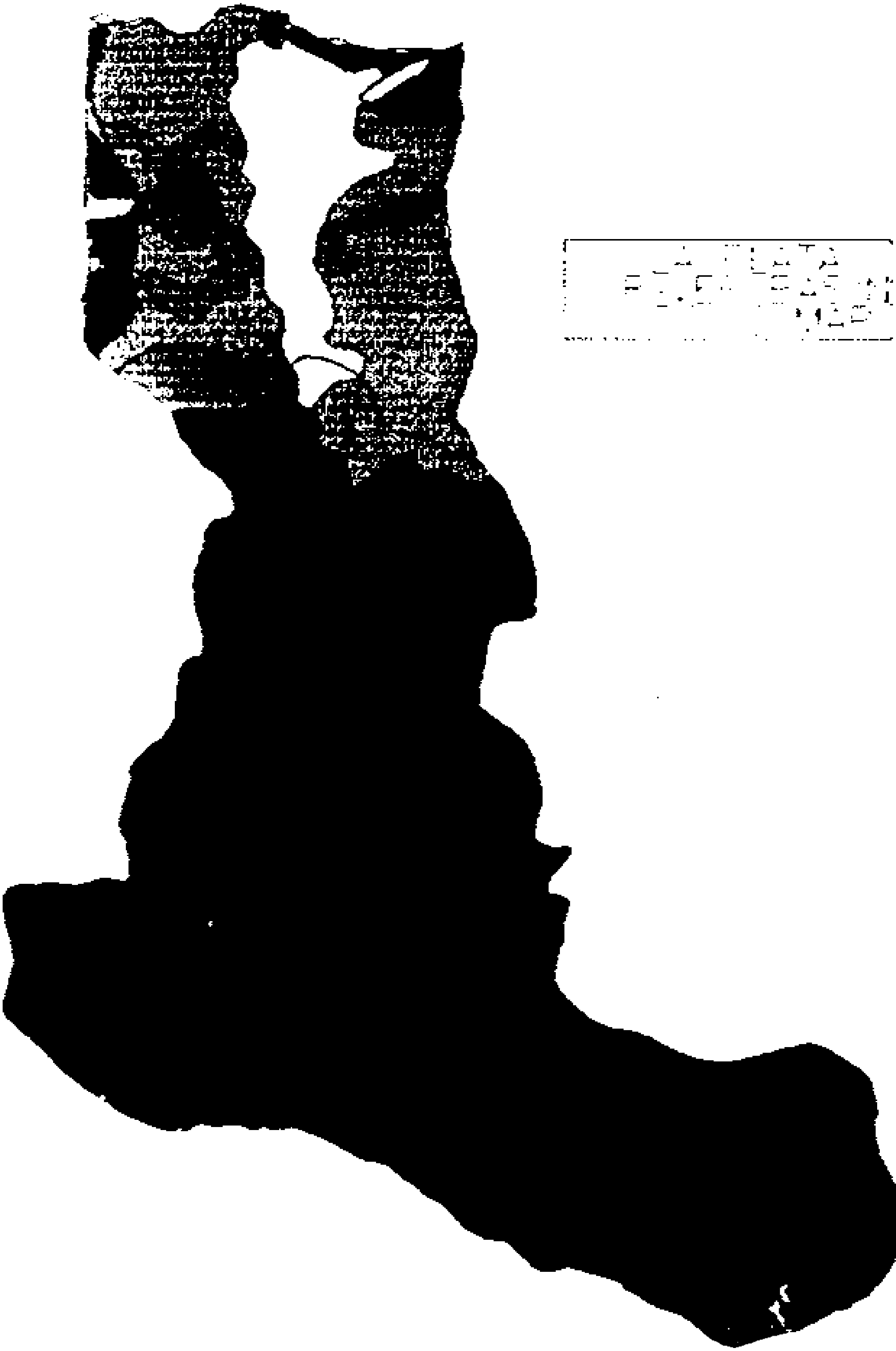
Allows for development of customized interpretations that are not normally found in published soil surveys.

none
Produced by: USDA Soil Conservation Service
Software: GRASS
Soils of Habersham Co. Georgia
HABERSHAM COUNTY, GEORGIA




KENT
STATSGO

STATSGO SOILS



North Carolina Center for Geographic Information & Analysis
Digital Soils Resources Program

TOM TRIBBLE

The North Carolina Center for Geographic Information 8 Analysis (CGIA) operates a geographic information system (GIS) and serves as the official repository for digital geographic data for the State of North Carolina. A receipt-funded agency established in 1977. CGIA is located in the Office of State Planning.

CGIA's mission is to build and maintain a statewide database of digital geographic information; to provide GIS services to other government agencies, universities, and private sector; and to address GIS coordination within state government.

The U.S. Department of Agriculture's Soil Conservation Service (SCS), the North Carolina Division of Soil and Water Conservation, and individual counties are participating in a cooperative effort to complete modem Soil Surveys for all 100 counties in North Carolina. CGIA, through an active Digital Soils Resource Program, is converting the County Soil Surveys to a digital format for inclusion in the State's corporate GIS database.

CGIA uses source materials prepared by SCS through the Cooperative Soil Survey Program. Because the mapping procedures have evolved over time, the multidated county soil surveys exhibit differences in soil classifications, mapping intensity, and the imagery used for publications. The CGIA Digital Soils Resource Program attempts to achieve a uniform and contiguous soils data layer by minimizing the effects of the multidated county soil surveys. CGIA has established standards and procedures for preparing and digitizing the data designed to minimize the problems inherent to the source materials.

CGIA cooperates closely with SCS in developing a digital soils database that matches the published SCS county soil survey. However, if the soil survey was not produced with orthophotography as a base, corrections must be made for image displacement problems. In order to property capture the data in a GIS, soil lines are transferred to stable hase, 1:24,000 scale, 7.5 minuta orthophotos. When resources are available, SCS reviews the soil line transfer work and resolves problems caused by differences in classification, mapping intensity and in the definition of county boundaries.

The soil lines are digitized, processed, edited, and stored by 7.5 minute quadrangle in a topological data format. To facilitate use in the GIS, CGIA interactively edits the data to match soil lines at quadrangle boundaries. CGIA uses ARC/INFO software from Environmental Systems Research Institute.

In 1992, CGIA will test and evaluate the use of scanning technology to convert soil surveys to a digital format. Digital soil survey data are available in ARC/INFO format for 16 counties. Attached is a digital soil survey status map for North Carolina. The SCS general soils association mapping for North Carolina is also available in digital format at CGIA.

For additional information on CGIA's Digital Soils Resource Program or on how to obtain data or products, please contact Zsolt Nagy at CGIA's main office in Raleigh (919) 733-2090 or Tom Tribble at the Asheville Field Office of CGIA at (704) 251-6223.

SOUTH-NORTHEAST REGIONAL TECHNICAL
WORK PUNNING CONFERENCE

ASHEVILLE, NORTH CAROLINA
JUNE 14-19, 1992

TASK FORCE 1 REPORT - SOIL SURVEY AND MANAGEMENT OF FOREST SOILS

Chairman: Jim Keys (South)
Vice Chair: Willis E. Hanna (Northeast)

Objective:

To determine how to effectively deal with interpretations that have local application.

Charge:

To review the convention, criteria, and coordination of making local interpretations.

Task Force members reviewed current handbook and manual instruction relating to local interpretations, and discussed ways of effectively dealing with local interpretations.

Responses to the Charge:

Committee V of this Conference identified interpretation needs of cooperators following the 1988 meeting in Knoxville, Tennessee. During the 1990 conference in Puerto Rico, committee members determined that only twenty-one of the seventy-five interpretation needs had regional or national application. The remainder should be addressed locally with limitation or suitability ratings or soil potentials. There was a concern that current direction did not allow for effective convention, criteria and coordination of local interpretations.

Direction for the convention, criteria and coordination of local interpretations is found in SSM Chapter 11, NSH Part 603, and NFM Part 537. The SSM provides definitions for kinds of soil ratings and soil potentials. But. a definition is not provided for national, regional or local interpretations. The SSH does provide instruction in development of soil potentials, and includes examples. The NSH and NFM identify responsibilities in interpretation development, and identify approved guides for selected interpretations. NSH 603.00(d) provides for the local field and state staffs and their cooperators to make the decision on the selection of land uses for which soil interpretations are to be developed for a survey area. Specific direction concerning coordination between cooperators, technology transfer, and how to handle not only local. but regional and national interpretations is not adequately addressed.

COMMITTEE V. **REPORT** (Continued)

The following were considered important when dealing with local interpretations:

1. Need **a** standard procedure for developing local interpretations to meet cooperator/user needs.

2. Peer review by cooperators is a must.

3. Approved guides should be made accessible to everyone.

4. Provide for ratings that ere positive to the user; limitation ratings sometimes have **a** negative coneration to the user (you can't do this because **it** has severe limitations).

5. Use research data when available to establish criteria.

6. Make it clear what can go in a database to support/develop local interpretations.

7. A local interpretations database may include climatic information es well es soil site properties.

8. Criteria should be developed that utilizes soil properties of major soil components of the map unit.

Recommendations:

The National Soil Survey Center provide the NCSS with more precise direction in handbooks and manuals for the convention, criteria and coordination of local interpretations.

-Assure that handbooks and manuals do not contradict each other in both definition of terms and direction.

-Provide direction for technology transfer of local interpretations between cooperators allowing for peer review. information sharing, and application.

The Task Force would like to propose that this issue be considered in the National Work Planning Conference.

There ere no current issues to address in the 1994 Conference.

ATTACHMENT 1

TASK FORCE MEMBERS

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D.Williams		

National Soil Survey Center

Dennis Lytle

1992 South-Northeast Soil Survey Conference
Ashville, North Carolina
June 14-19, 1992
Soil Temperature and Moisture Regimes
Task Force 2 Report
by

Edward J. Ciolkosz, William J. Waltman, and Wayne Hudnall

Background

Soil temperature and moisture information has become a very high priority area of investigation in recent years both in soil classification and in addressing global change issues. The cooperative soil survey has both the expertise and data to address many of the needs in soil classification and global change work Attempts to address some of these needs are outlined in the charges given below.

Charges

A. General

1. Identify, describe, and evaluate existing models that can be used to predict soil moisture and temperature regimes (i.e., Newhall, EPIC, WEPPS, etc.)

2. Compile a listing of studies that have related soil climate to local or regional trends in soil development. For example, Jenney's classic 1941 text graphs of clay content in soils vs. temperature and precipitation, or Stanley and Ciolkosz's (SSSAJ 45:912-917.1981) attempt to relate soil temperature to

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The **work** of the Task Force is given under the sections Action and Recommendations. An exception is a report of the Task Force Subgroup which follows.

Task Force Subgroup 1 Report

Modeling Approaches to Soil Moisture and Temperature Regimes

H. R. Mount, J. B. Nichols, and W. J. Waltman*

Introduction

The complexity of soil/landscape/climate relationships both spatially and temporally will make soil moisture/temperature regime models a necessity to help predict ecosystem responses and provide a spatial (GIS) linkage to general circulation models (GCMs). Predictive models that precisely characterize soil climate regimes are not only needed by soil scientists for classification, but may provide the missing spatial element that allows ecologists to extrapolate climatic changes and ecotone shifts to the landscape. The purpose of this paper is to describe and evaluate current models of soil climate regimes and provide recommendations for future research.

The Newhal'l Model

This model has long been used by the USDA Soil Conservation Service to estimate aridic, xeric, ustic, and udic soil moisture regimes as defined in Soil Taxonomy. Franklin Newhall and C. R. Berdanier have recently submitted the documentation and description of the model for publication as a Soil Survey Investigations Report Since its original release, their model has been modified by Van Wambeke et al. (1992). The modified model introduces subdivisions of soil moisture regimes and variable soil moisture storage. Although the original Newhall Model was developed in COBOL and FORTRAN, the Van Wambeke modified version is now written in BASICA and runs on most PCs.

The Newhall Model was intended to run on monthly 30 year normals for precipitation and temperature, but it can be run on annual monthly records to develop a frequency distribution of soil climate regimes. Newhall relies upon a Thomthwaite approach to the calculation of potential evapoaanspiration (PET). PET is assumed to be uniformly distributed during each month. Monthly precipitation (MP) is arbitrarily divided between heavy precipitation, which equals 1/2 of MP and is fixed to the middle of the month, and light precipitation that occurs over several minor events. Given the vintage of the Newhall Model, the computer hardware consaaints, and the difficulty of managing daily climatic records, this “tipping-bucket” approach and the needed assumptions were fairly reasonable. Table 1 presents a typical summary from the original Newhall Model (Newhall and Berdanier, 1992) and Table 2 gives a summary from the Van Wambeke modified version of the model.

Figure 1 gives Newhall soil moisture regimes for the conterminous U.S. based upon 1957 to 1976 climate records. Apparently, the earlier version of the Newhall Model did not recognize the perudic moisture regime. Figure 2 compares the Newhall Model results with the dominant soil moisture regimes (SMR) derived from STATSGO (State Soil Geographic Database). Soil scientists familiar with Nebraska soils generally commented that the Newhall Model interprets rhe ustic/udic boundary further west than the STATSGO map. Figure 3 relates precipitation isohyets to Newhall SMR for Kansas. The additional subdivisions of SMR in the Van Wambeke version may provide some new climatic interpretations relative to agricultural production (see Tables 1 and 2).

Soil Scientist, NSSC; Soil Scientist, SNTC; and Research Soil Scientist, NSSC, USDA/Soil Conservation Service.

Table 1. Report format from the original version of the Newhall Model (Newhall and Berdanier, 1992)

SOIL MOISTURE REGIME DEVELOPED FROM THE EXTENDED RECORD OF MONTH-BY-MONTH PRECIPITATION AND PE NORMALS

ROSEMONT, WEBSTER CO., NEBRASKA 40.3N 98.4W 610M STATION # 257330-7 PRECIPITATION RECORD 1931-1960

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
NORMAL AIR TEMPERATURE DEGREES CELSIUS	-5.9	-0.6	3.6	11.6	17.1	22.4	25.4	24.8	19.1	12.8	4.2	-1.0	11.2
NORMAL POTEN. EVAPOTRANSPIRATION MM	0	0	13	47	88	134	161	142	94	45	9	0	733
NORMAL PRECIPITATION MILLIMETERS	15	22	36.	51	86	112	74	64	62	31	22	17	594

SOIL MOISTURE PROBABILITIES TO DETERMINE SOIL MOISTURE REGIME FOR SOIL TAXONOMY

	PERCENT PROBABILITY	- - - - - - - - - - - - - - - CRITERIA FOR MOISTURE CONTROL SECTION (MCS)	- - - - - - - - - - - - - - -	
1	73	DRY SOME/ALL PARTS MCS	90 OR MORE DAYS CUMULATIVELY	WHEN SOIL TEMP 5 DEG C OR HIGHER
2	33	DRY SOME/ALL PARTS MCS	6/10 OR MORE OF DAYS CUMULATIVELY	WHEN SOIL TEMP 5 DEG C OR HIGHER
3	10	DRY ALL PARTS MCS	1/2 OR MORE OF DAYS CUMULATIVELY	WHEN SOIL TEMP 5 DEG C OR HIGHER
4	0	DRY ALL PARTS MCS	3/4 OR MORE OF DAYS CUMULATIVELY	WHEN SOIL TEMP 5 DEG C OR HIGHER
5	67	MOIST SOME/ALL PARTS MCS	90 OR MORE DAYS CONSECUTIVELY	WHEN SOIL TEMP 8 DEG C OR HIGHER
6	33	DRY ALL PARTS MCS	45 OR MORE DAYS CONSECUTIVELY	DURING 120 DAYS AFTER SUMMER SOLSTICE
7	97	MOIST ALL PARTS MCS	45 OR MORE DAYS CONSECUTIVELY	DURING 120 DAYS AFTER WINTER SOLSTICE

SOIL TEMPERATURE REGIME: MESIC ESTIMATED FROM NORMAL AIR TEMPERATURES

SOIL MOISTURE REGIME: USTIC ESTIMATED FROM PROBABILITY VALUES IN LINES 1, 3, 5, 6, 7

AND MOISTURE REQUIREMENT IS "TYPIC" FOR:
HAPLUSTALFS, PALEUSTALFS, USTOCHREPTS, ARGIUSTOLLS, CALCIUSTOLLS, HAPLUSTOLLS, NATRUSTOLLS, PALEUSTOLLS
ARGIALBOLLS

AND MOISTURE REQUIREMENT IS "NON-TYPIC" FOR:
DURARGIDS, HAPLARGIDS, PALEARGIDS, CALCIORTHIDS, CAMBORTHIDS, DURORTHIDS, PALEORTHIDS, TORRIFLUVENTS, TORRIORTHENTS, TORRIPSAMMENTS

ESTIMATED DATES AND DURATION WHEN SOIL TEMPERATURE IS 5 DEG C AND ABOVE. BEGINS APR 10. ENDS NOV 22. DURATION 226 DAYS.

ESTIMATED DATES AND DURATION WHEN SOIL TEMPERATURE IS 8 DEG C AND ABOVE. BEGINS APR 22. ENDS NOV 7. DURATION 199 DAYS.

USDA-SCS-SOIL SURVEY 04/06/76

FORMAT OF COMPUTER PRINTOUT OF SOIL MOISTURE PROBABILITIES, ROSEMONT, NEBRASKA,
BASED ON CALCULATED SOIL MOISTURE REGIME FROM 30 YEARS OF PRECIPITATION RECORD.

Table 2. Report format from the Van Wambeke et al. (1992) version of the Newhall Simulation Model. Based upon the Mt. Washington, NH, weather station, 1951 to 1980 normals.

```
Station:Mt. Washington       Country:usa            Latit:  44  16  N
Elevation:   6262                                   Longit: 71  18  w

Annual rainfall 2284 mm                  Waterholding capacity:  200  mm
Temperature  regime:  pergelic                  Moisture regime: Perudic

            SOIL CLIMATIC REGIME ACCORDING TO NEWHALL COMPUTATION
            (soil temp.-air temp.+2.5 C; amplit. reduced by 1/3)

    JAN    FEE    MAR    APR    MAY    JUN   JUL    AUG    SEP    OCT    NOV    DEC

  monthly  rainfall  (mm)
   185.7  203.5  208.0  178.6  164.1  179.3  175.3  193.0  181.6  170.9  216.9  227.1
  monthly air temperatures (Celcius)
   -14.9  -15.1  -11.1   -5.3    1.3    7.0    9.3    6.4    4.8   -0.8   -6.5  -12.7
  monthly evapotranspiration (Thornthwaite), mm.
     0.0    0.0    0.0    0.0   29.1   83.1   99.7   86.5   52.8    0.0    0.0    0.0

             TEMPERATURE CALENDAR                    MOISTURE CALENDAR
       (- : T<5) (5 : 5<T<8) (8 : T>8)       1 = DRY ; 2 = M/D; 3 = HOIST

       1************15***************30      1************15***************30

  JAN                                        333333333333333333333333333333
  FEB  ------------------------------        333333333333333333333333333333
  MAR  ------------------------------        333333333333333333333333333333
  APR                                        333333333333333333333333333333
  NAY  ------------------------------        333333333333333333333333333333
  JUN  ------------------------555555        333333333333333333333333333333
  JUL  555555555555888888808888888888        333333333333333333333333333333
  AUG  888088888888888808888888888888        333333333333333333333333333333
  SEP  88855555555555555555555-------        333333333333333333333333333333
  OCT                                        333333333333333333333333333333
  NOV  ------------------------------        333333333333333333333333333333
  DEC                                        333333333333333333333333333333
```

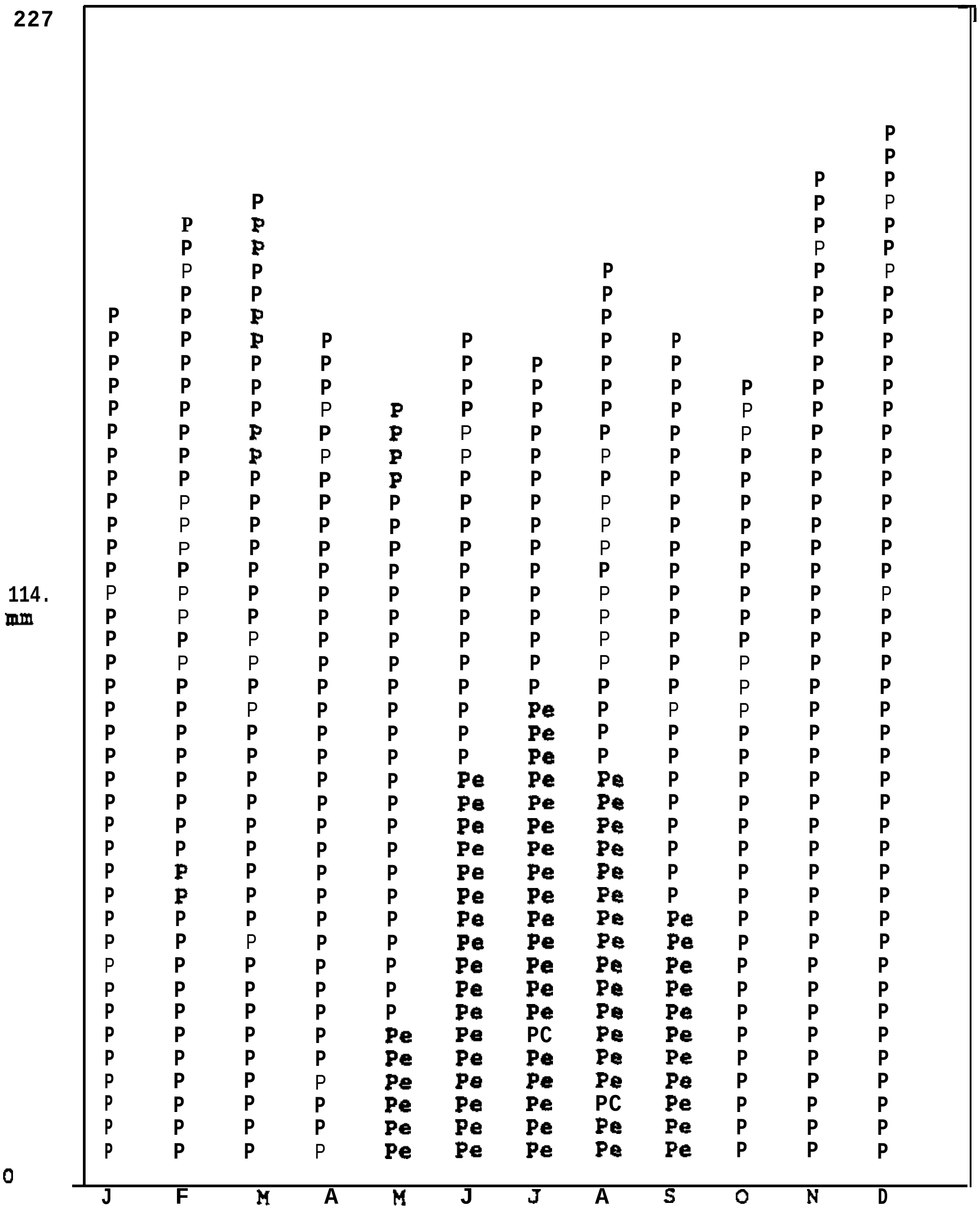
Number Of cumulative days that the moisture control section						Highest number of consecutive days that the MCS is			
During one year is			When soil temp is above 5 deg. C			Moist in some parts		Dry after summer solstice	Moist after winter solstice
DRY	M/D	MOIST	DRY	M/D	MOIST	YEAR	T>8		
0	0	360	0	0	89	360	51	0	120

*
Computed by BASIC program FLEXNSM (FEB 1991).
Tentative subdivision: for a waterholding capacity of 200 mm

Table 2 (cont.)

Station: Mt. Washington country: usa

P = precipitation e = potential evapo-transpiration



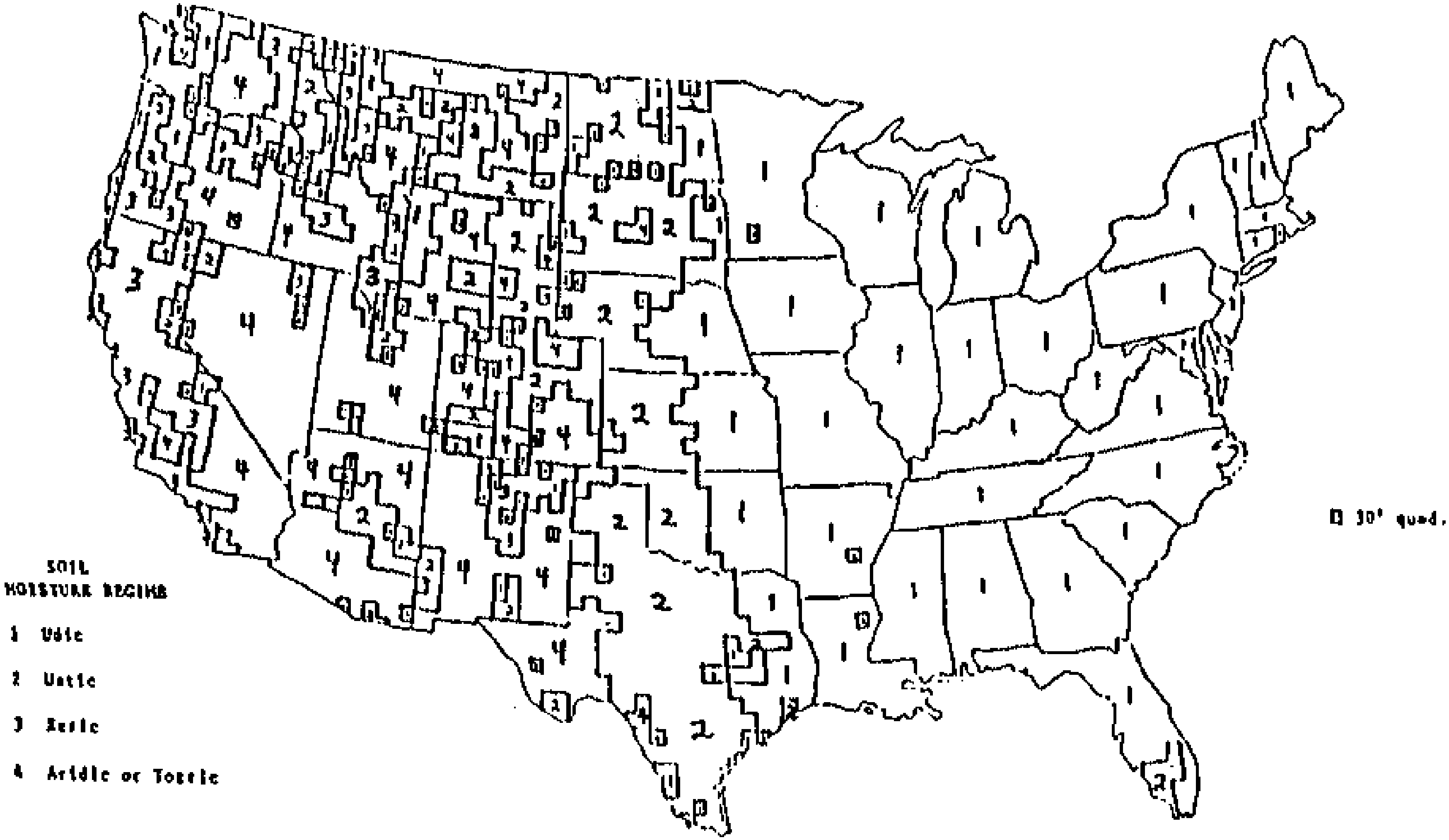
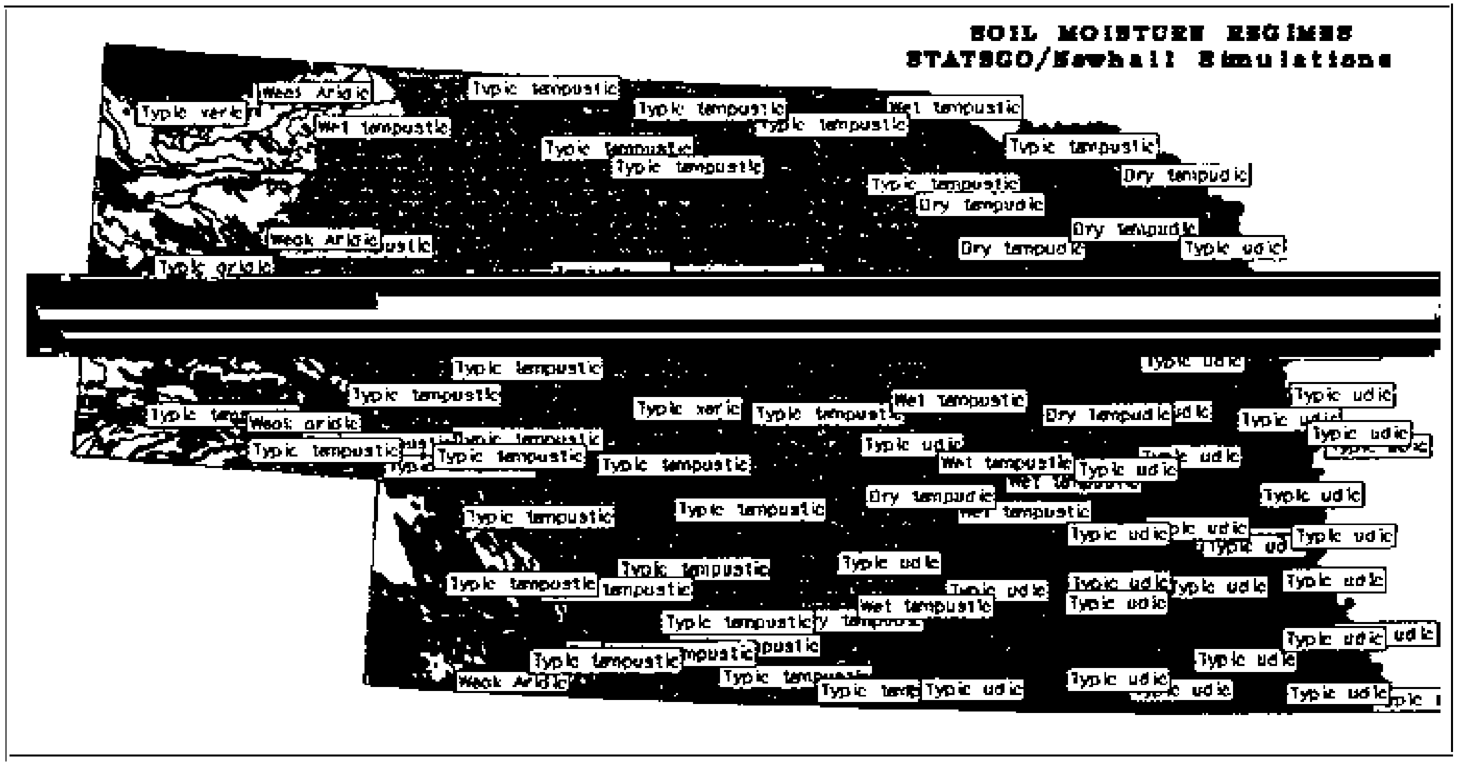


Fig. 1 Calculated soil moisture regime by 30-minute quadrangles for the conterminous United States derived from the Newhall Model using a 1957 to 1976 dataset (Newhall and Berdanier, 1992).



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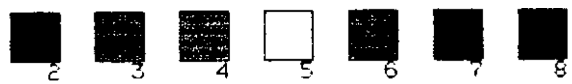
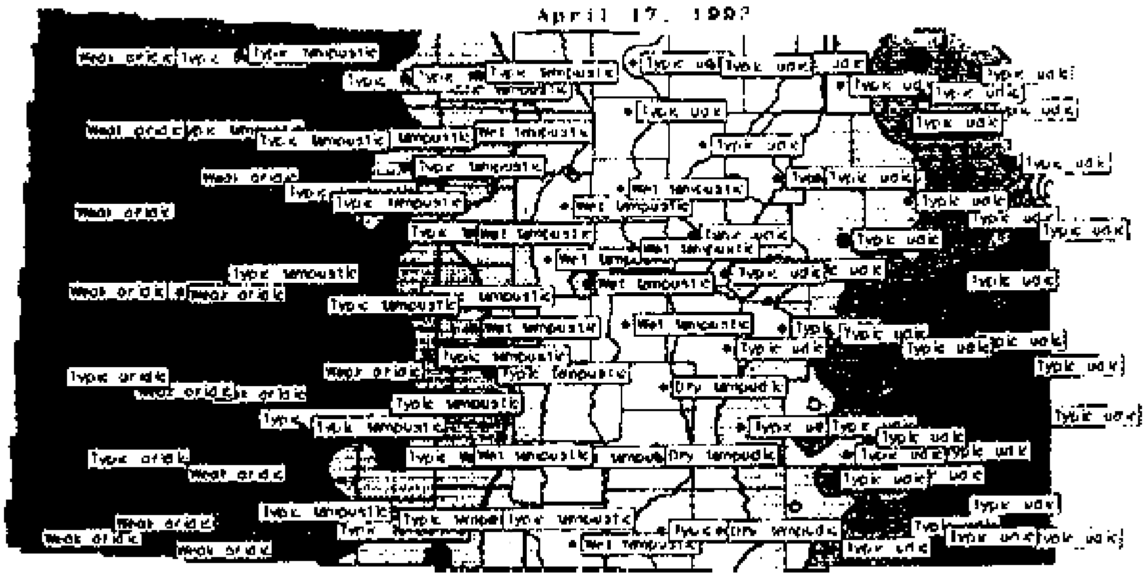


1 Aquic Moisture Regime
2 Udic Moisture Regime
3 Udic/Ustic Intergrades
4 Ustic Moisture Regime
5 Aridic/Ustic Intergrades
6 Ustic/Aridic Intergrades
7 Aridic Moisture Regime
8 Water

Fig. 2 Comparison of Newhall Simulation results with Nebraska STATSGO. The SMRs derived from Newhall Model were based upon 1951 to 1980 normals of Nebraska weather Stations and use proposed subdivisions of Van Wambeke et al. (1992).

TITLE: Mean annual precipitation (1951 - 1980 normals)
LOCATION: [illegible]

Newhall Simulation Model
(1951 1980)
W.J. Waltman
April 17, 1992



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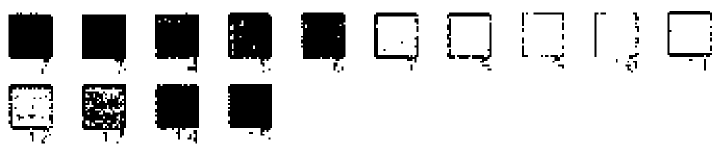


2 13 to 14 inches
3 15 to 16 inches
4 17 to 18 inches
5 19 to 20 inches
6 21 to 22 inches
7 23 to 24 inches
8 25 to 26 inches
9 27 to 28 inches
10 29 to 30 inches
11 31 to 32 inches
12 33 to 34 inches
13 35 to 36 inches
14 37 to 38 inches
15 39 to 40 inches

Fig. Comparison of Newhall Simulation results for SMR in Kansas with precipitation isohyets (1951 to 1980 normals). Each location represents a weather station with 30 yr normals for temperature and precipitation.

More recent work (Lytle et al., 1992) with the Newhall Model for global soil moisture regime and soil temperature regime maps indicates that the model becomes biased at high latitudes and predicts much of the tundra and spruce-fir forest regions as having aridic moisture regimes. The model appears to overestimate PET at the higher latitudes.

The weakest part of the Newhall Model may be its estimation of soil temperature regimes (STR). In the original version, mean annual soil temperature (MAST) was estimated by adding 1 C to the mean annual air temperature (MAAT). However, in the Van Wambeke modified version, MAST is approximated by adding 2.5 C to MAAT. Table 3 presents a brief literature search of soil temperature/air temperature relationships. From a combination of literature search and the SCS's Global Change monitoring stations, more sophisticated algorithms could be developed to predict MAST.

Table 3. Estimating MAST from MAAT.

Reference	Relationship*	Location
Smith et al. (1964)	MAAT + 1.1 C	Midwest & New York
Vann and Cline (1973)	MAAT + 2 C	New York
Carter and Ciolkosz (1980)	MAAT + 1.2 C	West Virginia &Pennsylvania
Ouellet (1972)	MAAT + 3.6	Canada
Mueller (1970)	MAAT + 0.6-2.5 C	Montana
McDole and Fosberg (1974)	MAAT + 2.3-3.6 C	Idaho
Newhall Simulation Model**	MAAT + 2.5 C	Global

*Depends upon snow cover, vegetative cover, and ET
**(Van Wambeke et al., 1992 version)

Figure 4 presents the Newhall (1980) map of soil temperature regimes (based on 30 minutes USGS quadrangles), which presumably represents the 1957 to 1976 climate record. This mapping/modeling approach did not differentiate between cryic and frigid regimes. In the Northeast, frigid and cryic regimes were largely restricted to areas north of the Mohawk Valley. Carter and Ciolkosz (1980) suggest that the frigid soil temperature regime extends farther south along the eastern Allegheny Plateau (MLRA 127) into West Virginia (Figure 5). The relationships developed by Carter and Ciolkosz (1980) between latitude, elevation, and MAST were later verified by Waltman et al. (1988) for the Glaciated Allegheny Plateau and Catskill Mountains (MLRA 140) and the Eastern Allegheny Plateau in southern New York.

Figure 6 shows a comparison of MAST in Kansas between the original Newhall Model and the Van Wambeke modified version using the same climate record (1951 to 1980). Again, the original version basically followed assumptions given in Smith et al. (1964). The mesic/thermic border is displaced approximately 200 km northward to the Manhattan and Lawrence, Kansas weather stations. Similarly, in the Northeast, under the Van Wambeke version, the mesic/thermic border would extend to Newark, Delaware, and southern New Jersey (Cape May), putting all of the Eastern Shore of Maryland in the thermic zone.

As the authors of the Newhall Model have pointed out, this model should be applied judiciously because the calculated soil moisture/temperature regimes are only estimates derived from climatic data, not soils data (Newhall and Berdanier, 1992). The Newhall Model results often look reasonable, until the spatial and temporal exuapolations are considered. Often, soil scientists tend to consider SMRs and STRs as static properties associated with a given pedon. However, SMRs and STRs have shifted through time and space during the Quatemary, which raises the following issues:

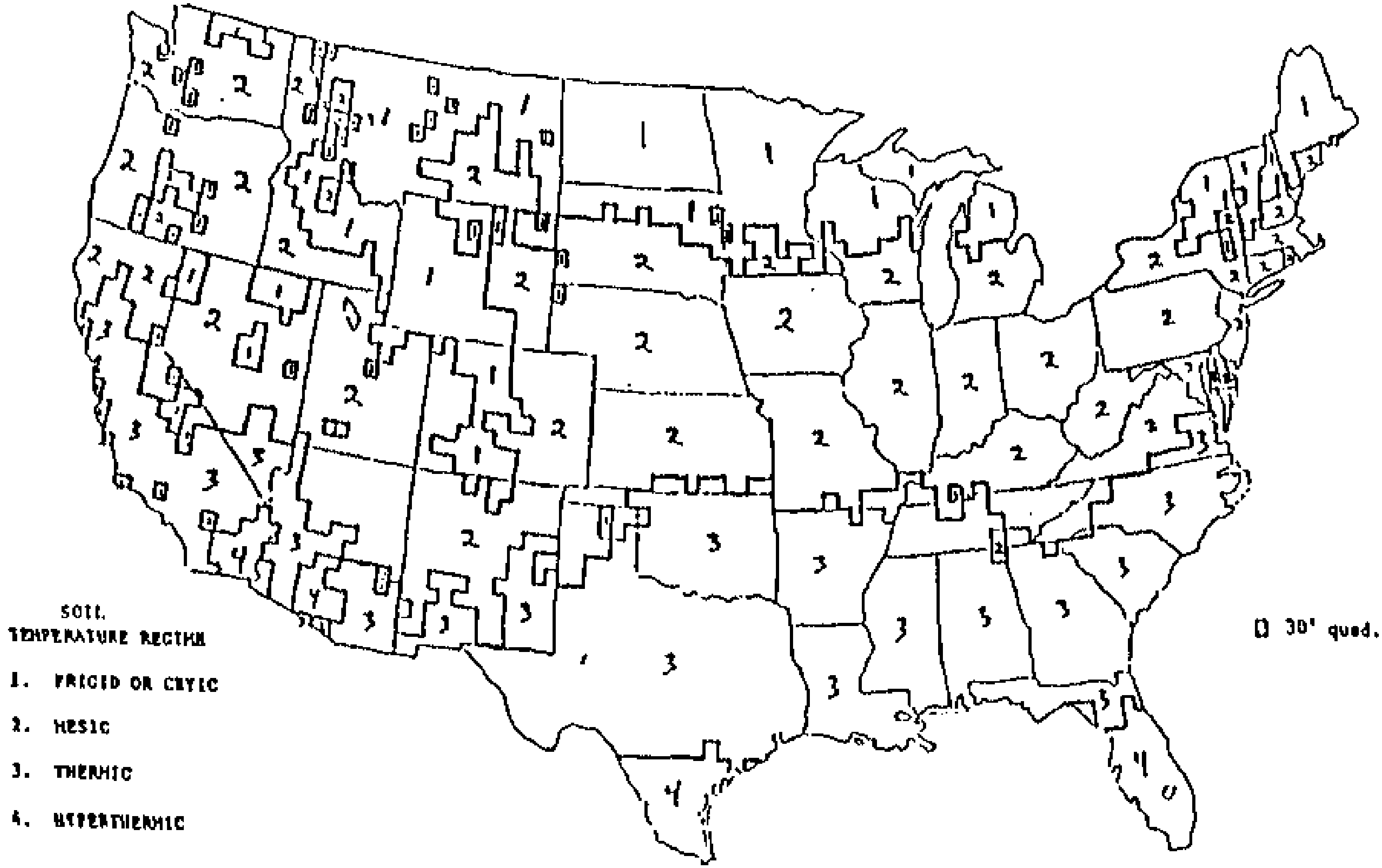


Fig. 4 Estimated soil temperature regimes by 30-minute quadrangles for the conterminous United States derived from the original Newhall Model using a 1957 to 1976 dataset (Newhall and Berdanier, 1992).

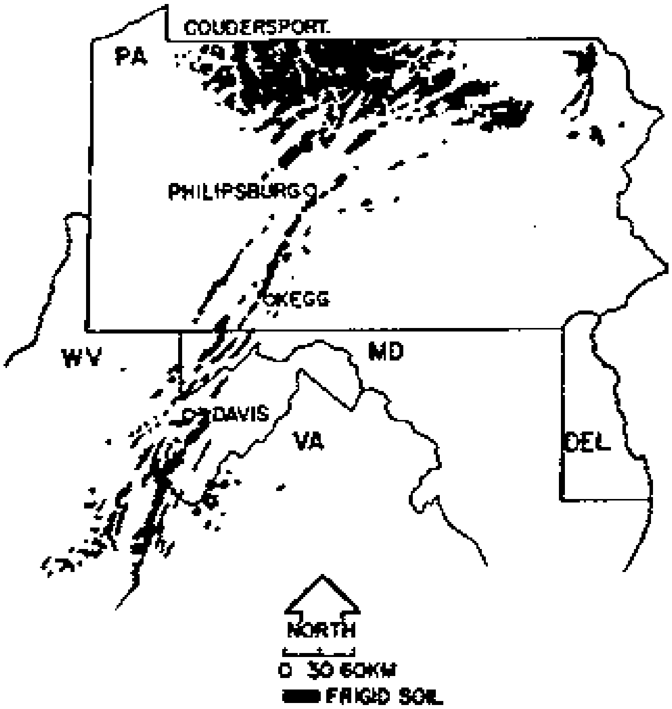


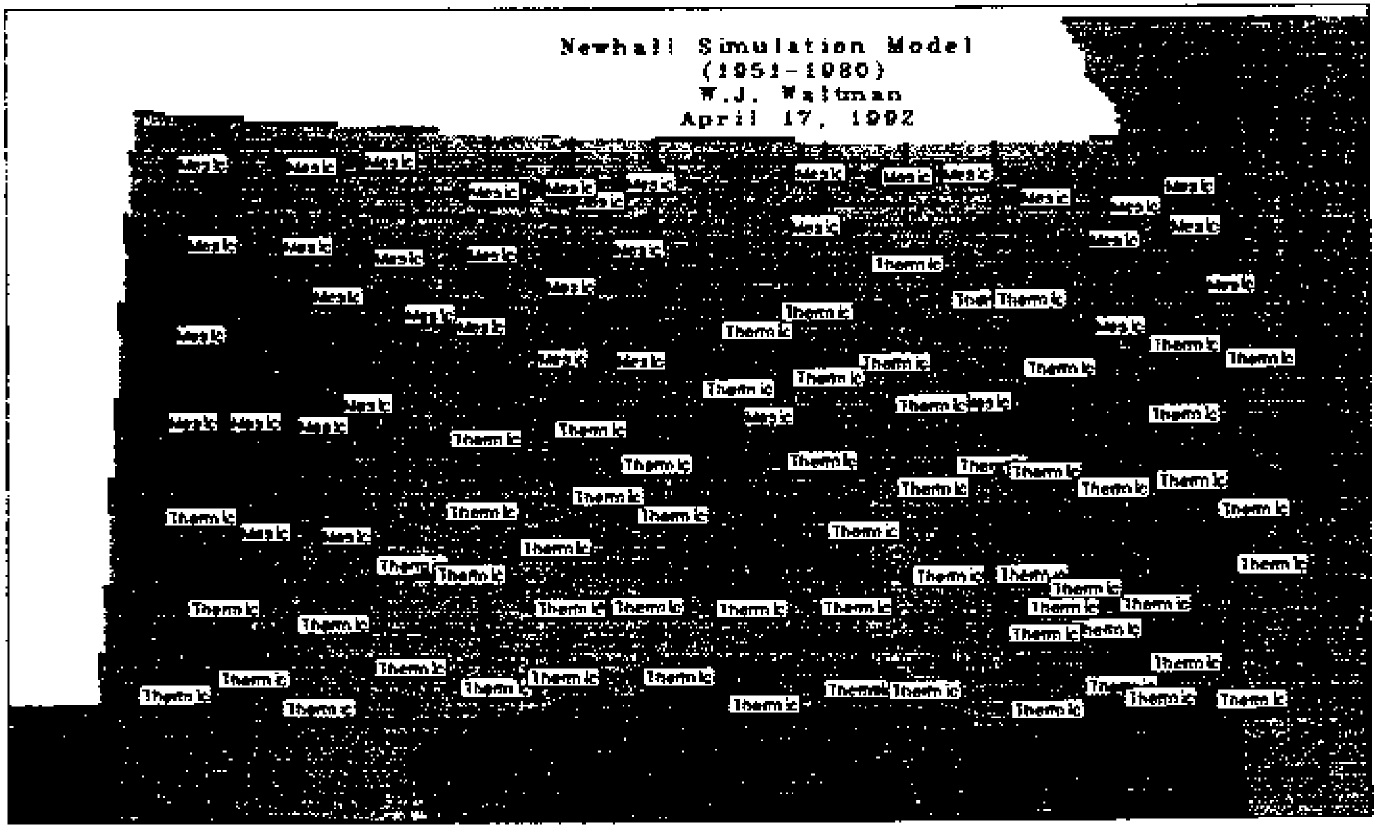
Figure 5. Map of areas of predicted frigid soil temperature regimes in Pennsylvania (PA), West Virginia (WV), Maryland (MD), and Virginia (VA), (unshaded areas have mesic soil temperature regimes), and location of soil temperature study areas (From Carter and Ciolkosz (1980).

1. Which climatic records (1931 to 1961; 195 1 to 1980; 1961 to 1990) should be used for Newhall Model runs?
2. Should the climatic record chosen vary by geographic region?
3. What methodology should be used to aggregate the Newhall results from individual weather stations and allow extrapolation to landscapes?
4. How can interpretive differences be reconciled between presumed SMRs/STRs in STATSGO and the Newhall Model approach?
5. How can temporal and spatial shifts in SMRs/STRs be illustrated at STATSGO and NATSGO levels?

ERHYM-II/RANGETEK

ERHYM-II is a climate, water-balance model that provides a daily simulation of soil and plant evaporation and water routing through the profile (Wight, 1991). ERHYM-II is driven by daily inputs of maximum and minimum air temperatures, precipitation, and solar radiation. The model incorporates infiltration and runoff calculated from daily precipitation and SCS curve number (Sharpley and Williams, 1980). Although the ERHYM-II model was intended to simulate daily soil water content and soil/plant evaporation in forecasting forage production, it could be adapted to predict soil climate regimes (Nichols, 1990; Nichols et al., 1991).

TITLE: SOIL TEMPERATURE REGIMES (1951-1980 normal)
LOCATION: National Soil Survey Center GIS



SCALE: 1: 3626432

1 Mesic Soil Temperature Regime (47 to 59 F)
2 Thermic Soil Temperature Regime (59 to 72 F)

Fig. 6 Comparison of Newhall Simulation results for STR. Each weather station is identified with the Newhall estimation of MAST. The background colors represent a Smith et al. (1964) approach of MAST = MAAT + 2°F.

RANGETEK, unlike the Newhall Model, introduces vegetative cover and range (forage) yield relationships to the estimation of SMRs/STRs. In the Great Plains, the adaptation of ERHYM-II/RANGETEK to prediction of SMRs/STRs might be useful in understanding ecotone shifts in grasslands.

EPIC

Nichols et al. (1991) have proposed that EPIC (Sharpley and Williams, 1990) be adapted to refine subgroup definitions of soil moisture regimes. Since this model can be run for a number of crops. range, and pasture, EPIC also provides the opportunity to bring vegetative cover into the prediction of soil moisture regimes. EPIC uses daily inputs of temperature, precipitation, and radiation from actual data or generated weather data

References

Carter, B. J. and E. J. Ciolkosz. 1980. Soil temperature regimes of the central Appalachians. Soil Sci. Soc. Amer. J. 44:1052-1058.

Lytle, D., N. Bliss, and H. Eswaran. 1992. Personal communication. USDA Soil Conservation Service, NSSC, Lincoln, NE.

McDole, R. E. and M. A. Fosberg. 1974. Soil temperatures in selected southeastern Idaho soils: II. Relation to soil and site characteristics. Soil Sci. Soc. Amer. Proc. 38:480-486.

Mueller, 0. P. 1970. Soil temperature regimes in a forested area of the northern Rockies. Soil Sci. 109:40-47.

Newhall, F. 1980. Internal memorandum. USDA Soil Conservation Service, Washington, DC.

Newhall, F. and C. R. Berdanier. 1992. Calculation of soil moisture regimes from the climatic record. (In press). Soil Survey Investigations Report, USDA Soil Conservation Service, National Soil Survey Center, Lincoln, NE.

Nichols, J. B. 1990. Report on ERHYM-II Model. Soil Climate Occasional Notes, Vol. V, No. 1. USDA Soil Conservation Service, NSSC, Lincoln, NE.

Nichols, J. B., R. L. Haberman, and R. J. Engel. 1991. Use of models to estimate soil moisture for soil classification. Agronomy Abstracts, Div. S-5. Madison, WI.

Quellet, C. E. 1972. Analysis of the annual cycles of soil and air temperatures in Canada. Nat. Can. 99:621-634.

Sharpley, A. N. and J. R. Williams. 1990. EPIC--Erosion/Productivity Impact Calculator: 1. Model Documentation. USDA Tech. Bulletin No. 1768. 235 p.

Smith, G. D., F. Newhall, L. H. Robinson, and D. Swansom. 1964. Soil temperature regimes--their characteristics and predictability. USDA Soil Conservation Service, SCS-TP-144, 14 pp.

Smith, R. E. and J. R. Williams. 1980. Simulation of surface water hydrology. In Vol. 1, Model Documentation; CREAMS: A field scale model for chemicals runoff, and erosion from agricultural management systems. Knisel, W. G. (ed.), USDA Conservation Report No. 26, pp. 13-35.

Van Wambeke, A., P. Hastings, and M. Tolomeo. 1992. Newshall Simulation Model. Dept. of Soil, Crop, and Atmospheric Sciences, Cornell University, Ithaca, NY.

Waltman, W. J., T. G. Macfie, and R. B. Bryant. 1988. Soil temperature regimes of the Catskill Mountains and the Southern Tier of New York State. Div. S-5, Agronomy Abstr., Annual Meetings, Amer. Soc. Agron., Madison, WI.

Wight, J. R. 1991. RANGETEK--Version 1.0. USDA ARS, Northwest Watershed Research Center, Boise, ID.

Action

1. All collected soil climate data has been turned over to the SCS Climate Data Access Facility at the Portland SCS WNTC including the data collected by Ron Paetzold (Soil Climate Notes, 1988, Vol. III, No. 2 1/2).

2. Soil climate references have been combined with those of Ron Paetzold (Soil Climate Notes, 1990. Vol. V, No. 2) and are presented as Appendix 1.

Recommendations

1. NCSS should target support to develop SMR/STR modules for existing models, such as ERHYM-II and EPIC, which rely upon daily weather parameters rather than monthly averages.

2. Through the Global Change Pilot Project and other SCS monitoring programs, an experimental design should be considered and implemented to foster development of predictive models for SMRs and STRs.

3.

4.

CDAF have responsibility for the archiving and distribution of the soil monitoring network inventory data.

8. To support the modeling of soil temperature/moisture regimes, it is recommended that the SCS conduct an inventory of slope, aspect, georeferencing by GPS, soil map unit, landform, and surrounding landuse for the national cooperative network weather stations.

9. It is recommended that Task Force 2 be discontinued

Appendix 1

SOIL CLIMATE LITERATURE[1]

GENERAL

1. Coleman, J. D. 1965. Geology, climate, and vegetation as factors affecting soil moisture. p. 93-99. In G. D. Aitchison (ed.) Moisture equilibria and moisture changes in soils beneath covered areas. Butterworths, Ausualia.

2. Eagleman, J. R. 1976. The visualization of climate. Lexington Books, Lexington, Massachusetts.

3. Hershfield, D. M. 1981. Frequency of dry day sequences. Water Resour. Bull. 17:317-320.

4. Kendall, H. M. 1935. Notes on climatic boundaries in the eastern United States. Geog. Rev. 25:117-124.

5. Meeker, D. O., Jr. and D. L. Merkel. 1984. Climax theories and a recommendation for vegetation classification - A viewpoint. J. Range Mgt. 37:427-430.

6. Osbom, H. B.. K. G. Renard, and J. R. Simarton. 1979. Dense networks to measure convective rainfall in the Southwestern United States. Water Resourc. Res. 15:1701-1711.

7. Passey, H. B.. V. K. Hugie, E. W. Williams, and D. E. Ball. 1982. Relationships between soil, plant community, and climate on rangelands of the Intermountain West. USDA Tech. Bull. No. 1669, 123 pp.

8. Rieger, S. 1983. The genesis and classification of cold soils. Academic Press, New York, 230 pp.

9. Smith, G. D. 1973. Soil moisture regimes and their use in soil taxonomies. p. 1-7. In Field soil water regime. Soil Sci. Soc. Am., Madison, Wis.

10. Smith, G. D. 1986. The Guy Smith interviews: rationale for concepts in Soil Taxonomy. T. R. Forbes (ed.) SMSS Tech. Monograph No. 11,259 pp.

11. Smith, G. D., F. Newhall, L. H. Robinson, and d. Swanson. 1964. Soil-temperature regimes--their characteristics and predictability. USDA Soil Conservation Service, SCS-TP-144, 14 pp.

12. Sombroek, W. G. 1982. A quest for an alternative to the use of soil moisture regimes at high categoric level in Soil Taxonomy. Working Paper and Preprint Presented at the Fifth International Soil Classification Workshop, Khartoum, Sudan, 8 pp.

13. Sophocleous, M. and C. A. Perry. 1985. Experimental studies in natural groundwater-recharge dynamics: the analysis of observed recharge events. J. Hydrol. 81:297-332.

[1]Reprinted from Paetzold, R. 1988. Soil Climate Notes. USDA-SCS, Lincoln, NE, Vol. III. No. 2 1/2

HUMAN INFLUENCE

1. Benoit, G. R. and S. Mostaghimi. 1985. Modeling soil frost depth under three tillage systems. Trans. ASAE 28:1499-1505.

2. Burrows, W. C. 1963. Characterization of soil temperature distribution from various tillage-induced microreliefs. Soil Sci. Soc. Am. Proc. 27:350-353.

3. Cruse, R. M., D. R. Linden, J. K. Radke, W. E. Larson, and K. Lamtz. 1980. A model to predict tillage effects on soil temperature. Soil Sci. Soc. Am. J. 44:378-383.

4. Griffith, D. R., J. V. Marmeting, H. M. Galloway, S. E. Parsons, and C. B. Richey. 1973. Effect of eight tillage-planting systems on soil temperature, percent stand, plant growth and yield of corn on five Indiana soils. Agron. J. 65:321-326.

5. Kallio, A. and S. Rieger. 1969. Recession of permafrost in a cultivated soil of interior Alaska. Soil Sci. Soc. Am. Proc. 33:430-432.

6. Thomas, G. W. and A. W. Young. 1954. Relation of soils, rainfall, and grazing management to vegetation: Western Edwards Plateau of Texas. Texas Agric. Exp. Sta. Bull.

19. Newhall, F. 1980. Calculation of soil moisture regimes from the climatic record. USDA-SCS working paper, Rev. 7.

20. Renger, M.. 0. Strebel, G. Wessolek, and W. H. M. Duynisveld. 1986. Evapotranspiration and groundwater recharge--a case study for different climate, crop patterns, soil properties, and groundwater depth conditions. Z. Pflanzenemaehr Bodenk. 149:37 1-381.

21. Richardson, C. W. 1985. Weather simulation for crop management models. Trans. ASAE 28:1602-1606.

22. Schieldge, J. P.. A. B. Kahle, and R. E. Alley. 1982. A numerical simulation of soil temperature and moisture variation for a bare field. Soil Sci. 133:197-207.

23. Van Bavel, C. H. M. 1956. Estimating soil moisture conditions and time for irrigation with the evapotranspiration method. ARS 41-11, 16 pp., revised Jan. 1957.

24. Van Dis, A. E. C. and R. Brinkman. 1986. Simulation of moisture availability for winter wheat. Soil Survey and Land Evaluation 6(1):1-8.

25. Van Wambeke, A. 1981. Calculated soil moisture and temperature regimes of South America. SMSS Tech. Monogr. No. 2, USDA SCS, Washington, DC.

26. Van Wambeke. A. 1982. Calculated soil moisture and temperature regimes of Africa. SMSS Tech. Monogr. No. 3, USDA SCS, Washington, DC.

27. Van Wambeke, A. 1985. Calculated soil moisture and temperature regimes of Asia. SMSS Tech. Monogr. No. 9, USDA SCS, Washington, DC.

28. Welker, J. E. 1984. Soil temperature extrema recovery rates after precipitation cooling, NASA-TM-86163, NASA GSFC, 22 pp.

SOIL CLIMATE

1. Campbell, I. B. and G. G. C. Claridge. 1987. Soils, weathering processes, and environment. Developments in Soil Sciences 16. Elsevier.

2. Gol'tsberg, I. A. and F. F. Davitaya (ed.) 197 1. Soil climate. Gidrometeorologicheskoe Press, Leningrad. Translated from Russian, Amerind Pub., New Delhi, 1980,256 pp.

3. Shulgin, A. M. 1967. Soil climate and its control. Gidrometeoizdat, Leningrad, Translated and published for the USDA SCS by the Indian National Scientific Documentation Centre, New Delhi, India. 406 pp.

4. Spaeth, J. N. and C. H. Diebold. 1938. Some interrelationships between soil characteristics, water tables, soil temperature, and snow cover in the forest and adjacent open areas in south-central New York. Memoir 213, N.Y. State Agr. Exp. Sta., Ithaca.

5. Passey. H. B., V. K. Hugie. E. W. Williams, and D. E. Ball. 1982. Relationships between soil, plant community, and climate on the rangelands of the Intermountain West. USDA-SCS Tech. Bull. 1669, 123 pp.

SOIL WATER

1. Arkley, R. J. 1963. Calculation of carbonate and water movement in soil from climatic data. Soil Sci. 96:239-248.

2. Boersma. L., G. H. Simonson, and D. G. Watts. 1972. Soil morphology and water table relations: 1. Annual water table fluctuations. Soil Sci. Soc. Am. Proc. 36:644-648.

3. Daniels, R. B., E. E. Gamble, and L. A. Nelson. 1971. Relations between soil morphology and water-table levels on a dissected North Carolina coastal plain surface. Soil Sci. Soc. Amer. Proc. 35:781-784.

4. Daniels, R. B., E. E. Gamble, L. A. Nelson, and A. Weaver. 1987. Water-table levels in some North Carolina Soils. Soil Survey Investigations Report No. 40, USDA SCS, 139 pp.

5. Fanning, D. C. and W. U. Reybold III. 1968. Water table fluctuations in poorly drained coastal plain soils. Maryland Agr. Exp. Sta. Misc. Pub. 662.

6. Franzmeier, D. P., J. E. Yahner. G. C. Steinhardt, and H. R. Sinclair, Jr. 1983. Water table levels and water contents of some Indiana soils. RB 976, Agri. Expt. Sta., Purdue Univ. West Lafayene, Indiana, 49 pp.

7. Franzmeier. D. P., J. E. Yahner, G. C. Steinhardt, and H. R. Sinclair, Jr. 1983. Color patterns and water table levels in some Indiana soils. Soil Sci. Soc. Am. J. 47: 1196-1202.

8. Franzmeier, D. P., D. Wiersma, S. H. Brownfield, J. M. Robbins, Jr., J. L. Shively, and R. C. Wingard. 1973. Water regimes of some Indiana soils. Agr. Exp. Sta. Purdue Univ., West Lafayette, Ind, rb 904 Oct., 19 pp.

9. Fritton, D. D. and G. W. Olson. 1972. Depth to the apparent water table in 17 New York soils from 1963 to 1970. NY Food and Life Sciences Bull. 13(2), 40 pp.

10. Guthrie, R. L. and B. F. Hajek. 1979. Morphology and water regime of a Dothan soil. Soil Sci. Soc. Am. J. 43:142-144.

11. Harlan, P. W. and D. P. Franzmeier. 1974. Soil-water regimes in Brookston and Crosby soils. Soil Sci. Soc. Am. Proc. 38:638-643.

12. Latshaw, G. J. and R. F. Thompson. 1968. Water table study verifies soil interpretations. J. Soil Water Conserv. 23:65-67.

13. Lewis, D. T. 1977. Subgroup designation of three Udolls in southwestern Nebraska. Soil Sci. Soc. Am. J. 41:940-945.

14. Lyford, W. H. 1964. Water table fluctuations in periodically wet soils of central New England. Hat-v. Forest Papers 8, Harvard Univ., Petersham, Mass.

15. Milford, M. H., G. W. Olson, and P. Bullock. 1969. Apparent water table in soils. NY Food and Life Sci. 2(1):18-19.

16. Nelson, L. A., R. B. Dartiels, and E. E. Gamble. 1973. Generalizing water table data. Soil Sci. Soc. Am. Proc. 37:74-78.

17. Nichols, J. D. and J. F. Stone. 1970. Evaluation of soil moisture measurements in Oklahoma as soil characteristics for classification. Soil Sci. Soc. Am. J. 34:638-641.

18. Oberlander. T. M. 1979. Characterization of arid climates according to combined water balance parameters. J. Arid Environments 2:219-241.

19. Pengra, R. F. 1959. Seasonal variations of soil moisture in South Dakota. Agri. Econ. Pamphlet 99, South Dakota State College Agri. Expt. Sta., Brookings, SD, 55 pp.

20. Pickering, E. W. and P. L. M. Veneman. 1984. Moisture regimes and morphological characteristics in a hydrosequence in central Massachusetts. Soil Sci. Soc. Am. J. 48: 113-118.

21. Quant, L. A. and R. B. Grossman. 1983. Soil-water states for select soils in the northeast region. USDA-SCS NTSC. 51 pp.

22. Simonson, G. H. and L. Boersma. 1972. Soil morphology and water table relations: Il. Correlation between annual water table fluctuations and profile features. Soil Sci. Soc. Amer. Proc. 36:649-653.

23. Smith, G. D/ 1973. Soil moisture regimes and their use in soil taxonomies. p. l-7. In Field soil water regime. Soil Sci. Soc. Am., Madison, Wis.

24. Sombroek, W. G. 1982. A quest for an alternative to the use of soil moisture regimes at high categoric levels in Soil Taxonomy. Working Paper and Preprint Presented at the Fifth International Soil Classification Workshop, Khartoum, Sudan, 8 pp.

25. Thomas, B. R., G. H. Simonson. and L. Boersma. 1973. Evaluation of criteria for separating soils with Xeric and Udic moisture regimes. Soil Sci. Soc. Amer. Proc. 37:738-741.

26. Thorp, J. and E. E. Gamble. 1972. Annual fluctuations of water levels in soils of the Miami catena, Wayne County, Indiana. Sci. Bull. 5, Earlham College, Richmond, Indiana.

27. Vepraskas, M. J. and L. P. Wilding. 1983. Aquic moisture regimes in soils with and without low chroma colors. soil Sci. Soc. Am. J. 47:280-285.

28. Zobeck, T. M. and A. Ritchie, Jr. 1984. Analysis of long-term water table depth records from a hydrosequence of soils in central Ohio. Soil Sci. Soc. Am. J. 48:119-125.

SOIL TEMPERATURE

1. Algren, A. B. 1949. Ground temperatures as affected by weather conditions. Heating, Piping, and Air Conditioning 21(6):111-116.

2. Beckel, D. K. B. 1957. Studies on seasonal changes in the temperature gradient of the active layer of soil at Fort Churchill, Manitoba. Artic 10:151-183.

3. Baker, D. G. and J. B. Swan. 1966. Climate of Minnesota. Part IV. Spring soil temperatures. Misc. Rep. 67, Agric. Expt. Sta., Univ. Minn., 11 pp.

4. Berggren, W. P. 1943. Prediction of temperature-distribution in frozen soils. Trans. Amer. Geophys. Union, p. 71-77.

5. Bliss, D. E.. D. C. Moore, and C. E. Bream. 1942. Air and soil temperatures in a California date garden. Soil Sci. 53:55-64.

6. Bocock. K. L., J. N. R. Jeffers, D. K. Lindley, J. K. Adamson, and C. A. Gill. 1977. Estimating woodland soil temperatures from air temperatures and other climatic variables. Agric. Meteorol. 18:351-372.

7. Bouyoucos, G. J. 1913. An investigation of soil temperature and some of the most important factors influencing it. Mich. Agri. Exp. Sta. Bull. 17, 196 pp.

8. Bouyoucos, G. J. 1916. Further investigations of soil temperatures. Mich. Agri. Exp. Sta. Bull. 26, 133 pp.

9. Brasfield. J. F. and V. W. Carlisle. 1975. Soil temperature of north Florida. Soil and Crop Sci. Soc. Florida Proc. 35:170-173.

10. Camp, A. F. and M. N. Walker. 1927. Soil temperature studies with cotton. Florida Agri. Expt. Sta. Tech. Bull. 189:1-32.

11. Carter, B. J. and E. J. Ciolkosz. 1980. Soil temperature regimes of the central Appalachians. Soil Sci. Soc. Am. J. 44:1052-1058.

12. Chiang. H. D. and D. G. Baker. 1968. Utilization of soil temperature data for ecological work. Ecology 49:1155-l 160.

13. Crabb, G. A., Jr. and J. L. Smith. 1953. Soil-temperature comparisons under varying covers. Highway Res. Board Bull. 71:32-80.

14. Davidoff, B., J. W. Lewis, and H. M. Selim. 1986. Variability of soil temperature with depth along a transect. Soil Sci. 142: 114-123.

15. Dean, L. A. 1947. Soil temperatures. Soil Sci. 63:95-105.

16. Dwyer. L. M. and H. N. Hayhoe. 1985. Comparisons of observations and macroclimatic model estimates of monthly winter soil temperatures at Ottawa. Can. J. Soil Sci. 65:109-122.

17. Dymess, C. T. 1982. Control of depth to permafrost and soil temperature by the forest floor in black spruce/feathermoss communities. U.S. Forest Service, Pacific Northwest Forest and Range Exp. Sta. Research Paper, PNW-396. Portland, Oregon.

18. Elford. C. R. and R. H. Shaw. 1960. The climate of Iowa. II. Soil temperatures at Ames. Iowa Agr. and Home Econ. Expt. Sta. Spec. Rpt. 24, 7J pp.

19. Embrechts, J. and R. Tavemier. 1986. Soil temperature regimes in Cameroon as defined in Soil Taxonomy. Geoderma 37:149-155.

20. Fedorova, N. M. 1974. Thermal and moisture regimes in a soil profile affected by prolonged seasonal freezing (middle taiga subzone, West Siberia). Geoderma 12:111-1 19.

21. Fluker, B. J. 1958. Soil temperatures. Soil Sci. 86:35-46.

22. Forbes, J. D. 1845. Account of some experiments on the temperature of the earth at different depths, and in different soils, near Edinburgh. Trans. Royal Soc. of Edinburgh. Vol. 16.

23. Gary, H. L. 1968. Soil temperatures under forest and grassland cover types in northern New Mexico. Research Note RM-118, USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, 11 pp.

24. Golovin, V. V. 1962. Description of the temperature regime of soils in the Amur region. Soviet Soil Sci. 213-217.

25. Harrington, E. L. 1928. Soil temperatures in Saskatchcwen. Soil Sci. 25:183-195.

26. Horn. L. 1952. Summary of information on soil temperatures. NBS report 5A120, Restricted, U.S. Dept. Commerce, National Bureau of Standards, 26 pp.

27. Jeffrey, W. W. 1963. Soil temperature measurements in forest of northwestern Canada. Ecology 44:151-153.

28. Keen, B. A. and E. J. Russell. 1921. The factors determining soil temperature. J. Agr. Sci. Vol. 11.

29. Legget, R. F. and F. L. Peckover. 1949. Soil temperature studies - A progress report. p. 434-445. In Proc. Ann. Mtg. Highway Res. Board.

30. Longly, R. W. 1967. Temperature increases under snow during a mild spell. Soil Sci. 104:379-382.

31. Mackay, J. R. and D. K. MacKay. 1974. Snow cover and ground temperatures, Garry Island, N. W. T. Artic 27:287-296.

32. McDole, R. E. and M. A. Fosberg. 1974. Soil temperatures in selected southeastern Idaho soils: I. Evaluation of sampling techniques and classification of soils. Soil Sci. Soc. Amer. Proc. 38:480-486.

33. McDole, R. E. and M. A. Fosberg. 1974. Soil temperatures in selected southeastern Idaho soils: II. Relation to soil and site characteristics. Soil Sci. Soc. Amer. Proc. 38:480-486.

34. Miller, F. P. 1974. Soil temperatures in Maryland. Dept. of Agron., Univ. Maryland, Soil Survey Series No. 6, 14 pp.

35. Mueller, 0. P. 1970. Soil temperature regimes in a forested area of the northern Rockies. Soil Sci. 109:40-47.

36. Munn. L. C., B. A. Buchanan, and G. A. Nielsen. 1978. Soil temperatures in adjacent high elevation forests and meadows of Montana. Soil Sci. Soc. Am. J. 42:982-983.

37. Murtha, G. G. and J. Williams. 1986. Measurement, prediction, and interpretation of soil temperature for use in soil taxonomy: Tropical Australian experience. Geoderma 37:189-206.

38. Ping, C. 1985. Soil-temperature monitoring network in Alaska. Agroborealis 17(2):13-18.

39. Ping, C. L. 1987. Soil temperature profiles of two Alaskan soils. Soil Sci. Soc. Am. J. 51:1010-1018.

40. Pustovoytov, N. D. 1962. Soil temperature regime in the plains of Amur River region. Soviet Soil Sci. p. 352-359.

41. Quellet, C. E. and R. L. Desjardins. 1975. Annual variability of minimum soil temperature. Can. J. Soil Sci. 55:167-176.

42. Rice, 0. W. 1969. Notes on soil temperature regimes in Thailand. Soil Survey Division Bangkok, May, Report SSR-79-1969. Land Devel. Dept., Mm. of Nat. Devel., Kingdom of Thailand.

43. Rieger, S. 1973. Temperature regimes and classification of some well-drained alpine soils in Alaska. Soil Sci. Soc. Amer. Proc. 37:806-807.

44. Rieger, S. 1983. The genesis and classification of cold soils. Academic Press, New York, 230 pp.

45. Schmidlin, T. W., F. F. Peterson, and R. 0. Gifford. 1983. Soil temperature regimes in Nevada. Soil Sci. Soc. Am. J. 47:977-982.

46. Smith, A. 1926. A contribution to the study of inter-relations between the temperature of the soil and the atmosphere, and a new type of thermometer for such study. Soil Sci. 22:447-456.

47. Smith, A. 1929. Daily and seasonal air and soil temperatures at Davis, California. Hilgardia 4:77-1 12.

48. Smith, A. 1939. Value of mean and average soil and air temperatures. Soil Sci. Soc. Amer. hoc. 4:41-49.

49. Smith, G. D., F. Newhall, L. H. Robinson, and D. Swanson. 1964. Soil-temperature regimes--their characteristics and predictability. USDA Soil Conservation Service, SCS-TP-144, 14 pp.

50. Tarnocai, C. 1980. Summer temperatures of Ctyosolic soils in the north-central Keewatin, N.W.T. Can. J. Soil Sci. 60:311-327.

51. Taylor, E. M. 1928. Soil temperature in Egypt. J. Agric. Sci. 18:90-

52. Tedrow, J. C. F. 1966. Polar desert soils. Soil Sci. Soc. Am. Proc. 30:381-387.

53. Thompson, W. A. 1934. Soil temperatures at Winnipeg, Manitoba. Scientific Agric. Canada 15(4):209-217.

54. Toogood, J. A. 1979. Comparison of soil temperatures under different vegetation covers at Edmonton. Can. J. Soil Sci. 59:329-335.

55. Toy, T. J.. A. J. Kuhaida, and B. E. Munson. 1978. The prediction of mean monthly soil temperature from mean monthly air temperature. Soil Sci. 128:181-189.

56. U.S. Dept. Commerce. 1961. History of soil temperature stations in the United States. U.S. Dept. Commerce, Weather Bureau. Wash., DC, 43 pp.

57. Weedfall, R. 0. 1963. Variation of soil temperatures in Ogotoruk Valley, Alaska. Artic 16:181-194.

58. West, E. S. 1932. The effect of a soil mulch on soil temperature. J. Counc. Sci. Ind. Res., Nov., p. 236-246.

59. White, R. G. 1946. Installations for noting water and thermal relationships in soils. Ag. Engr. 27:21-25.

60. Willis, W. 0. 1964. Bibliography on soil temperature (through 1963). USDA ARS 41-94, 82 PP.

ADDITIONAL REFERENCES COMPILED BY THE TASK FORCE

1. Ciolkosz, E. J., W. J. Waltman, T. W. Simpson, and R. R. Dobos. 1989. Distribution and genesis of soils of the northeastern United States. Geomorphology 2:285-302.

2. Daugherty, L. A., M. H. Nash, L. W. Muny, and T. M. Zobeck. 1991. Mathematical modeling of soil temperature, soil moisture, and precipitation in central New Mexico. Agronomy Abstracts. ASA. Madison, WI. p. 310.

3. Feldman, S. B., L. W. Zelazny, and J. C. Baker. 1991. High-elevation forest soils of the southern Appalachians. II. Geomorphology, pedogenesis, and clay mineralogy. Soil Sci. Soc. Am. J. 55:1782-1791.

4. Nichols, J. D., R. L. Haberman, and R. J. Englel. 1991. Use of models to estimate soil moisture for soil classification. Agronomy Abstracts. ASA. Madison, WI. p. 318.

5. Rose, A. W., E. J. Ciolkosz, and J. W. Washington. 1990. Effects of regional and seasonal variations in soil moisture and temperature on soil radon gas. US Environ. Protect. Agency Publ. EPA/600/9-90/005C.

6. Smallwood. B., H. Eswaran, and E. Van Den Berg. 1991. Soil moisture and temperature regimes of North America: Canada, U.S. and Mexico. Agronomy Abstracts. ASA. Madison, WI. p. 321.

7. Stanley, S. R. and E. J. Ciolkosz. 1981. Classification and genesis of Spodosols in the central Appalachians. Soil Sci. Soc. Am. J. 45:912-917.

EVANGELISTS, SCHOLARS, HISTORIANS, LAB TYPES, COMPUTER BUFFS, **MAP MAKERS** AND AUGER PULLERS IN THE SOIL SURVEY 1/

Ralph J. McCracken 2/

If I were to be asked which of the activities in the title are most important for a modern soil survey, I would resoundingly answer "all of the above." A model of a modern major soil survey (to paraphrase a Gilbert & Sullivan song about a model of a modern major general) must include all of these aspects if it is to be fully effective. Each can and should contribute significantly and be considered fully equal to the other components, irregardless of Federal or state agency affiliation and disciplinary background (not some more equal than others as has been the case sometimes in the past) in a well-balanced modern soil survey program as full team members. This hasn't always been the situation. However, it seems progress is being made and additional progress is forthcoming, growing out of the planning and the cooperative attitudes you are displaying here in this conference. The soil survey must continue in promoting cooperation and joint planning if it is to be effective and serve our country well.

I should like to congratulate you for agreeing to and participating in what I understand to be the first South-Northeast Cooperative Soil Survey Conference. Special commendations go to the Steering Committee which arranged this well-planned, well executed conference. Such a joint session would have pleased Dr. Charles Kellogg greatly, for he was always concerned about the "fault lines" (as he called them) between the various regions of the USA. From what I hear and have seen during the time I have been at this conference there are not no iron curtains or trenches between the two regions and among the several agencies participating in this conference. Ecologists and other natural scientists have studied and written about the "tension zones" between the types of forests, vegetation zones, climates and soils (the Alfisol-Ultisol interface) along and near the boundaries of these two Regions. My observation and thought has always been that the tension was in the minds of scientists either side of the regional boundary due to disagreement on placement of human-defined boundaries between these types of natural resources. It is encouraging that you have worked this week to ease this tension in the minds of scientists either side of the South-Northeast boundary.

Your steering committee has shown good judgment in choosing Asheville in the midst of these beautiful Great Smoky Hountains as the scene for your conference. It was also good judgment to set this conference where participants would have opportunity to see in the field the very interesting soils of this mountain-foothills area which are different in many respects from soils of the Piedmont, Coastal Plain and northern glaciated regions to which we are accustomed.

1/ Delivered to banquet session of South-Northeast Soil Survey Conference June 20, 1992

2/ Deputy Chief, Retired, USDA Soil Conservation Service

Here in the Smokies there is a different interplay of soil forming factors. it is good to see these soils are finally getting some research and classification attention. Previously they were given little serious attention other than soil mapping with strong Tennessee Valley Authority financial support, but recently have come under more intensive investigation and characterization by several of you here.

I well remember the unexpected results I experienced when I started studying these high mountain soils in the middle 50's jointly with Dr. Royal Shanks. ecologist, University of Tennessee (now deceased).

Because you have been studying these soils and this environment on your field trips here, let me share with you the lighter side of some of my mountain and foothills experiences while working with soils in this area.

One incident occurred while soil mapping in the foothills of the Smokies, on the Tennessee side. While moving along a rough track in a densely wooded area, a representative of a local industry stepped out from behind a tree with the query "where be you headed fer and what brung you here?" I replied that I was mapping soils for a soil survey of the county. He replied, "Ain't no soils down this way." So I found another way to check the veracity of his pedologic pronouncement, using stereoscope and geologic and topographic maps. That was when I found it was good practice to stop in the country stores for an RC and a Moon Pie, letting the'word out as to what we were doing in the area.

Another interesting experience occurred while Dr. Shanks and I were studying and sampling soils in the Great Smoky Mountain Park in the spring of 1957 for our mountain soil study. We had obtained our special permit for the soil sampling from the park ranger headquarters and were opening a soil "profile pit" for sampling when we were approached by a person obviously a local citizen who sidled up to us and asked "You uns found any sang yet?." Shanks, who had a great deal of experience in the area, translated this to mean that the person was asking if we had found any ginseng yet, roots of which brought a good price for sale overseas, especially in China, because of the alleged value of the root for medicinal purposes and for the sexual prowess. The fellow showed up a couple of more times during the morning with the same question. We finally concluded that he thought that we had "cut a deal" with the rangers to be able to collect ginseng roots in the Park and he was hinting that he wanted to be let into the deal.

Back to soil science in these mountains - after sampling several representative high mountain soils, we proceeded with lab analyses with the help of colleagues in the NC State Soil Science Department. When we got the results, we were astonished to find the soil properties rather different than we expected from these dark brown loamy and, in places, thin soils. WWith the help of Nat Coleman, then professor of soil chemistry at NC State, it was determined that relatively large amounts of exchangeable aluminum were associated with the "permanent charge" exchange capacity of these soils and large amounts of "true" exchangeable hydrogen were associated with the variable charge sites, and some of the primary minerals had been altered to hyrdoxy aluminum interlayered vermiculite type clays.

These results didn't coincide with the then conventional wisdom. These findings and the findings of large amounts of exchangeable aluminum associated with 2:1 clays in some soils of the Piedmont led Coleman and associates to publish a definitive paper on exchangeable aluminum, which was not widely recognized to exist at that time.

Another surprise came from studies of soils of the foothills and lower slopes of the Smokies. To our surprise, we found relatively large amounts of gibbsite associated with the finer soil fractions. This led us to conclude that under intense weathering related to high rainfall with rapid removal of silica from the soil system due to good rapid soil drainage, the soils could be driven far along the weathering sequence leaving gibbsite without appreciable resilication. So we had much to relearn about soil forming factors and their effect on mountain and foothill soils in this region.

Back to the components mentioned in the title of this presentation:

Soil Evangelists:

I first heard this term when it was directed at me when I was presenting an orientation lecture on soil resources and soil conservation to ministerial students at the seminary in Wake Forest, NC. These were students expecting to go into rural ministry. After my lecture and during the discussion period, one future preacher said to me, "In our terminology, you are a soil evangelist - one who is trying to save soils whereas we ware trying to save souls." I took this as a compliment.

Of course, the greatest soil evangelist of all time was North Carolinian Hugh Harmnond Bennett, founding father of the Soil Conservation Service. He sensitized the public, not only in the US, but also in several other countries on the importance of soil conservation. The work that you all have done in support of the soil conservation program stands as a monument to "Big Hugh." But soil conservation is now more important than ever, with many needs broader than soil erosion control, which was the Bennett emphasis (appropriately at the time). Now there are many other soil conservation needs - controlling erosion to reduce sediment pollution of our waters, identifying prime farmland for protection against urbanization, conserving the soils of the wetlands, protecting the soils of the grasslands, and assuring we have sufficient supply of productive soils to meet future world food needs in face of a growing global population. So there is still a need for soil evangelism in the soil survey, with the fervor and enthusiasm which Bennett brought to the program, The battle is not done. One of the few persons now engaged in soil evangelism in the soil survey is Francis Hole, retired Professor of Soil Science, University of Wisconsin. He has many calls to present his soils programs to a wide range of public groups in Wisconsin and surrounding area - with his violin and soil songs. This involves adjusting the wording of well-known folk and popular songs to reflect soil conservation concerns and the importance of knowledge of and appreciation for our soil resources. The repertoire includes songs such as Home, Home on the Loam; Simple Gifts paraphrased to "Tis a gift to have land" and many others. In his programs, he brings out the importance of knowledge of soils and the use of soil surveys. This is an example of kind of soil evangelism that is needed in the soil survey.

Scholars :

At times, in some quarters, there is lifting of eyebrows about basic research and scholarly pursuits in the soil survey. There occasionally arises this question or implication - why do we need these eggheads involved in the soil survey program? Ye need new ideas, new ways of thinking about soils - as to their genesis, their classification and mapping, and the need for accumulation of basic data to support the applied soil survey programs. We've been fortunate in the past in having some intellectual giants affiliated with the soil survey who could see the "big picture.' For example, Dokuchaiev and his Russian colleagues and Hilgard in America were among those responsible for making a significant leap forward with their studies of the effects of climatic and vegetation gradients on soil properties. This contributed to the development of the concept of soil as a natural body owing its properties to varying combinations of soils forming factors. Hans Jenny in California first quantified the concept of five soil forming factors which has led to fuller understanding and appreciation of the soil-forming processes. (contrary to some beliefs, Guy Smith and others of the Soil Survey Division were in frequent contact with Hans Jenny).

He also developed and expanded the concept of the soil as an important component of ecosystems. This has led to a more precise, quantitative and rigorous study of soil formation. Curtis Harbut and Charles Kellogg (and associates) were prime movers in America in establishing the philosophy and intellectual basis for scientific study and classification of soils. Dokuchaiev was among the first to establish the concept of soil as a natural body; Marbut brought to the soil survey the application of basic geologic and geomorphic principles to soil survey and turned it away from the emphasis on soil texture and the practice of relating soils to specific geologic formations. Kellogg was a renaissance man with both basic and applied research concern, soil use interests and contributed greatly to development of soil survey as a scientifically-based endeavor applicable to a number of uses - agricultural and nonagricultural. Jenny was the epitome of a true natural scientist. All these men were scholars who contributed basic concepts with life long interests in soil genesis, ecology, soil conservation and soil chemistry.

Hilgard of California and Russian emigre C.C. Nikiforoff of the US soil survey are examples of the different kinds of scholars which the soil survey needs. Hilgard was also among the first to recognize soil as a distinct entity worthy of study by scientific methods and as a natural object; he was also concerned with soil use and improvement. Nikiforoff, with his Russian background, is an example of the kind of person a program like the soil survey needs - one who considers soil as a natural object worthy of study to understand it better as a part of nature, without attention to the applied practical uses of soil.

But these scholars are gone and new challenges are arising for basic understanding of soil systems and how to use basic soil information for applied problems. We must continue to have scholars on the soil survey team - those who can put their feet on the desk and think big but who are also sensitive to practical applications. Now more than ever there is an ongoing need for scholars in the soil survey.

Soil Historians :

The philosopher Santayana said in effect - those who do not study history are doomed to repeat it. But some of us in the soil survey haven't seen much need for historians and historical studies in the soil survey program. Now, at the end of my career in soil science, I am strongly convinced we must maintain historical records and collect and preserve oral histories associated with the soil survey. Ye need to know the reasons for previous actions and activities in the soil survey - for example, why various soil classification systems were developed in the fashion in which they were structured. This is especially true for our present Soil Taxonomy. We need to know and understand its roots, origin, and procedures used in its development and why certain key decisions were made as they were. This will help us in using this classification system and will be useful in future adjustments of its present structure and criteria. We need to be aware of the origins of soil survey from geology, soil chemistry and agronomy. As former President Truman is reported to have said - the only history that is not useful is that you haven't read or don't know about. We must understand the origin of the concepts, theories, terminology and jargon blended into Soil Taxonomy.

These matters relating to history of soil survey must be recorded for future use. Ue're no longer able to discuss these historical matters of the soil survey program with the early day giants of the field who've passed on. We'd like to think they've gone on to soil survey heaven - where there is no spatial variability, all mapping units are 100% pure and there are no soil correlators. Some, but unfortunately not all of their thinking and reasons for the action taken have been recorded.

A few soil scientists have made efforts to record the history of soil survey programs in the USA. For example. **Macy Lapham** of California recorded in his book "Crisscross Trails" many of his experiences in the early days of the development of soil surveys in the United States - from the perspective of an "auger puller" and of an "inspector" as they were called earlier (now known as soil correlators). Roy **Simonson** has done a superb and very useful work in writing about the evolution of the American soil survey since its inception just before the turn of the century to recent days. This study is laid out in three articles in "Soil Survey Horizons." He was "present at the creation" of some of the intermediate and latter phases of the soil survey program in America, and has recorded the events and actions in a very useful and readable way.

Douglas Helms, present Soil Conservation Service historian, has recorded oral history from some of the pioneers in soil conservation, which is very useful information.

Understanding and appreciating the evolutionary changes which have taken place in soil survey and soil classification over the past 100 years not only makes the field auger puller's work more interesting, it helps in doing a better job of soil survey. Probably few present day soil surveyors are aware of the great time pressures and stresses that accompanied the development of Soil Taxonomy, mostly accomplished within one decade. Most natural scientific classification systems in other fields evolved gradually over a period of nearly a century. An example is the botanic classification of Linnaeus. And they probably are not aware of the many temper tantrums, scorching letters and even insults that Dr. Guy D. Smith had to bear in leading and coordinating the preparation of Soil Taxonomy. These were mostly from soil scientists incensed because some one had dared to tinker with classification of "their soils." It can be said that soil surveyors are a group of people who tend to "think otherwise."

You, as present day soil surveyors are heirs and beneficiaries of this giant step forward. The torch is passed to you to keep Soil Taxonomy adjusted and updated as needed - to carry on the proud tradition.

And let's not be too critical of our soil survey "ancestors". Looking back without a feel of history, it's easy to question why they did what they did. But it takes some study and effort to understand their reasoning and use this knowledge to help us improve soil survey. These early day scientists were caught in a dilemma. They couldn't classify and map soils without knowing their significant characteristics but couldn't know these until a wide range of soils had been studied in fields and forests, experimental plots and in the labs. In looking back to our roots in soil genesis and classification we shouldn't identify heroes whose views anticipated present ones while criticizing other soil scientists of the past as having been wrong, too narrow, too subjective. Changes in theory and scientific background of our field are not only due to new discoveries but also due to creative imagination and nature of contemporary scientific, social and political thought.

Adjustments in Soil Taxonomy and in ways of doing soil survey to avoid rigor mortis and acconvnodate new findings will continually be necessary. There is a need to be flexible and adjust to new information.

A **summary** of why it's important to know and understand history of soil surveys and classification:

1. Demonstrates the field is dynamic, changing as new information and ideas develop. As Victor Hugo wrote "Nothing is more powerful than an idea whose time has come."
2. Shows importance of keeping in touch with developments and new ideas in other countries (we don't have a monopoly on soil knowledge!)
3. Help us understand where present concepts came from and why.
4. Demonstrates importance of coordination of field and lab activities and developments.
5. Gives us inspiration and incentive to keep pushing ahead in trying new ideas and approaches.

Speaking of history of soil survey, I want to share with you a very recent finding of mine - the first identification of need for soil surveys in America, written about North Carolina in 1709:

Lawson, John. A description of North Carolina, from a new voyage to North Carolina. This was published in American Garden Uriting, p. 107-112. Edited by Bonnie **Maranca** and published by PAJ Publishing, New York City:

> "The wheat of this place is very good, seldom yielding less that 30 fold, provided the land where it is sown. I have been informed by people of credit that wheat which was planted in a very rich piece of land brought a hundred and off pecks for one peck. If our planters when they found such great increase, would be so curious as to make nice observations of the soil, they would soon be acquainted with the nature of the earth, and be better qualified to manage their agriculture to more certainty and greater advantage, whereby they might arrive to the crops and harvests of Babylon. But I must confess, I never saw one acre of land managed as it ought to be in North Carolina."

Lab Types:

The term "lab types" is a term we have sometimes used in the soil survey to denote those who make their contributions to the soil survey through laboratory analyses (not intended as a derogatory or pejorative term).

The increasing importance of quantifying soil information with "hard data" makes this component of the soil survey team even more important to the program. This is especially true for use of soils data in solving environmental concerns.

Lyle Alexander is my model of the way in which laboratory-based soil scientist can support an 'action" program like the soil survey. He participated in field collection of soil samples as much as possible and was receptive to new approaches and new technology. He and his colleagues maintained high standards of lab analyses. His was a true success story, having grown up as one of 10 children in a sharecropper family and became a self-made outstanding scientist. His work in measuring fallout on soils from atomic and nuclear bomb explosions is a classic. I well recall a personal experience with his dedication to high standards of careful soil analyses. As party chief of a soil survey party in Iowa, I wrote Dr. Alexander a request for what I (unfortunately) called 'routine analyses" (referring to customary analytical procedures for soil survey samples) of samples of several soils with which we were having problems. He inmediately responded with a curt note that no "routine analyses" were done in his labs as careful attention was given to each sample analyzed.

Another example of a dedicated lab type very supportive of the soil survey is John Cady. His work with soil mineralogy and soil micromorphology contributed much to support of the soil survey. He was quite willing and made himself available for discussion of problems with field soil survey personnel and for assistance with the hard work of field sampling of pedons.

Laboratory-oriented soil scientists supporting the soil survey face a wide range of new and challenging problems in the soil surveys of the future, These would include, for example, characterization of permeability of soil material in saprolite for a number of chemicals other than water in relation to waste disposal and chemicals, measurements of release and sequestration of carbon in soil-plant systems in relation to potential global warming, measurement of nitrous oxide evolution or of potential for such evolution from soil systems, measurements of soil-iron and soil-carbon interactions using new technologies, and need for predicting soil behavior In nonfarm situations based on soil property measurements.

Computer Buffs :

A potentially important component of the soil survey program is the use of computers and new software for making soil survey data more accessible and useful for multiple purposes. This especially includes increasing the accessibility of the soil survey data for the growing group of non-soil scientist non-agriculturally oriented soil information users. This means that computer buffs should be an integral part of the soil survey team, working alongside soil scientists with an interest and a capability for working with numbers and computers.

In the Pedon Data Base at Lincoln, NE the soil survey has a potential Ft. Knox gold mine of soil information, which will become increasingly useful and important as the soil survey moves into the next phase after completion of the national soil survey "once over." The development of software particularly applicable to access and use of soil data is a strong future need and opportunity. This includes geographic information systems designed specifically for use and interpretation of soil survey data, expert systems (artificial intelligence) for use in the advisory work with soil survey data and software specifically designed for production of computer-generated soil maps and interpretive maps based on the soil survey - for both agricultural, forestry and nonagricultural purposes. Here is a special opportunity for the computer-literate city-bred young men and women interested in real-life applications of soil information to environmental protection, resource conservation and the development and protection of soil resources for future food needs of the world's growing population.

Mapmakers in the Soil Survey:

The US soil survey has a long, strong history of pioneering by cartographic members of the soil survey team. The old printed line maps on topographic bases (yes, the kind that blew in the wind and which you could never get refolded properly) were improved with the aid of innovations by soil survey cartographers who pioneered new techniques in map making - especially the use of airphotos for the base maps for the soil delineations. And soil survey cartographers also contributed to pioneering the use of computer-generated automated map making. It was soil scientists such as William Battle Cobb of North Carolina and Tom Bushnell of Indiana who instituted the use of airphotos as the basis for soil mapping in the 1920's and early 1930's. Cartographers with the SCS soil survey group also were part of a multidisciplinary. multiagency team that tested and instituted the use of high altitude and infrared air photography which has made soil mapping much easier for the soil surveyors.

Now there are new challenges for the soil survey map makers. These include greater use of new remote sensing technology for improving and accelerating soil surveys and for special purpose interpretive studies such as measurement of ephemeral soil erosion, detection of salt-affected soils, rangeland soil mapping and software for producing computer-drawn multiple and single purpose interpretive soil maps at the local level. It will be very important for soil surveyors and cartographers to continue to work closely together in the future.

Auger Pullers :

Last in this discussion but first in importance, we come to the infantry of the soil survey - the soil scientists doing the field mapping in the heat and the cold in the fields, forests and swamps - watching for snakes, mean farm dogs and answering the inevitable questions by farmers and others "Looking for oil? (or gold?). They face a real challenge in the future - with the completion of the US soil survey "once over" (all areas of the US with reasonably up-to-date soil maps). This calls for a stronger move to updating and interpreting soil information for a multitude of purposes agricultural and nonagricultural. This also will call for helping the rest of the world complete soil surveys of all the arable land areas of the globe. A significant percentage of the world's land mass lacks the soil information needed to aid in preparing to meet the food supply needs of the world's rapidly growing population.

The future field soil survey force will of necessity be of a different character than that to which we've been accustomed. Tomorrow's soil surveyors will have had little or no farm background, must be broad gauged with respect to preparation of maps and their interpretation for a wide variety of uses in addition to agriculture and forestry. Future projections are that by 2000 AD the majority of entrants into science field (including soil survey) must of necessity be women, Blacks and Hispanics because of the makeup of our younger population at that time and this will be increasingly so in the 21st century.

These future developments (lack of agricultural experience through living on a farm, the demographic transition to many more minorities and greater number of women interested in and being encouraged to enter the fields of soil survey and related fields) will call for different orientation, training and procedures than in the past (and the soil survey must be prepared to put to good use the enthusiasm, training, computer capability and environmental interests of this new breed.) The soil survey has made good progress in employment and upward mobility of females and minorities, so this should not be as large a problem as some might think.

Professional Pride:

It is important to have pride in your profession - both for your own mental welfare and your personal satisfaction in being able and willing to make contributions to your own chosen field, to environmental protection and resource conservation and to helping to ensure an adequate world food supply. As Dr. Kellogg said on several occasions: "If you want to be treated like a professional, then act like one" and "You cannot be humiliated or put down unless you allow it."

Valedictory:

As a retiree, who looks ahead to the future soil survey like Moses looked out to the promised land he couldn't enter, I foresee a soil survey program which Kellogg, Harbut, and Dokuchaiev would not recognize, but of which they would highly approve and of which they would be proud. They would be delighted with the widespread use of soil data for so many purposes and with the increased recognition of the importance of our soil resources. They would, I think, be pleased and proud with all the components of soil survey working together as a team, composed of men and women of varying backgrounds and national origins working together to make a better, more livable and better-fed world. That's your challenge and opportunity for the future.

Good wishes to all of you for a fine future in some aspect of a broader based, more diversified soil survey program. This old auger puller fades away with the feeling that he did the best he could with the tools given him and with fine help and support from soil survey colleagues. Special appreciation for their support and encouragement goes to those who served as my advisors in my undergraduate and graduate studies - James Thorp, Marlin Cline and Frank Riecken.

REPORT

COMMITTEE 1

SOILS OF THE NORTHEASTERN UNITED STATES

JUNE 19, 1992

BACKGROUND

Bulletin 848, of the Pennsylvania Agricultural Experiment Station, Soils of the Northeastern United States, was published in 1984. The supply of Bulletin 848 is exhausted.

Committee 4 of the 1984 Northeast Cooperative Soil Survey Conference suggested that an additional teport be prepared that would provide interpretations for the map units on the General Soil Map in Bulletin 848. This has not been done.

Task Force 1 of the 1988 Northeast Cooperative Soil Survey Conference had the following recommendations:

1. The bulletin should be revised and a standard format be established for the chapters to make the bulletin more consistent and complete.

2. The map should be compared to the STATSGO map and revised only if there are major discrepancies between the two maps.

3. Only general interpretations should be included in the bulletin at about the great group level.

4. The conference steering committee should establish a map and bulletin committee and an overall committee chairman to get the job done.

In October 1991, STATSGO maps for all states in the Northeast were received at the Northeast NTC. The NNTC planned to load STATSGO data into GRASS and produce a General Soil Map for the Northeast to be used by the committee for comparison to the map in Bulletin 048.

CHARGES

1. Compare the "General Soil Hap of the Northeastern United States" published in 1984, with the composite STATSGO map of the Northeast. Determine whether the 1984 map should be used in a new publication of "Soils of the Northeastern United States" or whether a new map using STATSGO data should be developed for the publication.

2. Develop a format for the bulletin so it is consistent

and complete. Develop an outline for chapters so they will be consistent and uniform when written by different authors.

3. Recommend authors for chapters in the bulletin.

4. Determine what interpretations should be developed and included in the bulletin.

5. Who should publish the revised bulletin?

DISCUSSION

The AT&T 6386 was not adequate to handled all of the **STATSGO** data for the northeast. The NNTC is in the process of purchasing a Sun - SPARC station 2. After this station is installed, the NNTC will be able to print **STATSGO** for comparison with the "General Soil Map of the Northeastern United **States"** published in 1984.

As the committee convened during the week of June 15, 1992, the following members were present:

Martin C. Rabenhorst
Ronnie L. Taylor
Stephen Gourley
William F. Hatfield
Norman R. Kalloch, Jr.
Travis Neely
Dean D. Rector
Richard **Scanu**
William R. Wright
Karl **Langlois**
Layal A. Quandt

The committee felt the need to **revisit the original question regarding whether or not the NE** Soils bulletin should be re-written, re-published or re-issued. Questions were raised concerning the audience for the bulletin, the demand for this publication, and whether or not there really was experiment station/university personnel generally feel a stronger need to have the publication republished than SCS personnel.

3. Because of their greater interest in the bulletin, University personnel should be the ones to head up any effort to republish the bulletin and this task should not be thrown back onto the steering committee of the NE work planning conference. If there is no initiative introduced by the University people (and some individual or committee to head up the effort), then the idea of republication of the bulletin should be dropped.

4. The SCS, especially the staff at the NNTC and the NCG, have expressed their willingness to support the efforts and initiative of the University personnel. In particular, they have indicated that they would be willing to develop a STATSGO based map for the NE with appropriate summary tables of acreage of soil taxa within the states and region.

An impromptu meeting (caucus) of the NEC-50 committee was held in order to determine how individuals from each University felt concerning republication of the bulletin. A report was brought back to the entire committee, after which the following items were decided.

5. Because there was consensus among the University personnel on this matter, the idea to republish the bulletin not be dropped but should be pursued at this point.

6. If the bulletin is to be republished, it should probably be reorganized along the lines proposed by Committee 2 for the southern bulletin (ie around soil/physiographic regions such as individual or groups of MLRA's rather than around the soil orders of Soil Taxonomy).

7. The executive committee of NEC-50 (outgoing chairman Bill Wright, incoming chairman Ray Bryant, and chairman elect unselected) will begin to coordinate an effort to proceed toward a rewriting and republication of the bulletin. As the general coordinating (editorial) committee, they will:

   a. Develop an outline and format for the bulletin to ensure completeness and consistency.

   b. Consider and evaluate possible means to acquire financial support for publication of the bulletin including 1) developing a proposal to submit to the NE CES directors at their meeting in July; 2) contacting commercial publishers.

c. Select authors for each chapter.

a. Develop a workable timetable for completion and publication of the bulletin.

e. Obtain from the SCS a draft copy of the map to be printed in association with the bulletin, and provide this to the chapter authors.

8. Because Sharon **Waltman** (Lincoln NE) is already working on **1:1** million and a **1:5** million compilation of **STATSGO** for the US beginning with the NE region, it was concluded that this would be an appropriate map (perhaps with some modifications) for use in this project. Darlene Monds will head up a NE SCS task force to coordinate this effort, and will serve as the SCS contact for the NEC-50 coordinating/editorial committee. SCS will go forward with the map publication with or without the text.

RESPONSES TO PARTICULAR CHARGES

Charge 1. The committee was agreed that any publication a new map should be based on some form **or** combination of the **STATSGO** maps.

Charge 2. The responsibilities of this charge have been delegated to the coordinating/editorial committee of NEC-50 under 7a above.

Charge 3. The responsibilities of this charge have been delegated to the coordinating/editorial committee of NEC-50 under **7c** above.

Charge 4. It was concluded that any republication of the bulletin should not provide interpretations for the map units.

Charge 5. The responsibilities of this charge have been delegated to the coordinating/editorial committee of NEC-50. They will pursue this as indicated under 7b above.

RECOMMENDATIONS

1) We recommend that Committee1 be dissolved.

2) We recommend that the NEC 50 group and the SCS group report progress at the next Northeast work planning conference in two years. If substantial progress is not made, this subject should be dropped.

COMMITTEE 2 - SOILS OF THE SOUTHERN STATES AND PUERTO RICO

Charges:

1. Determine the format for an updated general soil map publication for the Southern States and Puerto Rico

2. Determine the scale and type of map to be in the publication.

3. Recommend National Cooperative Soil Survey (NCSS) personnel to complete the various sections of the publication and suggest a timetable for completing the project.

Southern Cooperative Series Bulletin No. 174, "Soils of the Southern States and Puerto Rico", was published in 1973 and reprinted without revision in 1983. A limited number of copies are still available. Additional information gained through mapping, field study, and research of soils since publication of this bulletin has substantially increased our knowledge of properties, genesis, and distribution of soils in the region. In addition, the computer age and geographic information systems (GIS) have revolutionized compilation, display, and distribution of soils information. Thus, Soils of the Southern States and Puerto Rico needs to be revised to incorporate new knowledge and techniques of disseminating soils information.

Charge **1: Determine the format for an updated general soil map publication for the Soutbem States and Puerto Rico**

Objective of the publication:

To present information, at a regional level, concerning properties, distribution, and genesis of soils in the southern U.S. including Puerto Rico and the Virgin Islands.

Audience:

The major audience for a map and accompanying text describing properties, distribution, and genesis of the soils at a regional level would likely be natural science teachers, geographers, ecologists, etc. looking for a reference from which to base a lecture or some other similar project requiring general soil information. As such, the text should be written at a level that can be understood by individuals with a science background but not a high level of training in Soil Science. The publication may also be useful as a regional planning tool, but this use should be considered secondary. Similarly, Pedologists and other Soil Scientists both within this region and in other parts of the world may find such a publication useful as a reference but should not be considered as the primary audience.

Format:

Other than two introductory chapters describing the publication and the physiography of the area, the original publication was organized by chapters describing properties of each soil order and much of the text was devoted to explanation of the “new” system of soil classification. The classification system is no longer new, and the publication would be more useful if it was devoted to discussions of the soils in the region in terms of their distribution, genesis, properties, and use. A proposed format for the revision Soils of the Southern Region and Puerto Rico is outlined below.

1. Introduction

   A. Definition of soil
   B. Relation of soils to man - after “Soil and Society”, C.E. Kellogg, ‘38 Yearbook of Agriculture
   C. Explanation of Soil Taxonomy
   D. Purpose and organization of the publication

II. Geology and Landforms of Southern States, Puerto Rico, and the Virgin Islands

   A. Discussion of geology and landforms of Soil Regions or groups of Soil Regions
      1. Where they occur - separation from adjoining regions
      2. Depositional environment or other factors of geologic nature
      3. Nature and composition of parent materials
      4. Topography and landforms
      5. Other?

III. Climate of the Southern States, Puerto Rico, and the Virgin Islands

   A. Temperature
   B Precipitation
   C. Evapotranspiration
   D. Other climatic factors

IV. How the Map was Made (another title may be more suitable)

   A. State of GIS at the time the map was compiled
   B. Description of data base (STATSGO) from which map was generated including contacts for digital STATSGO data.
   C. Other digital soils data bases
   D. Description of methodology used to derive map units (Taxonomic or other base, composition considerations, etc.)

V. Chapter for each Soil Region (or groupings of Soil Regions)

A. Soil properties
1. Morphological
2. General physical, chemical, mineralogical, and biological
3. Data for selected **soils**
3. Relation to soil behavior and use

B. Soil distribution
1. General relationships of major soils among and **within** map units in Soil Region - need to include block diagrams and other illustrations.

C. Soil Genesis - handle in terms of state factors

D. **Other** information or concepts left to individual authors (but not too much)

Division of **the** area of interest into Soil Regions will be critical. Too many Soil Regions may lead to redundancy (similar soils discussed in more than one chapter). Too few, and the soils in the Region may be so diverse that their properties, distribution, and genesis cannot be described in a meaningful manner. Final decision concerning Soil Regions will not be made until decisions have been made as to map unit design and a draft of the Regional Soil Map has been prepared.

Interpretations of soils for specific uses **will** not be included. Such interpretations are beyond the scope and intent of this publication. The soil map will be much too general for specific interpretations of soil use for any area, and other larger scale maps are readily available for soil use interpretations. General suitability of soils in a region for general uses may be included by the authors of each chapter if they desire.

Charge 2. Determine **the** scale **and type of map to be in the publication.**

The map will be derived from the **STATSGO** data base. This is probably **the** best information available at this time and can be modified to generate a paper map at the scale needed for the publication. No digital map or attribute data will be included with the publication. Tbe scale of the map will be too small for any meaningful interpretations. Sources of digital soils data at other scales will **be** included in the publication (likely in more than one location), and users interested in obtaining these data can do so.

The scale of the map in tbe edition published in 1974 was **1:5,000,000.** Most state Soil Association Maps are **1:500,000** to 1: **1,000,000.** The scale of the bard copy of the map included in the publication will be determined, to some extent, by a convenient physical size of tbe map. Most users would not want a map **too** large to unfold and read at a desk or in the front seat of an automobile which restricts the dimensions to about 36 to 40 inches square. At a scale of **1:3,000,000,** the southern states would require a paper map 38” wide without margins. A map paper map at a scale of **1:5,000,000** would be smaller, easier to use, and may retain sufficient detail for a regional publication. Test data sets for selected areas in the region will be evaluated by selected individuals at both scales to determine the amount of detail and map unit purity at each scale. These evaluations will be used to make a final decision on map scale. Because the N-S dimension of the region is less than the E-W dimension, ample room would be available

Chapters on Soil Regions and Groups of Soil Regions
(Soil Region names subject to change)

Region

1. Southern High Plains and **Trans-Pecos** - B.L. Allen/Earl **Blakley/Bill** Harris
2. Rolling Red Plains and Prairies - Richard **Drees/Gaylon** Lane
3. Edwards Plateau, Texas Central Basin, and Rio **Grande** Plain - Tom **Hallmark/Clyde Stahnke/Charles Batte**
4. Cross Timbers, Grand Prairie, and Cherokee Prairies - Brian Carter/Mike Golden
5. Texas Blackland Prairie and **Claypan** Area - Larry **Wilding/Dewayne** Williams
6. [illegible]
7.
8.
9.

July 1, 1994 Chapter reviews completed and chapter revision initiated.

Oct. I, 1994 Final copy of manuscripts completed; final version of map completed; map and manuscript to publisher.

Recommendations:

1. Approval for revision of Bulletin 174 be obtained from Southern Region Experiment Station Directors, Soil Conservation Service, and other appropriate agencies.

2. Title be changed to "Soils of the Southern States, Puerto Rico, and the Virgin Islands".

3. A small standing committee be established to initiate manuscript preparation and oversee editorial handling of publication.

Committee members:

J.T. Ammons	C.T. Hallmark	A.D. Karatbanasis	E.M. Rutledge
Frederick Beinroth	R.B. Hinton	David McMillen	C.A. Steers
E.R. Blakley	Wayne Hudnall	Hem-y Mount	L.T. West, Chair
S.W. Buol	G.W. Hurt	Javier Ruiz	

REPORT OF COMMITTEE 3

CLASSIFYING, MAPPING AND INTERPRETING DISTURBED LANDS

BACKGROUND

Current practices within the National Cooperative Soil Survey (NCSS) do not allow soil properties to be recorded on the soil interpretations record for disturbed soils. Interpretations are not developed for taxa above the series level. There is a need for computer-generated interpretations for taxa above the series level. There is also a need to look at the classification and mapping concepts for disturbed lands.

CHARGES

1. Evaluate the way these soils are classified and recommend any needed changes.

2. Examine map unit design and mapping conventions for these soils and recommend needed changes.

3. Recommend methods to improve interpretations for these soils.

COMMITTEE MEMBERS

John T. Ammons, Chair (South) - Classification and mapping

F. Dale Childs, Vice Chair (Northeast) - Interpretations

Classification and mapping	Interpretations
John Davis	Larry Brow"
Del Fanning	Lewis Daniels
Louie Frost	Bob Eigel
John Sencindiver	Glenn Hickman
John Short	John Kelley
Nelson Thruman	George Martin
David McMillen	Dewayne Hays
Darwin Newton	James Patterson
Everett Stuart	Daryl Lund

INTRODUCTION

The 1992 South-Northeast Soil Survey Work Planning Conference met in Asheville, North Carolina on June 14-19, Committee 3, Classification, napping and Interpreting disturbed lands began at the 1988 Southern Soil Survey Conference in Knoxville, Tennessee. During the 1990 meeting in San Juan, Puerto Rico, the committee decided to split into two groups. One group would concentrate on classification and mapping and the other group interpretations.

Classification and Mapping Committee

CHARGES

1. Evaluate the way these soils are classified and recommend any needed changes.

After much discussion, the committee agreed that we need a taxonomic system to "tag" or inventory disturbed or man influenced soils. Additionally, the present use of soil series and the taxon Typic Udorthent does not readily identify these soils as disturbed or man influenced. Moreover, the committee felt that a taxonomic system be developed at the order, suborder, and/or subgroup level of Soil Taxonomy.
Properties of disturbed soils need to be reviewed to consider those properties common to a broad class of land disturbances. With these criteria identified, diagnostic criterion can then be established for classification purposes.

2. Examine map unit design and mapping conventions for these soils and recommend needed changes.

Present mapping unit is based on the series classification (Typic Udorthents). Design of mapping units was briefly discussed but the committee concentrated on classification which will be the basis for mapping unit design. (NCSS is developing an interpretive computer data base program based en measured soil properties.)

DISCUSSION

Classification andmapping committee discussed properties that were common across all disturbed soils. Citing Sencindiver (1977), Ammons and Sencindiver (1990). and Fanning (1992) we outlined four properties common to all disturbed soils.

1. Color mottling not related to drainage.
2. Disordered coarse fragments (when present) in soil profiles.
3. Pockets of dissimilar material that are randomly oriented in the profile.
4. Irregular distribution of oxidized carbon not associated with fluvial processes.

Where in the soil taxonomic system should these taxon be placed?

Option 1 - The criteria at the great group Udorthents would be modified to include disturbed soils. A subgroup modifier such as "Spolic" or "Urbic" (Fanning, 1992) would be used to "tag" or identify disturbed soils.

Option 2 - New suborders in the Entisol and Inceptisol orders would be developed and defined to identify man influenced soil. These may include proposed suborders as Spolents (Sencindiver, 1977). Spolepts, Urbents, or Urbepts.

The committee discussed three possible suborders based on past and present research. The Urbents (Urbepts) are urban associated soils with specific criteria (Fanning, 1992). The Spolents (Spolepts) are related to drastic disturbances such as surface mining for coal or large civil works projects (Sencindiver, 1977). Garbents (Garbepts) (Fanning, 1992) are associated with sanitary landfills with potential methane gas problems such as fires or failure of vegetation due to methane toxicity (or displacement of oxygen by methane gas within the root zone). The committee feels that some revision of the names for the subgroup or whatever level of taxonomy is chosen is needed to prevent prejudices on part of the readers or from blocking the concept Of the proposed taxonomic unit.

Specific criteria for each division of disturbed soils will be established and presented to NCSS. Additionally, we propose that once the system is refined, that an international committee on disturbed soils be established to test and review the proposed criteron.

Interpretations committee

Disturbed'soils should be interpretated using the same procedures applied to natural (undisturbed) soils. However, specific rating criteria should be developed for specific uses. The soils should be classified to the lowest category possible based on consistency of soil properties in the map units. A reliability statement should be ascribed to each data element and this information should accompany the soil interpretations.

Disturbed soils may present safety hazards not necessarily associated with undisturbed soils such as the presence of heavy metals, toxic materials, unstable soils, and etc. Field soil scientists working with ouch soils should be aware of the potential safety hazards and they should inform others of such potential hazards.

RECOMMENDATIONS

1. That this committee continue as a core group and that they get together within the next year to view field study sites. Additionally, a detailed study of available characterization data should be completed. A proposed classification system with interpretative guides should be developed before the 1993 national soil survey conference.

2. The committee should maintain two separate subcommittees; one for classification and one for interpretations.

3. A list of past and present literature directly related to disturbed soil properties and interpretations should be compiled and distributed to all interested soil scientists for review and additions.

4. Once criteria for identifying disturbed lands are established, an international committee should be formed to further develop the system worldwide.

5. Complete development of two options for soil taxonomy and decide which would be the best to "tag" or inventory disturbed soils.

6. Disturbed soils should be interpreted using the same procedures applies to undisturbed soils but develop specific criteria for specific uses.

7. Special safety precautions should be recognized when investigating these soils for soil interpretations.

REFERENCES

Ammons, J.T. and J.C. Sencindiver. 1990. Minesoil Happing at the Family Level Using a Proposed Classification System. J. of Soil and Water Conservation. Vol 45:567-571.

Fanning, D.J. 1992. Human-Influenced and Disturbed Soils: Overview with Emphasis on Classification. Proceedings of a Conference on Human-Influenced and Disturbed Soil. University of New Hampshire (in press).

Sencindiver, J.C. 1977. Classification and Genesis of Minesoils. Ph.D. diss. (Diss. Abstr. 38:1495B). West Virginia Univ., Norgantown.

Short, J.R., D.S. Fanning, H.S. McIntosh, J.E.Foss, and J.C. Patterson. 1986. Soils of the Mall in Washington, D.C.: I. statistical summary of properties. Soil Sci. Soc. Am. J. 50:699-705.

Short, J.R., D.S. Fanning, M.S. McIntosh, J.E. Foss, and J.C. Patterson. 1986. Soils of the Hall in Washington, D.C.: II. Genesis, classification, and mapping. Soil Sci. Soc. Am. J. 50:705-710.

Short, J.R. 1983. Characterization and classification of highly man-influenced soils on the Mall in Washington, D.C. H.S. Thesis, University of Maryland. College Park.

COMMITTEE 4
NATIONAL COOPERATIVE BOIL SURVEY (NCSS) AND PRIVATE SECTOR COOPERATION

COMMITTEE MEMBERS:

John C. Meetze, Chair (South)
Russell J. Kelsea, Vice Chair (Northeast)

South

Samuel J. Dunn
Charles L. Fultz
B.L. Harris
David L. Jones
William H. Craddock
Joe Kleiss
Kevin Martin
Dennis Osborne
Carroll Pierce
Jerry Ragus
Ray P. Sims
J.M. Soileau
Frankie Wheeler

Northeast

Edward P. Ealy, Jr.
Lee Daniels
David E. Hill
Kip kolesinskas
Charles Krueger
Garland Lipscomb
Laurel Mueller
Donald Owens
Raymond F. Shipp
Karl Langlois, Jr.

NHQ & National Soil Survev Center

Richard W. Arnold
Ray Sinclair

FORSWORD: I would like to thank the members of this committee for their responses and cooperation in working on this committee. I especially want to thank Russ Kelsea, Vice Chair of the Committee, for taking notes during the committee sessions and in preparation of this report. I also want to think Kip Kolesinskas for his assistance in keeping the flip chart during the Committee Meetings and for his assistance in the preparation of this report.

The Committee instructed the chair to send a cody of this report to the National Leader of the National Cooperative Soil Survev with a request that he take steps to initiate action on these recommendations. The Committee recommends that this committee remain active if needed to aid in resolving issues that could occur from the actions taken on these recommendations.

The Charges assigned to the Committee and the Committee's Recommendations to each Charge are given on the following pages.

BACKGROUND :

There is a need for more cooperation between NCSS and private sector soil scientists. NCSS has information such as manuals, guides, and handbooks that are of interest and use to private sector soil scientists. Private sector soil scientists develop interpretations and other products that are of interest to NCSS. It is desirable to establish working protocols that will enhance the professionalism in soil science.

CHARGE 1:

Investigate the need to develop Hemorandums of Understanding between NCSS and private sector soil scientists. Should a Memorandum of Understanding be developed between an individual, groups, or organizations?

COMMITTEE'S RECOMMENDATIONS:

1. Develop a National MOU between SCS, as lead agency for NCSS, and "National" professional organizations of private soil scientists.
2. The National MOU developed between SCS and professional organizations should be general in nature and may serve as a model for state or regional MOU's.

CHARGE 2:

If a Memorandum of Understanding is developed, suggest potential responsibilities of NCSS and private sector soil scientists.

COMMITTEE'S RECOMMENDATIONS:

The MOU should include as a minimum:

1. Specific guidance for both SCS and private sector regarding roles and responsibilities. The kind and extent of services provided by SCS relative to Title 42 should be clearly stated in the MOU so that both SCS and the private sector understand the roles and responsibilities. scs field staffs must be made aware of these roles and responsibilities.

3. Development of protocols specifying quality coordination and quality control relative to mapping and data collection using NCSS standards.

4. Methods to address ethics and complaints.

CHARGE 3:

As cooperation between NCSS and private sector soil scientists develops, how should ethics and professionalism be addressed?

COMMITTEE'S RECOMMENDATIONS:

1. Any national organization should have a strong codes of ethics and method of enforcement.

2. The public should be protected by strongly encouraging state legislation for licensing or certification.

CHARGE 4:

Clarify the definition of "Cooperators" and type of NCSS assistance provided to cooperators and non-cooperators.

COMMITTEE'S RECOMMENDATIONS:

1. Committee 4 is not aware of any restriction on the inclusion of non-federal parties as NCSS cooperators.

2. Two kinds of cooperators are identified. First, conservation district cooperators and second, NCSS cooperators.

    a. Generally NCSS cooperators work together to produce and document soil surveys.

    b. Services to conservation district cooperators are in line with SCS program responsibilities.

3. In addition, SCS services are available to non-cooperators to the extent described in Title 42 and as described in charge 2.

CHARGE 5:

As an NCSS cooperator, please expound (positive or negative) on your experience with private sector soil scientists. If you have worked as a soil scientist in the private sector, please give your experience (positive or negative) in working with the NCSS.

COMMITTEE'S RECOMMENDATIONS:

1. Generally, comments received by committee 4 indicate positive experiences with public/private cooperation. Some of the negative experiences have been addressed in charges 1 through 4. However, a negative aspect not addressed in charges 1 through 4 relates to a misunderstanding by contracting officers, state agencies, and others of the requirements for education and experience necessary for individuals who provide soil science services.

2. Contracts for services should specify education and experience requirements of the soil scientist and technical standards necessary to complete the contract.

Submitted By:

John C. Meetze,
Chair, Committee 4

1992 S-NECSSC TECHNICAL COMMITTEE 5

REPRESENTATIVE TAXA FOR MODELING

Committee Members

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Background

There is a growing need from other disciplines to use representative soil data for models. The National Cooperative Soil Survey can assist in these efforts by assuring quality control and representativeness. Needs for this information exist at several levels of generalization. There is a need to have this data readily available to all users.

Charges

1. Review the benchmark soil concept and determine if this concept is applicable for modem inventorying and modeling needs.

2. Determine how to use benchmark data in representative larger cell areas.

3. Determine how to aggregate pedon data to represent higher category taxa.

4. Determine how to interpolate information for non-benchmark soils from benchmark soils data.

5. Determine how to place confidence limits on soils data at various levels of generalization.

General

Committee 5 was a continuation of the 1990 Southern Regional CSSC Technical Committee 3, which addressed soils data for modeling. The 1990 Committee Report is a thorough evaluation of the adequacy of soil survey data as the soil data base for environmental and agricultural models and knowledge-based systems. The committee recommended continuance in 1992 with emphasis on "spatial variability and modeling."

Prior to the 1992 conference, two mailings were sent to all committee 5 members to provide the background information contained in the 1990 Committee 3 report and to generate discussion between committee members and modelers in advance of the meetings in North Carolina. The charges and topics that were addressed are stated below, followed by a synopsis of the responses.

Summary of Discussion

1. Review of the "benchmark soil" concept and its applicability to modeling.

There was a strong consensus among the members of the committee that the "benchmark soil" concept was <u>not</u> applicable for modem inventorying and modeling needs. The term means too many different things. Depending on the objectives and the modeling approach, the user may need g-referenced point data from as many locations as possible, even though the number of properties observed at each site may be limited. However, it may be useful to flag some characterization data that are most complete (eg - the WEPP sites).

2. Determine how to extrapolate and aggregate soil data for modeling.

Charges 2, 3 and 4 are similar and were covered in the following general discussion. Committee members were in agreement that the aggregation and extrapolation of soil data is a function of the model and its objectives. Therefore, the modelers should be the ones to perform these operations. The SSURGO, STATSGO, and NATSGO data sets do provide valuable aggregations of soils that will suffice for many purposes. Of these, the STATSGO database will probably be in greater demand for aggregating soils information. A report on the status of STATSGO, given at the CSSC, showed the project nearing completion.

3. Access to soil databases.

Following the previous discussion of modelers aggregating and extrapolating data according to the purpose and objectives of the model, the committee discussed user access to soil databases. We anticipate (and have already had) requests for access to soil databases of all kinds, including the pedon data base, the soil interpretation records, and the map unit interpretations records. There was general agreement that the public should have direct access to soil databases. Some format such as exists at Iowa State University is needed. Today, libraries at the Land Grant Universities (ie - Cornell and perhaps others) actively seek to maintain and promote user access to large public databases. With electronic networks, the distribution of data is virtually unlimited.

4. A useable database format for modeling.

The committee concluded that the present database structure is inadequate for many modeling efforts. Of most concern was the use of ranges for soil properties and the lack of a mean or single representative value.

The SCS is currently developing a National Soils Information System (NASIS). The system includes the three soil geographic databases: SSURGO, STATSGO, and NATSGO. The SCS has developed interface computer programs that link the map data with the relational attribute data. These programs allow easy, menu driven access to both the map data and tabular data. At the soil survey level, single representative values for soil characteristics will be provided. These will be generalized at the state and regional or national level to include representative values with ranges. Georeferenced point data will also accompany this database.

The committee felt that the NASIS database structure would deliver the soils information most requested by modelers in a format that facilitates aggregation and extrapolation. NASIS also addresses charge 5 of this committee (How to place confidence limits. ..).

5. Soils database user education.

In view of the consensus for providing direct access to the database and allowing modelers to aggregate and extrapolate soils data as desired, the committee discussed the need for user education. Basically, our soils data model should be defined. The concepts of soil series, phases, map units, inclusions, etc. as they are used in our free style survey should be communicated to the user. The user should be aware that sites selected for sampling are usually not selected randomly, but are usually meant to be representative of a class or map unit concept. A technical information bulletin should be developed and released by the National Soils Center upon implementation of NASIS.

6. Soil variability.

The committee addressed the defined charges and further developed discussion and recommendations beyond the scope of the charges but within the original intent and purpose for establishing the committee. However, several members felt that we have not fully answered the recommendation of the Southern Regional CSSC Committee 3 to have a committee address ‘soil variability.” Whether or not this issue can be addressed by a committee with well defined charges beyond those given to committee 5 was not addressed.

Recommendation

1. Benchmark soils is **not** a concept we want to use in modeling.

2. Aggregation and extrapolation of data should be done by the modeler.

3. Modelers should have direct access to soil databases, perhaps through the land grant university libraries.

4. NASIS should be sent out for review by **cooperators,** who in turn should seek comments from modelers. NASIS should then be completed and implemented as soon as possible.

5. An information bulletin that describes our ‘soil data model” and the structure of **NASIS** should be written and released concurrently with NASIS.

6. This committee should be discontinued.

COMMITTEE 6 - EXTRAPEDONAL INVESTIGATIONS FINAL REPORT

1992 SOUTH-NORTHEAST COOPERATIVE SOIL SURVEY CONFERENCE

Asheville, North Carolina
June 14-19, 1992

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BACKGROUND

National Cooperative Soil Survey (NCSS) soil scientists currently describe and classify soils to a maximum depth of 2 m. This is only a part of the earthy materials affecting recharge water. Soil scientists are in a good position to evaluate earthy material (regolith) between 2 m and hard bedrock.

The *regolith* is defined as the unconsolidated material overlying rocks and includes the soil (Brady, N. C., 1990. The nature and properties of soils. 10th edition. New York: MacMillan Publ. Co.). Therefore, the term *nonsoil regolith* is used to describe materials between the bottom of the soil and hard bedrock in this report.

Not all water flow is vertical through the regolith, especially on slopes. Evaluation of through-flow (lateral flow) water is needed to properly evaluation sites for waste disposal and other uses. How can these needs be addressed in soil survey operations?

CHARGES

1. Determine how lateral water flow information should be collected. What information should be collected? How should the information be presented?

2. Examine the efforts of the Saprolite-Taxonomy Network. Evaluate the feasibility of this effort for future NCSS work.

3. Review Committee Report Number 4 from the 1990 Northeast Soil Survey Conference; and, in light of Charge 2 above, are there further recommendations?

4. Suggest ways to collect and incorporate this data into soil survey reports.

INTRODUCTION

Prior to the South-Northeast Cooperative Soil Survey Conference, copies (i) of Circular Letter No. 7 of the Saprolite-Taxonomic Network, (ii) of the Final Report of Committee 4 (1990 Northeast Cooperative Soil Survey Conference, Morgantown, WV, June 3-8, 1990), (iii) of papers and materials received from Bob Grossman and (iv) of a questionnaire pertaining to the above charges were mailed to each committee member for comments. A list of comments and recommendations based on the above materials were presented and discussed by conference participants.

XEY POINTS OF DISCUSSION:

1. The NCSS needs to decide whether or not it is interested in expanding observations and/or mapping into the nonsoil regolith including seasonal variations in the water table surface.

The conference participants considered the approach used by NCSS to describe and characterize soils to have a high potential for describing and characterizing the nonsoil regolith. The following properties were considered to be important attributes that could be used as a first approximation.

Potential properties for describing nonsoil layers of the regolith

- designations for layers

  Designations for layers below the soil have not been developed. The conference felt that this work should be done in concert with participants from other disciplines, such as engineers, hydrologists, and geologists.

- depth to and thickness of layers

  Depth to and thickness of layers are site specific. The practical lower limit for depth of observations should be defined, because depths to hard rock in the Atlantic Coastal Plain can be hundreds or thousands of feet. Committee 4 of the 1990 Northeast Cooperative Soil Survey Conference suggested 2 to 5 m, 5 to 20 m, and >20 m.

  Practical methods of observing the nonsoil regolith are suggested; i.e., use the hand auger for the 2 to 5 m zone, use coring for the 5 to 10 m zone, and use drilling for the zone >20 m.

  Practical density of observations in a mapping context could also be developed for the 2 to 5 m, 5 to 10 m, and >20 m zones.

- matrix color
- USDA-particle-size distribution
- mottle color(s)
- structure

  Guidelines for describing structure should be developed in concert with other disciplines.

- consistence (dry, moist, wet)

  Guidelines for describing consistence should be developed in concert with other disciplines and should include strength of materials.

- roots

  Should include root casts, including those that are calcified and silicified.

- pores

  Guidelines for describing macropores in the field should be used to the level of a 10x hand lens. Description of pores using water retention curves could be used below the level of the 10% hand lens.

Percent pore space estimated using bulk density and particle density should be considered.

- plinthite
- pressure surfaces with or without shear failure
- relict-rock fissures filled with iron, aluminum, or manganese oxides; organic matter; salts; carbonates; quartz; etc.
- concentrations
- mica

  Expansive classes of mica could be needed.

- rock fragments
- brittleness

  Brittleness should be quantified.

- selected chemical properties
  - salinity
  - sodicity
  - gypsum
  - sulfides
  - reaction (pH)
- boundary of layers

Potential properties for characterizing **nonsoil** layers of the regolith

- free water occurrence; i.e, variations in watertable surface
- particle-size distribution
  - USDA-particle-size class
  - fraction >250 mm, 250-75 mm
  - percent passing sieve numbers 4, 10, 40, and 200
  - clay
  - particle-size-superseding characteristics (sapric material, coprogenous earth, cinders, marl, muck, etc.)
- fabric-related analyses
  - moist-bulk density
  - shrink-swell potential
  - saturated-hydraulic conductivity (K_{SAT})
  - unsaturated flow $\Theta(h)$ and $K(\Theta)$
- engineering properties
  - liquid limit
  - plastic limit
  - unconfined compression strength

- engineering classification
  - unified
  - AASHTO
- chemical properties
  - $CaCO_3$ equivalent
  - cation-exchange capacity
  - gypsum
  - organic matter
  - reaction (pH)
  - salinity
  - sodium adsorption ratio
  - sulfur content
  - total Fe_2O_3 and Al_2O_3 content as a measure of ore potential

2. The NCSS needs to identify potential uses and potential users of information generated by describing and characterizing the nonsoil regolith.

Potential uses of the information identified by the conference participants are primarily related to water quality as it is influenced by

- solute transport and fate
- waste disposal

Potential benefactors of the use of the information for proper disposal of waste materials include every livina thinq on this planet.

RECOMMENDATIONS:

1. Committee 6 recommends that the steering committee of the 1993 NCSS Conference form an interdisciplinary committee composed of:

- soil scientists
- engineers (civil and geotechnical)
- groundwater hydrologists
- geologists (USGS)
- EPA scientists

2. Committee 6 recommends that the newly formed committee be charged to:

- determine which properties of the nonsoil regolith generate pertinent information for users

- determine what should be characterized

  - detailed soil map units as defined by NSH
  - general soil map units as defined by NSH
  - specific sites

- evaluate current procedures and terminology for describing and characterizing the **nonsoil** reqolith used by

  - soil scientists
  - engineers
  - hydrologists
  - geologists
  - others

- evaluate the extent and usefulness of currently available data generated by:

  - SCS engineers
  - civil engineers
  - stratiqraphers, geologists
  - hydrologists
  - state highway and transportation departments

  for characterizing the **nonsoil** reqolith in a mapping and taxonomic context

- determine practical limits of observation
- determine data structure

3. Committee 6 recommends that the efforts of the Saprolite-Taxonomy Network be used as an approach for developing a scheme for classifying the **nonsoil** reqolith and that this classification be kept separate from the classification of the soil by *Soil Taxonomy.*

4. Bob Dyar (a USGS hydrologists formally trained as a civil engineer and a member of Committee 6) stated, "Move methodically ahead on the committee's agenda; i.e., do not be affected by worries such as *who leads, who* gets credit, or *who funds the work at* this time. The fact remains that everyone recognizes that the committee charges address important earth science needs and that the work should be done. The point is that unless someone is further ahead, why not proceed"? The other members of committee agreed with Bob's statement; i.e., **let's doit!**

5. Committee 6 recommends that it not be continued.

SOUTH-NORTHEAST COOPERATIVE SOIL SURVEY CONFERENCE

CLOSING COMMENTS

KARL H. LANGLOIS, JR.

The Conference this week was excellent. We had several speakers during the week that brought us up to date about many items that affect our work as soil scientists. Individuals on the two panels, 1) Requirements and Hiring Procedures for Soil Scientist, and 2) GIS Support for Soil Survey and Resource Inventories, did a great job of informing us about these items.

The subjects of the 6 committees and 2 task forces were pertinent to today's soil survey. The committees, especially the committee chairs, are to be commended for the work they did prior to and during the Conference. We are looking forward to receiving the conwnittee's recommendations so they can be considered for implementation or further study.

We were able to see the variety of soils in this area, and their use, during the field tour on Wednesday. The Banquet on Thursday evening was enjoyable and it was great having Dr. McCracken as the guest speaker.

This week could not have been the great success it was without the hard work of Horace Smith and his staff. They paid attention to the small details which helped everything go so smoothly. Let's give Horace and his staff a hand for a job well done!

The Regional meetings in 1994 will be in Arkansas for the South, and in Maryland for the Northeast. Have a safe trip home.

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South Taxonomy committee **Members**

Elected at *the* 1992 Southern Regional Work Planning Conference

Term Expires at **the Work Planning Conf.** or in June of alternate Years	**State Representatives**	Federal **Representatives**
1993 (term began in 1990)	Dr. Frederick Beinroth	Barry C. Davis
1994 (term began in 1991)	Dr. **B.** L. **Allen**	**Benjamin Stuckey**

Elected at the 1992 Southern Regional work Planning *Conference*

Term Expires at the *Work* Planning **Conf.** or in June of Alternate Years	state **Representatives**	Federal **Representatives**
1995 (term begins in 1992)	Dr. David Petry	Larry Ward
1996 (term begins in 1993)	Dr. Bill **Smith**	**Ken Murphy**

Joe D. Nichols

JOE D. NICHOLS

June 10, 1992

Report of the Soil Taxonomy Committee of the Southern Regional Work Planning Conference of the National cooperative Soil Survey

May 25, 1990 - Letter to South Taxonomy Committee on a proposal to eliminate micro families. The proposal was from the West Committee. The South Committee was to comment directly to John Witty. Micro families were deleted in NSTH Issue No. 15.

September 18, 1990 - Comments to Richard CKrehwi

March 17, 1992 - Comments to John Witty on proposed changes in the draft National Soil Taxonomy Handbook Issue NO. 16. There were numerous comments.

April 10, 1992 - A letter to Richard Babcock informing him that the South Committee had approved a proposed amendment on soils with gypsum, if the soil scientists on John's staff and the National Soil Survey Laboratory could work out problems on analysis and interpretation of the data. This is still in process.

Joe D. Nichols

JOE D. NICHOLS

SOUTH-NORTHEAST COOPERATIVE SOIL SURVEY CONFERENCE
ASHEVILLE, NORTH CAROLINA

MINUTES OF THE NORTHEAST BUSINESS MEETING
JUNE 18, 1992

The business meeting was called to order at 1:00 p.m. by Chair John Sencindiver. The minutes of the 1990 meeting were read and approved as read.

Bill Wright presented the Silver Spade Award. This year's 1992 recipient was Del Fanning. Previous year recipients are as follows:

1984 Edward J. Ciolkosz, Pennsylvania State University
1986 Edward H. Sautter, State Soil Scientist, CT
1988 Sidney A. L. Pilgrim, State Soil Scientist, NH
1990 William R. Wright, University of Rhode Island
1992 Del Fanning, University of Maryland

Marty Rabenhorst announced the next Northeast Cooperative Soil Survey Conference will be in Maryland in 1994. As per the Northeast Cooperative Soil Survey By-laws, Steve Hundley will serve as Chair. Marty Rabenhorst will serve as Vice-Chair in charge of local arrangements.

Karl Langlois discussed the 1993 National Cooperative Soil Survey Conference. This conference will be held in Burlington, Vermont. There will be a state soil scientist, selected by Karl, who will be asked to participate in the conference. The NEC-50 group will select two experiment station representatives to attend the conference. These names should be provided to Karl in the near future to be submitted to National Headquarters.

Karl Langlois discussed the makeup of the Soil Taxonomy Committee. Karl mentioned that since the inception of the National Soil Survey Center his responsibilities as permanent Chair of the Northeast Taxonomy Committee have been minimal. Karl suggested two options:

1. Keep the committee makeup as it is currently.

2. Recommend the NSSC Supervisory Soil Scientist for the East be the permanent chair of the committee.

Ed Ciolkosz made a motion that the by-laws be amended to read: "The membership of the Northeast Soil Taxonomy Committee will be comprised of all experiment station representatives and scs state office representatives in the Northeast."

Dale Child made a motion to amend the current motion to add the following: "The National Soil Survey Center Supervisory Soil Scientist in charge of the Northeast will serve as permanent Chair of the Northeast Soil Taxonomy Committee, and the head of the Northeast Interpretations Staff serve as a permanent member on the committee.

After considerable discussion and confusion, the motion and the amendment to the motion were withdrawn.

John Sencindiver called for a straw vote to assess the interest in the group to turn over the Chair of the Northeast Soil Taxonomy Committee to the NSSC Supervisory Soil Scientist for the Northeast. A show of hands indicated 10 were not in favor: 25 were. Based on this straw vote, Karl will submit to John Witty the recommendation that the Chair come from the National Soil Survey Center. If other regions also agree to this structure then the Steering Committee will revise the By-laws for a vote at the 1994 Northeast Conference.

Karl mentioned that the Steering Committee attempts to take action on recommendations made by active committees at the conference. However, action for some committees is sometimes not as timely as it could be. Karl suggested that if anyone has any concerns over the timeliness of actions taken to contact him with specifics.

There was no further business. The meeting adjourned at 1:58 p.m.

Respectfully submitted,

Steven J. Hundley
State Soil Scientist

SILVER SPADE AWARD

The Silver Spade Award is presented to a member of the Northeast Cooperative Soil Survey who has contributed outstanding regional and/or national service to soil survey. Recipients of the Silver Spade Award are:

1984 Edward J. Ciolkosz, Pennsylvania State University
1986 Edward H. Sautter, State Soil Scientist, CT
1988 Sidney A.L. Pilgrim, State Soil Scientist, NH
1990 William R. Wright, University of Rhode Island
1992 Delvin, Fanny, University of Maryland

BY-LAWS OF THE

NORTHEAST COOPERATIVE SOIL SURVEY CONFERENCE

Purpose, Policies and Procedures

I. Purpose of Conference

The purpose of the NECSS conference is to bring together representatives of the National Cooperative Soil Survey

III. Organization and Management

A. steering Committee

1. Membership

A Steering Committee assists in the planning and management of biennial meetings. including the formulation of committee memberships and selection of committee chairmen and vice-chairmen. The Steering Committee consists of the following four members:

Head, Soil Interpretations Staff, NENTC, SCS (chairman)
The conference chairman
The conference vice-chairman
The conference past chairman

The Steering Committee may designate a conference chairman and vice-chairman if the persons are unable to fulfill their obligations.

2. Meetings and Communications

A planning meeting is to be held about 1 year prior to the conference. Additional meetings may be scheduled by the chairman if the need arises.

Most ot the committee's communications will be in writing. Copies ot all correspondence between members of the committee shall be sent to the chairman.

3. Authority and Responsibilities

a. Conference participants

The Steering Committee formulates policy on conterence participants. but final approval or disapproval of changes in policy is by consensus ot the participants.

The Steering Committee makes recommendations to the conference for extra and special participants in specific conferences.

b. Conference Committees and Committee Chairman

The Steering Committee formulates the conference committee membership and selects committee chairman and vice-chairmen.

The Steering Committee is responsible **for** the **formulation** of committee charges.

c. Conference Policies

The Steering Committee is responsible for the **formulation** of statements of conference policy. Final approval of such statements is by consensus of the conference participants.

d. **Liaison**

The Steering Committee is responsible for maintaining liaison between the regional conference and **(a)** The Northeastern Experiment State Directors, **(b)** The Northeastern State Conservationists, SCS, **(c)** Director of Soils of the Soil Conservation Service, **(d)** regional and national **offices** of the U.S. Forest Service and other cooperating and participating agencies, **(e)** the Northeast Soil Research **Committee,** and **(f)** the National Soil Survey Conference of the Cooperative Soil Survey.

4. Chairman's Responsibilities

a. Call a planning meeting of the steering committee about 1 year in advance of and if possible at the place of the conference to plan the agenda.

b. Develop with the steering committee the first and final drafts **of** the conference's committees and their charges.

c. Send committee assignments to committee members. The committee assignments will be determined by the Steering Committee at the planning meeting. The proposed chairman and vice-chairman of each committee will be contacted personally by the conference chairman or vice-chairman and asked if they will serve prior to final assignments. SCS people will be contacted by a SCS person and experiment station people will be contacted by an experiment station person.

d. Compile and maintain a conference mailing list that can be copied on mailing labels.

e. **Serve** as a member **of** the editorial board of the Northeast Cooperative Soil Survey Journal.

B. Conference Chairman and Vice-Chairman

A" experiment station representative and a SCS state soil scientist alternate as chairman and vice-chairman. This sequence may be altered by the steering committee for special situations. The vice-chairman named at the biennial meeting serves as program leader for one conference and becomes conference chairman for the next one. The chairman functions as chairman of the biennial conference and his responsibilities include the following:

1. Planning and management of the biennial conference.
2. Function as a member of the Steering Committee.
3. Send out a first announcement of the conference about 3/4 year prior to the conference.
4. Send written invitations to all speakers or panel members. These people will be contacted beforehand by phone or in person by various members of the Steering Committee.
5. Send out written requests to experiment station representatives to find out if they will be presenting a report at the conference.
6. Notify all speakers, panel members. and experiment station representatives in writing that a brief written summary of their presentation will be requested atter the conference is over. This material will be included in the conference's proceedings.
7. Preside over the conference.
8. Provide for appropriate publicity for the conference.
9. Preside at the business meeting of the conference.
10. Serve as a member of the editorial board of the Northeast Cooperative Soil Survey Journal.

The vice-chairman functions as Program Chairman of the biennial conference and his responsibilities include the following:

1. Serve as a member of the Steering Committee.
2. Act for the chairman in the chairman's absence or disability.

3. Develop the program agenda of the conference.

4. Make necessary arrangements for lodging accommodations for conference members, for food functions, for meeting rooms, including committee rooms, and for local transport on official functions. Notify all persons attending the meeting of the arrangments for the conference (rooms, etc.). Included in the last mailing will be a copy ot the agenda.

5. Compile and distribute the proceedings of the conference.

6. Serve as a member of the editorial board of the Northeast Cooperative Soil Survey Journal.

C. Past Conference Chairman

The past conference chairman's responsibilities are primarily to provide continuity from conference to conference. In particular, his responsibilities include the following:

1. Serve as a member of the Steering Committee.

2. Assist in planning the conference.

3. Serve as the editor of the Northeast Cooperative Soil Survey Journal. This responsibility encompasses gathering information with the other editorial board members, printing the Journal, and distributing it.

D. Administrative Advisors

Administrative advisors to the conference consist of the Northeast National Technial Center Director, SCS. and the chairman of the N.E. Agricultural Experiment Station Directors or their designated representatives.

E. Committee Chairman and Vice-chairman

Each conference committee has a chairman and vice-chairman who are selected by the Steering Committee.

IV. Time and Place of Meetings

The conference convenes every two years, In even-numbered years. The date and location will be determined by the Steering committee.

V. Conference Committees

A. Most of the work of the conference is accomplished by duly constituted committees.

B. Each committee has a chairman and vice-chairman. A secretary or recorder may be selected by the chairman, if necessary. Committee chairmen and vice-chairmen are selected by the Steering Committee.

C. The kinds of committees and their members are determined by the Steering Committee. In making their selections, the Steering Committee makes use of expressions of interest filed by the conference participants.

D. Each committee shall make an official report at the designated time at each biennial conference. Chairmen of committees are responsible for submitting the required number of committee reports promptly to the vice-chairman of the conference. The conference vice-chairman is responsible for assembling and distributing the conference proceedings.
Suggested distribution is:

One copy ot each participant on the mailing list.

One copy to each state conservationist, SCS, and Experiment Station Director ot the Northeast.

Five copies to the Director of Soils, SCS. for distribution to National office staff.

Two copies to each SCS National Technical Center Head of Soil Interpretations Staff for distribution and circulation to both the SCS and cooperators within their region.

Five copies to the Region 8 and 9 Forest Service Regional Directors.

Three copies to the National Canadian Soil Survey office.

Much of the work of committees will of necessity be conducted by correspondence between the times ot biennial conferences. Committee chairmen are charged with the responsibility for initiating and carrying forward this work.

VI. Representatives to the National and Regional Soil Survey Conferences

The elected Experiment Station chairman or vice-chairman will attend the national conference. A second Experiment Station representative also will attend the conference. He is to be selected by the Experiment Station representatives at the regional conference.

The SCS representatives are usually selected by the Director of Soils and SCS, in consultation with the NENTC Director and state conservationists.

One member of the Steering Committee will represent the Northeast region at the Southern, North Central and Western Regional Soil Survey Conference. If “one of the members of the Steering Committee can attend s particular conference, a member of the conference will be selected by the Steering Committee for this duty.

VII. Northeast Cooperative Soil Survey Journal

The Northeast Cooperative Soil Survey Conference will publish a journal on soil survey and related topics at least once each year. The journal will be governed by a” editorial board made of the Steering Committee for the Northeast conference. The editor of the journal will be the pest conterence chairman. His responsibility will be to assist in gathering information for the journal. es well as printing and distributing the journal.

VIII. Northeast Soil Taxonomy Committee

Membership of the standing committee is as follows:

Head, Soil Interpretations Staff, NENTC, SCS (permanent chairman, non-voting)
Three Federal representatives
Three State representatives

The term of membership is usually three years, with one-third replaced each year. The Experiment Station conference chairman or vice-chairman is responsible tor overseeing the selection of state representatives.

IX. Silver Spade Award

The award will be presented every two years at the conference meeting. It will be presented to s member of the conference who has contributed outstanding regional and/or national service to soil survey. One or two individuals can be selected for the award every two years. The selection committee will be made up of past award winners with the last award recipient acting as chairman of the selection committee. If multiple awards were given at the previous meeting. the chairman of the selected committee will be elected by the committee. The recipients of the award will become members of the Silver Spade Club.

X. Amendments

Any part of this statement for purposes. policy and procedures may be amended any time by agreement of the conference participants.

By-Laws Adopted January 16, 1976
By-Laws Amended June 25, 1982
By-Laws Amended June 15, 1984
By-Laws Amended June 20, 1986
By-laws Amended June 17, 1988

FOREWORD

In 7 985 soil surveys were accelerated and a comprehensive study of soils on mountain landscapes in the Southern Blue Ridge of North Carolina [Major Land Resource Area 130) was initiated by Soil Survey Cooperators. During the seven-year period since these activities began, nearly 50 new soil series have been recognized and proposed. In July 1990 a Mountain Soils Tour and Seminar was held to examine some of these soils in the field and to present laboratory data for selected pedons.

The sites that will be examined on this tour include soils that represent a cross-section of soil classification and correlation concerns, challenges and opportunities in MLRA 130. Some of these concerns include:

(1) Particle-size Classification

The particle-size class of many of these soils is difficult to define because it straddles the line between fine-loamy and coarse-loamy;

(2) Mineralogy Classification

Proper mineralogy placement continues to provide challenges for several soil series in the Southern Blue Ridge. Depending upon the laboratory, laboratory methods, and the individual interpretating the data, many of these soils could be placed in any of three mineralogy classes--mixed, micaceous, or oxidic; and

(3) Presence or Absence of Andisols and Andic Subgroups

The question of Andisols and Andic subgroups in MLRA 130 has generated several spirited discussions. This classification concern has developed due to the high organic matter content resulting in extremely low bulk densities in the Umbric epipedons in some of these soils.

INTERESTING FACTS ABOUT NORTH CAROLINA

The first silver mine discovered in the United States was the Silvei Hill Mine in 1838 near Lexington. N.C.

The first gold nugget found in the United States was found a, Reed Mine in Cabarrus County. N.C. in 1799.

The University of North Carolina. which opened in 1795, is the oldest state university in the United Slates.

Bechtler Mint in Rutherford County. N.C., was the first mint in the United States to coin a gold dollar.

Albemarle Sound in North Carolina is the largest freshwater sound in the world.

Murphy. North Carolina's westermost county, is closer to six other state capitals than it is to Raleigh. North Carolina's capital.

Richard Jordan Galling. inventor of the gatling gun. was born in Hertford County in 1818.

The Tryon Daily Bulletin of Tryon, North Carolina. claims to be the world's smallest daily newspaper.

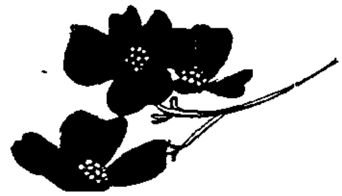
There are 43 mountain peaks in North Carolina that exceed 6,000 feet in elevation. and 62 peaks that exceed 5,000 lee,.

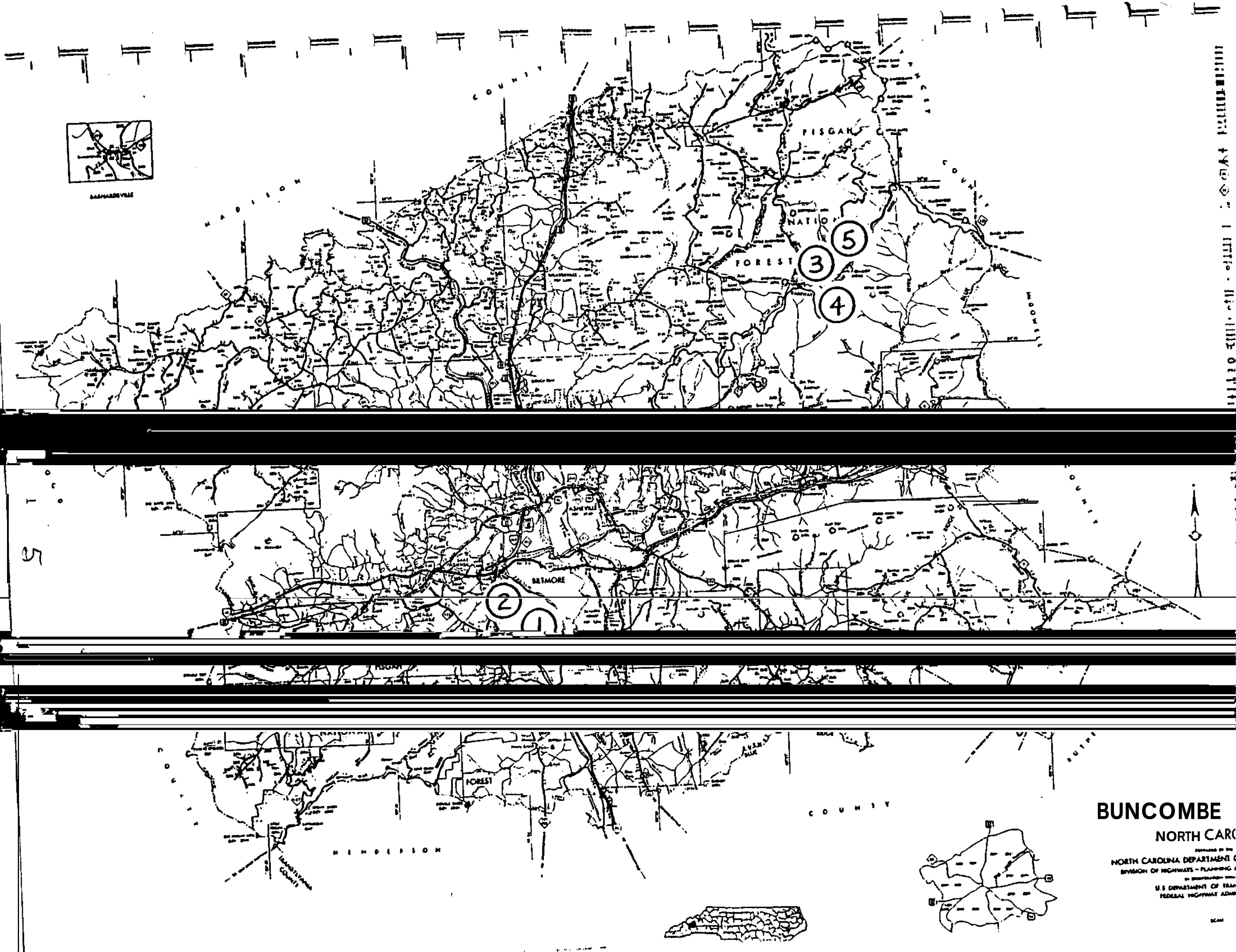
Snow has been recorded on Mount Mitchell. the highest peak in eastern America. in every month of the year.

In addition to the Blue Ridge. there are five other mountain ranges in North Carolina: Stack Mountains. Balsam Mountains. Pisgah Mountains. New Found Mountains. and the Great Smoky Mountains.

32 of North Carolina's 100 counties were organized before the Revolutionary

Capital—Raleigh (established 1792)
Name Origin—from Latin "Carolus" in honor of King Charles I
Nickname—Tar Heel State
Motto—"Esse Quam Videri" ("To Be, Rather Than To Seem")
Song—"The Old North State" by Judge William Gaston





BUNCOMBE
NORTH CAR
NORTH CAROLINA DEPARTMENT
DIVISION OF HIGHWAYS – PLANNING
U.S DEPARTMENT OF TRA
FEDERAL HIGHWAY ADM
MADISON
COUNTY
YANCEY
COUNTY
PISGAH
NATIONAL
FOREST
McDOWELL
COUNTY
ASHEVILLE
BILTMORE
PISGAH
FOREST
HENDERSON
COUNTY
TRANSYLVANIA COUNTY
BARNARDSVILLE
1
2
3
4
5

STOP 1 - HAYESVILLE SERIES

Classification: clayey, kaolinitic, mesic Typic Kanhapludults

Hayesville is the only soil with a kandic horizon that is presently being correlated in soil surveys in the North Carolina mountains (MLRA 130). It formed in residuum weathered from high grade metamorphic and igneous rocks on intermountain hills.

peds; many very fine and fine vesicular, and few medium and coarse tubular pores: many faint red (2.5YR

y
le, slig
fine

*** PRIMARY CHARACTERIZATION 0ATA ***

S91NC- 21-001 PRINT DATE 03/23/92
SAYPLEO AS : HAYESVILLE ; CLAYEY, KAOLINITIC, MESIC TYPIC KANHAPLUDULT
NATIONAL SOIL SURVEY LABORATORY ; PEDON 92P 81, SAMPLE 92P 580- 589

DEPTH (CM)	-1-- (- NH4OAC EXTRACTABLE BASES -) CA 5B5a 6N2e	-2-- MG 5B5a 602d	-3-- NA 5B5a 6P2b	-4-- K 5B5a 6Q2b	-5-- SUM BASES	-6-- ACID- ITY 6H5a	-7-- EXTR AL 6096	-8-- (- - - -CEC SUM CATS 5A3a	-9-- NH4- OAC 5A8b	-10- BASES + AL 5A3b ---)	-11- AL SAT 5G1	-12- -BASE SAT- SUN 5C3	-13- NH4 OAC 5C1	-14- CO3 AS CAC03 <2MM 6EIg	-15- RES. OHMS /CM 8E1	-16-	-17- CONO.(- MMHOS /CM 8I	-18- ---PH---) KCL IN 8C1g	-19- CACL2 .01M 8C1f 1:2	-20- H2O 8C1f 1:1
	<- - -	- - -	- - -	- - -	-MEQ	/ 100 G	- - -	- - -	- - -	- - ->	<- - -	- -PCT	- - - ->							
0- 17									5.9		3	43	47						4.9	5.5
17- 30									5.4			61	63						5.6	6.1
30-									6.3			53	63						6.7	7.6
									6.2			44	60						6.2	7.1
									4.8			26	37							
									4.7			100	28							
									6.7			10	4						5.4	
			---						5.5			10	7						5.2	
			0.1						6.3			14	6						5.4	

*** PRIMARY CHARACTERIZATION DATA ***

S91NC- 21-001 PRINT DATE **03/23/92**
SAMPLED AS : **HAYESVILLE** ; CLAYEY, **KAOLINITIC,MESIC** TYPIC KANHAPLUDULT
NATIONAL SOIL SURVEY LABORATORY ; PEOON 92P **81,** SAMPLE 92P **580-** 589

CLAY MINERALOGY (<.002mm)

SAMPLE NUMBER	FRACTION	X-RAY 7A2i peak size					THERMAL DTA 7A6 percent	THERMAL TGA 7A4b percent		ELEMENTAL 7C3 percent SiO2	Al2O3	Fe2O3	MgO	CaO	K2O	Na2O	EGME RETN 7D2 mg/g	INTERPRETATION
92p **580**	TCLV	**GI** 4	KK 3	VR 2	GE 2	HE **1**		KK33	**GI24**		**27.0**	11.2			**0.3**		9	**CMIX**
92P **581**	TCLY	GI 5	KY 3	VR 2	GE 2	HE 2					34.0	14.3			**0.3**		**18**	**CMIX**
92P **582**	TCLV	GI 4	KK 3	VR 2	GE 2	HE 2		KK32	**GI30**		34.8	14.3			0.2		22	**CMIX**
92p **583**	TCLY	**GI** 4	**KK** 3	VR 2	GE 2	HE 2		KK27	**GI29**		35.8	15.7			**0.2**		22	**CMIX**
92P 584	TCLY	**GI** 3	**KK** 2	GE 2	VR 1	**HE 1**		**KK28**	**GI29**		35.0	17.2			**0.4**		14	**CMIX**
92P 585	TCLV																11	
92p **586**	TCLY																**9**	
92P **587**	TCLV	**GI** 2	KK **1**					**KK19**	**GI21**		**24.0**	14.3			8.2		**7**	**CMIX**
92P 588	TCLY																**9**	

SAND - SILT MINERALOGY (2.0-0.002mm)

SAMPLE NUMBER	FRACTION	X-RAY 7A2i Peak Size	THERMAL DTA 7A3b Percent	THERMAL TGA 7A4b Percent	->TOT RE	OPTICAL GRAIN COUNT 7B1a Percent	INTERPRETATION
92p **587**	FS					**51 QZ50 BT36 OT** 9 **MS** 4 **OP 1 CATR**	**SMIX**

FRACTION INTERPRETATION:

TCLV Total **Clay,<0.002mm** FS **Fine** Send. **0.1-0.25mm**

MINERAL INTERPRETATION:

CI **gibbsite** KK **kaolinite** VR **vermiculite** GE goethite HE **hematite** QZ **quartz**
et **biotite** DT other **MS muscovite** **OP** opaques CA calcite

RELATIVE PEAK SIZE: 5 very **Large** 4 **Large** 3 Medium 2 Small 1 Very Small 6 No Peaks

INTERPRETATION (BY HORIZON):
CMIX= MIXED CLAYS; **SMIX=MIXED** SANDS

PEDON MINERALOGY
BASED ON SAND/SILT: MIXED
BASED ON CLAY: NIXED
FAMILY MINERALOGY: **OXIDIC**
COMMENTS:

*** SUPPLEMENTARY CHARACTERIZATION 0ATA •**

S91NC- 21-001 PRINT DATE 03/23/92
SAMPLED AS : HAYESVILLE ; CLAYEY, KAOLINITIC,MESIC TYPIC KANHAPLUDULT
NATIONAL SOIL SURVEY LABORATORY ; PEDON 92P al, SAMPLE 92P 580-589

(V O L U M E F R A C T I O N S)(C/)(R A T I O S to C L A Y)(LINEAR EXTENSIBILITY)(W R O)
----WHOLE SOIL (mm) at 1/3 BAR---(/N) ---------<2 mm FRACTION------- WHOLE SOIL --<2 mm-- WHOLE <2
<-------------PCT of WHOLE SOIL---------------> ; <-1/3 BAR to (PCT)---> ; SOIL mm <--In/In->

DEPTH (In.)	>2	250 -UP	250 -75	75 -2	15 -20	20 -5	5 -2	<2	2- .05	.05- .002	LT .002	PORES D	PORES F	RAT -10	FINE CLAY	C E C SUN CATS	C E C NH4- OAC	15 BAR H2O	1:: BAR	WHOLE SOIL 15 BAR	WHOLE SOIL OVEN -DRY	<2 mm 15 BAR	<2 mm OVEN -DRY	WHOLE SOIL	<2 mm
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	10	71	12	-DRY 73	14	15
	5			5		4																			
0- 7	TR	--	--	--	--	--	2	95	31	14	i i	16	24	12	0.38	0.34	0.31	0.43	0.047	0.4	0.8	0.4	0.9	0.12	0.12
1- 12		- -	- -		- -		TR	100	25	10	22	13	30	10	8.45	0.14	0.14	0.36	0.023	0.8	1.8	0.2	0.9	0.09	8.09
12- 11	TR	- -	- -	- -	- -	TR	TR	100	20	a	22	14	37	10	0.49	0.17	0.14	0.40	0.040	0.8	2.1	0.8	1.8	0.13	0.13
17- 28	--	--	--	--	--	--	- -	100	21	6	21	15	37	10	0.51	0.19	0.14	0.43	0.048		-..	0.8	2.1	0.13	0.13
28- 35	TR	--	--	--	- -	5	TR	100	35	a	18	15	25		0.58	0.30	0.21	8.57	0.017	0.2	0.4	0.2	0.4	0.14	0.14
35- 45	6	--	--	6	--	TR	1	94	36	9	2	20	18		8.56	0.08	0.30	0.68						0.10	0.11
45- 73	1	--	- -	,	- -		1	99	50	9					8.64	8.74	1.72	1.23						0.11	0.11
73- 80	10	--	--	10	--	11	7	a2	46	a	4	15	10		8.56	8.66	0.86	0.84						8.02	0.02
80-100	14	--	- -	14	10	2	2	86	33	9	3	22	19		0.54	0.42	0.94	1.07						0.11	0.12

(W E I G H T F R A C T I O N S - C L A Y F R E E)(-TEXTURE--)(--P S D A(mm)---)(PH)(-ELECTRICAL)(CUMULT. AMOUNTS)
(--WHOLE SOIL--) (--<2 mm FRACTION ----)(DETERMINED)(SAND SILT CLAY) ; SALT ; Inch of H2O
PCT of >2mm+SAND+SILT > <------PCT of SAND+SILT-------><---<2 mm--><---PCT of 2mm---><--------- <2 mm -------><WholeSoil>

DEPTH (In.)	>2	15 -2	20 -2	2- .05	.05- .002	LT .002	------"A~""-;----- VC	C			VF	SILTS C	SILTS F	CL AY	IN FIELD	BY PSDA	SAND 2- .05	SILT .05- .002	CLAY LT .002	CA- CL2 .01M	RES- IST. OHMS	CON- DUCT. MMHOS	MG/ KC	1/3 BAR to 15BR	AIRDRY
	76	77	78	79	a0	81	a2	a3	a4	a5	a6	a7	88	a9	90	91	92	93	94	95	96	97	98	99	100
0- 7	11	11	11	61	28	21	1	2	11		20	11	20	24	FSL	VFSL	55.7	25.1	19.2	4.9					
7- 12				71	29	64	1	2	13		17	a	21	64	CL	CL	43.1	11.9	39.0	5.6					
ii- ii				72	28	80	2	2	12		18	10	18	80	C	c	39.8	15.7	44,5	6.7					
ii- 28				76	24	77		4	15		17	10	14	77	C	C	43.1	13.5	43.4	6.2					
28- 35				a2	18	30	T1	1	16	--	22	9	9	30	CL	SCL	62.8	13.9	23.3	5.6					
35- 45	12	12	12	71	18	16	2	25	17 13	44	21	11	9	19	SL	FSL	67.4	16.9	15.1	5.6					
45- 73	1	1	1	84	15	4				40	21	8	8	4	SL	LFS	81.2	14.9	3.9	5.4					
73- 80	25	25	25	64	11	5	5	10	18	34	19	7	7	7	SL	LS	80.3	13.3	6.4	5.2					
ao-100	24	24	6	59	i i	5	6	10	15	26	20	11	11	7		FSL	72.5	20.8	6.7	5.4					
45- 13																									

peds and in pores; many insect and worm krotovina; few tine plate like mica flakes; slightly acid (pH 6.5); clear wavy boundary.

C1--71 to 132 cm, 92P0594; red (2.5YR 4/6) loam; common coarse distinct red (2.5YR 5/8), dark reddish brown (2.5YR 3/4), and yellow (10YR 7/8) mottles; massive; non sticky, non plastic; few very fine and fine roots in cracks; few medium discontinuous tubular pores; few fine plate like mica flakes, and few very coarse plate like iron-manganese concretions; moderately acid (pH 6.0); gradual wavy boundary.

C2--132 to 209 cm, 92P0595; tine sandy loam; many coarse faint dark yellowish brown (10YR 4/6) mottles: massive; non sticky, non plastic; few very tine discontinuous tubular pores; multicolored saprolite; few fine plate like mica flakes, and many very coarse plate like iron-manganese concretions; strongly acid (pH 5.5); gradual wavy boundary.

CT-209 to 250 cm, 92P0596 pale red (10R 6/3) loam; many coarse prominent very dark gray (2.5YR 3/0), yellowish red (.YR 5/6), and brownish yellow (1 0YR 6/8) mottles; massive; non sticky, non plastic: few fine plate like mica flakes, and many very coarse plate like iron-manganese concretions.

*** PRIMARY CHARACTERIZATION DATA ***

S91NC- 21-002 PRINT DATE 03/23/92
SAMPLED AS : HAYESVILLE ; CLAYEY,KAOLINITIC,MESIC TYPIC KANHAPLUDULT
NATIONAL SOIL SURVEY LABORATORY ; PEDON 92P 82, SAMPLE 92P 590- 596

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-	EXTR													
	CA	MG	NA	K	SUM	ITY	AL	CATS	OAC	+ AL										
																81				
			TR																	
			0.1																	
			TR																	

15

19

*** PRIMARY CHARACTERIZATION DATA ***

S91NC- 21-002 PRINT DATE 03/23/92
SAMPLED AS : HAYESVILLE ; CLAYEY, KAOLINITIC, MESIC TYPIC KANHAPLUDULT
NATIONAL SOIL SURVEY LABORATORY ; PEOON 92P 82, SAMPLE 92P 590- 596

SAMPLE NUMBER	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	CLAY MINERALOGY (<.002mm)																			
	FRACTION	X-RAY 7A21 peak size					THERMAL DTA 7A6 Percent		THERMAL TGA 7A4B Percent		ELEMENTAL SIO2 7C3 Percent	AL2O3	Fe2O3	MgO	ICaO	Na2O			EGME RETN 7D2 mg/g	INTERPRETATION
92P 598	TCLV	KK 5	GI 2	VR 2	GE 2				KK53	GI 7		24.e	10.9			0.6			9	KAOL
92P 591	TCLV	KK 5	GI 3	GE 2	VR 2	HE 1			KK46	GI 4		29.8	13.4			0.5			17	KAOL
92P 593	TCLV	KK 5	GI 3	GE 2	VR 2	HE 2			KK53	GI 6		30.0	14.3			0.5			20	KAOL
92P 594	TCLV	KK 5	GI 2	GE 2	VR 2	HE 2			KK56	GI 6		29.8	15.7			0.7			18	KAOL
	TCLV																		9	
92P 595	TCLY	KK 3	GE 2	GI 1	VR 1				KK47	GI 4		16.8	13.7			0.6			5	CMIX
92P 596	TCLY																		3	

FRACTION INTERPRETATION:

TCLV Total Clay. <0.002mm

17

MINERAL INTERPRETATION:

KK kaolinite GI gibbsite VR vermiculite GE goethite HE hematite

RELATIVE PEAK SIZE: 5 very Large 4 Large 3 Medium 2 small 1 Very Small 6 No Peaks

INTERPRETATION (BY HORIZON):
KAOL = KAOLINITIC; CMIX = MIXED CLAYS

PEDON MINERALOGY
BASED ON SAND/SILT:
BASED ON CLAY: KAOLINITIC
FAMILY YINERALDGV: KAOLINITIC
COMMENTS:

*** SUPPLEMENTARY CHARACTERIZATION DATA ***

S91NC- 21-002 PRINT DATE 03/23/92
SAMPLED AS : HAYESVILLE ; CLAYEY, KAOLINITIC,MESIC TYPIC KANHAPLUDULT
NATIONAL SOIL SURVEY LABORATORY ; PEDON 92P 82, SAMPLE 92P 590- 596

(V O L U M E F R A C T I O N S)(C/)(R A T I O S to C L A Y)(LINEAR EXTENSIBILITY)(WR D)
----W H O L E S O I L (mm) at 1/3 B A R---(/N) --------<2 mm FRACTION------- W H O L E S O I L --<2 ml-- WHOLE <2
>2 250 250 75 75 20 5 2-.05- L T PORES RAT FINE ---C E- C--15 LE <-1/3 BAR to (PCT)---> SOIL mm
-UP -75 -2 -20 -5 -2 <2 .05 .002 .002 D F -10 CLAY SUM NH4- BAR 1/3 15 OVEN 15 OVEN
<---------------PCT of WHOLE SOIL----------------> CATS OAC H2O BAR BAR -DRY BAR -DRY <--In/In->

DEPTH (In.)	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
				2	1																	0.4			
0- 5	2	--	--	--	--	1	1	98	37	15	14	5	27	12	8.39	0.28	0.28	0.48	0.053	0.4	1.9	0.4	1.1	0.10	0.10
5- 9	TR	--	--			TR	--	100	24	12	24	5	35	8	0.45	0.16	0.14	0.45	0.048	0.4	2.2	...	1.9	0.06	0.06
9- 18	--	--	--	--	--	--	--	loe	19	11	26			10	0.48	0.19	0.16	0.46	0.048		...	0.4	2.2	0.06	0.06
18- 28	--	--	--	--	--	--	--	100	21	13	20	6	37	8	0.50	0.15	0.14	0.52	0.057	0.7	1.1	0.7	2.1	0.15	0.15
28- 52	--	--	--	--	--	--	--	100	33	14	7	13	48		0.53	0.33	0.18	0.76	0.081	0.7	0.5	0.2	1.1	0.21	0.21
52- 82	TR	--	--	--	--	TR	--	100	36	11	3	22	27		0.48	8.31	8.26	1.07	0.093	0.2		0.2	0.5	0.19	0.19
82- 98	--	--	--	--	--	--	--	100	43	11	1	19	26		8.71	2.35	0.82	2.82	0.118	0.2	0.2		0.2	0.19	0.19

(W E I G H T F R A C T I O N S - C L A Y F R E E)(-TEXTURE--)(--P S D A(mm)---)(PH)(-ELECTRICAL)
(--W H O L E S O I L--) (--<2 m m F R A C T I O N ----)(DETERMINED)(SAND SILT CLAY) CA- RES- CON-
>2 75 20 2- .05- LT ------SANDS------- SILTS CL IN BY 2- .05- LT CL2 IST. DUCT.
-2 -2 .05 .002.002 VC C M F VF C F AY FIELD PSDA .05 .002 .002 .01M OHMS MMHOS
PCT of >2mm+SAND+SILT > <------PCT of SAND+SILT-------><---<2 mm--><---PCT Of 2mm---><-------- <2 mm

DEPTH (In.)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94
0- 5	4	4	3	69	28	25	1					9	20	26	FSL				
5- 9				66	34	66	TR	2	11	41	17	[illegible]	[illegible]	[illegible]		SCL CL	56.6 40.1	22.7 28.3	20.7 39.6
9- 18				63	37	86	TR	8	29	24	12		26	86	C	C	33.8	20.1	46.1
18- 28				61	39	59		1								CL	...		
28- 52				70	30	16		17828 30 25 32 14 16 26 14 59 16							CL	VFSL	3860.72	25.8 24.8	37.0 13.5
52- 82				76	24	6	TR	1	11	33	31	12	12	6	FSL	FSL	71.0	22.8	5.4
82- 98				80	20	2	TR	3	9	30	38	11	9	2	L	LFS	79.1	19.2	1.7

The C horizon is saprolite that is sandy clay loam, loam, sandy loam. or fine sandy loam. It is variable in color.

COMPETING SERIES: This is the only other known series in this family. Bradson, Brevard, Graddock. Clifton. Evard. Fannin. and Nantahala (tentative) soils are in closely related families. Bradson and Braddock soils have water worn coarse fragments. In addition, the Braddock soils have mixed mineralogy. Brevard, Evard. and Fannin soils have less than 35 percent clay in the control section. Nantahala (tentative) and Clifton soils have mixed mineralogy.

GEOGRAPHIC SETTING: The Hayesville soils are on gently sloping to very steep ridges and side slopes in the intermountain plateaus and valleys of the southern Appalachian Mountains. Slopes range from 2 to 60 percent. Elevation ranges from 1400 to 4000 feet. The soils formed in residuum from igneous and high grade metamorphic rocks such as granite. granodiorite. mica gneiss and schist with some colluvial influence on steep or very steep slopes. Mean annual temperature is 55 degrees F.. and average annual precipitation is about 56 inches near the type location.

GEOGRAPHICALLY ASSOCIATED SOILS: In addition to the competing Braddock, Clifton. Evard. and Fannin soils these include the Brevard, Cullasaja. Saunook. Tate, Tuckasegee. and Tusquitee soils. All except Braddock and Clifton soils have less than 35 percent clay in the control section. Braddock soils are on high terraces. Clifton. Evard, and Fannin soils are on ridges and rids slopes. Brevard, Cullasaja. Saunook. Tate, Tuckasegee. and Tusquitee soils are on colluvial fans and toe slopes.

DRAINAGE ANO PERMEABILITY: Well drained; medium to rapid runoff; medium internal drainage; moderate permeability.

USE ANO VEGETATION: About one-half of the acres of this soil is in cultivation. Common trees in wooded areas are yellow- poplar, eastern white pine. northern red oak, pitch pine. shortleaf pine and Virginia pine. The understory includes flowering dogwood, rhododendron. mountain laurel and sourwood. Cleared areas are used for cultivated crops such as corn. small grain. pasture. hayland, burley tobacco, vegetable crops and Christmas trees.

DISTRIBUTION ANO EXTENT: Mountain areas of North Carolina. Virginia. South Carolina. Georgia. and perhaps Tennessee. The series is of large extent.

SERIES ESTABLISHED: Clay County. North Carolina: 1935.

REMARKS: The classification of the Hayesville series was changed in April, 1989 to clayey, kaolinitic. mesic Typic Kanhapludults. This is change is based on lab data from South Carolina, North Carolina. and Virginia that indicates presence of a kandic horizon.

Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon: The zone from 0 to 5 inches (AI and A2 horizons). Kandic horizon: The zone from 5 to 48 inches (BA, Bt, and BC horizons).

Argillic horizon: The zone from 5 to 48 inches (GA. Bt, and BC horizons).

AODITIONAL DATA: A Southern Cooperative Series Bulletin No. 157. April 1971, "Soils of the Hayesville. Cecil, and Pacolet series in the Southern Appalachian and Piedmont Regions of the United States."

MLRA: 130 SIR'S: NC0013. NC0151 (STONY)

National Cooperative Soil Survey
U.S.A.

Soil Series: Biltmore
Soil Survey No.: S91-NC-021-003 (SSL Pedon No.: 92130083)
Classification: mixed, mesic Typic Udipsamment

Location: Buncombe County, NC; about 5 km S of Asheville on Biltmore Estate; about 80 m SSW of French Broad River.
Latitude: 35-32-39-N Longitude: 082-34-23-W
MLRA: 130

Physiography: River Valley in Blue Ridge Mountains
Geomorphic Position: Flood Plain
Slope Characteristics: 1% plane
Elevation: 652 m MSL
Parent Material: alluvium from metamorphic material

Precipitation: 124 cm udic moisture regime
Water Table Depth: 154 cm apparent
Hydraulic Conductivity: very high
Dramage Class: well drained
Land Use: cropland
Stoniness: 0
Erosion: none
Particle Size Control Section: 25 to 100 cm
Runoff: slow
Vegetation Code(s): CROPS, TOMATO
Diagnostic Horizons: 0 to 43 cm ochric
Described By: Milton Martinez, John Allison, Mark Hudson
Date: 10/91
Notes

Apl--0 to 18 cm, 92P0597; dark yellowish brown (10YR 4/4) loamy sand; weak fine granular structure; loose, non sticky, non plastic; many very fine and fine roots throughout; many very fine discontinuous tubular pores; common very fine and fine plate like mica flakes; slightly acid (pH 6.5); clear smooth boundary.

Ap2--18 to 43 cm, 92P0598; yellowish brown (10YR 5/4) loamy sand; single gram; loose, non sticky, non plastic; common very fine and fine roots throughout; few very fine discontinuous tubular pores; common very fine and fine plate like mica flakes; slightly acid (pH 6.5); clear wavy boundary.

Cl-43 to 71 cm, 92P0599; brownish yellow (10YR 6/6) sand; single grain; loose, non sticky, non plastic; few very fine and fine roots throughout; few very fine disconrmuous tubular pores; common very fine and fine plate like mica flakes; slightly acid (pH 6.5); clear wavy boundary.

C2--71 to 89 cm, 92P0600; brownish yellow (10YR 6/8) sand; single grain;loose, non sticky, non plastic; few very fine roots throughout; few very fine discontinuous tubular pores; few very fine and fine plate like mica flakes; moderately acid (pH 6.0); clear wavy boundary.

C3--89 to 107 cm, 92P0601; light yellowish brown (10YR 6/4) sand; single grain; loose, non sticky, non plastic; few very fine roots throughout; few very fine discontinuous tubular pores: few very fine and fme plate like mica flakes; slightly acid (pH 6.5); gradual wavy boundary.

S91NC- 21-003

*** PRIMARY CHARACTERIZATION OATA ***
(BUNCONBE COUNTY, NORTH CAROLINA)

PRINT DATE 03/23/92

SAYPLEO AS : BILTMORE ; MIXED, MESIC TYPIC UDIPSAMMENT
REVISED TO :

NSSL - PROJECT 92P 13, NCMTN-BUNCOMBE CO.
- PEOON 92P 83, SAMPLES 92P 597-609
- GENERAL METHODS 1B1A, 2A1, 2B

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

SANPLE NO.	DEPTH (CM)	HORIZON	-1-- CLAY LT .002	-2-- SILT .002 -.05	-3-- SAND .05 - 2	-4-- FINE LT .0002	-5-- CO3 LT .002	-6-- FINE .002 -.02	-7-- COARSE .02 -.05	-8-- VF .05 -.10	-9-- F .10 -.25	-10- M .25 -.50	-11- C .5 -1	-12- VC 1 -2	-13- 2 -5	-14- 5 -20	-15- 20 -75	-16- .1-75	-17- WT PCT OF WHOLE SOIL
			(---TOTAL---)			(--CLAY--)		(--SILT--)		(------SAND------)					(-COARSE FRACTIONS(MM)-) WEIGHT				(>2MM)
			<- PCT OF <2MM (3A1) ->												<- PCT OF <75MM(3B1)->				SOIL
		Ap1	4.2	13.0	82.8								3.6						
		Ap2	3.3	6.7	88.0								9.2						
		C1	0.5	2.4	97.1														
		C2	1.0	3.6	95.4			2.5	1.1	11.6	40.1	39.5	4.1	0.1	--		--	82	--
		C3	1.0	4.3	94.7			2.8	2.3	12.6	48.0	30.0	4.0	0.1	—	TR	--	80	--
		C4	...																
		C5	0.9 e.8	2.1 5.4	93.7 96.5			2.3 1.6	3.1 1.1	13.2 7.4	42.8 38.4	34.8 45.9	3 6	0.10.1	--_	_-	_-	8 9	_-
		C6											...4.7					75	--
		C6	2.3 0.4	6.1 2.0	91.6 96.6			2.4 1.2	3.7 1.6	16.4 4.1	34.2 16.8	34.5 65.4	10.46.3	0.20.1_--		....	-..	93	--
		C6		6.1	91.9			2.1											
		C6	2.8 8.6	2.0	97.4			0.6	4.0	12.7 3 8									
		C7		...				...	1.4										
		C6		17.2 5.2				7.8 1.7	9.4 3.5										

PI
4F

0.2	0.9
0.3	0.9
0.9	
0.8	
0.3	
9.6	2.2
0.5	0.6
3.1	1.7
0.1	0.8
17.8	3.9
	0.8

S91NC- 21-003 • PRIMARY CHARACTERIZATION DATA •
(BUNCOMBE COUNTY, NORTH CAROLINA)

PRINT DATE 03/23/92

SAMPLED AS : BILTMORE ; MIXED, MESIC TYPIC UDIPSAMMENT

NSSL - PROJECT 92P 13, NCMTN-BUNCOMBE CO.
- PEDON 92P 83, SAMPLES 92P 597- 609
- GENERAL METHODS 1B1A, 2A1, 2B

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

SAMPLE NO.	HZ NO	-1-- DEN 8J	-2-- ACID OXALATE EXTRACTION OPT 6C9a	-3-- FE 6V2	-4-- SI 6612	-5-- AL RET 6S4	-6-- PHOSPHOUS CIT- ACID 6S5	-7-- KCL MN 6D3	-8-- TOTAL C 6A2d	-9-- (--WATER CONTENT- 0.06 BAR 4B1c	-10- 1- BAR 4B1a	-11- 2- BAR 4B1a	-12- -) 15 BAR 4B2b	-13- (---- WATER DISPERSIBLE <- -PIPETTE CLAY <- - - 3A1c	-14- SILT	-15- ->< SAND	-16- - HYDROMETER CLAY	-17- SILT SHL	-18- ----) -> SAND	-19- MIN SOIL CONT 8F1	-20- AGGRT STABL <5mm 4G1
			<- PCT of < 2 mm			-><- PPM		-><-				PERCENT of < 2 mm									->< PCT>
92P 597	1											6.5									
92P 598	2							8.3				4.3									
92P 600	4							8.1				1.3									
92P 601	5											2.6 1.6									
92P 603	7											2.4									
92P 604	8											3.5 1.8									
92P 605	9											1.4									
92P 606	10											2.9									
92P 607	11											1.1									
608	12											6.1									
92P 92P 609	13											2.8									

-1-- -2-- -3-- -4-- -5-- -6-- -7-- -8-- -9-- -10- -11- -12- -13- -14- -15- -16- -17- -18- -19- -20-

27

S91NC- 21-003

*** SUPPLEMENTARY CHARACTERIZATION DATA ***
(BUNCOMBE COUNTY, NORTH CAROLINA)

PRINT DATE 03/23/92

SAMPLED AS : BILTMORE ; NIXED, MESIC TYPIC UDIPSAMMENT
REVISED TO : ;

NSSL - PROJECT 92P 13,
- PEOON 92P 83, SAWPLES 92P 597- 609
- GENERAL METHODS (ENGINEERING FRACTIONS ARE CALCULATED FROM USDA FRACTION SIZES)

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

SAMPLE No.	DEPTH (In.)	HORIZON	ENGINEERING PERCENTAGE PASSING <-----INCHES-----> 3 (1)	2 (2)	3/2 (3)	1 (4)	3/4 (5)	3/a (6)	'-NUMBER-> 4 (7)	10 (8)	40 (9)	200 (10)	PSDA SIEVE <-MICRONS-> 20 (11)	5 (12)	2 (13)	USDA <--- MILLIMETER ---> ..1 (14)	.5 (15)	.25 (16)	.10 (17)	.05 (18)	CUMULATIVE CURVE FRACTIONS(<75mm) LESS THAN DIAMETERS(mm) AT <--PERCENTILE--> 60 (19)	50 (20)	10 (21)	ATTERBERG <-PCT> LL (22)	PI (23)	GRADATION UNIFMTY CU (24)	CURVTUR CC (25)
92P 597s	0- 7	AD1	100	100	100	100	100	100	100	100	89	25	8		4	99	96	70	33	17	0.20	0.153	0.012			15.8	3.1
92P 598S	7- 17	Ap2	100	100	100	100	100	100	100	100	81	19	12	5	3	98	89	58	25	12	8.26	0.199	0.032			8.2	1.6
92P 599S	17- 28	CI	100	100	100	100	100	100	100	100	70	6		1	1	99	84	27	B	3	0.37	0.329	8.112			3.3	1.6
92P 600S	28- 35	C2	100	100	100	100	100	100	100	100	86	11	3	2	1	100	96	56	16	5	0.27	0.216	0.069			3.9	1.0
92P 601S	35- 42	C3	100	100	100	100	100	100	lee	100	88	12	3	22	1	100	96	66	18	5	0.22	0.185	0.065			3.5	1.1
92P 602S	42- 56	c4	100	100	100	100	100	100	100	100	88	14	2	1	1	100	96	62	20	6	0.24	0.195	0.061			4.0	1.1
92P 603S	56- 61	C5	100	100	100	100	100	100	100	100	84	a	5	3	21	100	95	49	11	3	0.29	0.253	0.092			3.2	0.9
92P 604S	61- 66	C6	100	100	100	100	100	100	100	100	85	17				100	93	59	25	s	0.26	0.196	0.054			4.8	1.0
92P 605S	66- 12	C6	100	100	100	100	100	100	100	100	73	6	2	1	TR	100	89	24	7	3	0.37	0.329	0.116			3.2	1.7
92P 606S	72- 74	C6	100	100	100	100	100	we	100	100	80	15	4	3	2	100	91	49	21	a	0.30	0.256	0.055			5.4	1.1
92P 607S	74- a1	C6	100	100	100	100	100	100	100	100	63	5	1	1	1	lee	78	19	6	3	0.40	0.359	8.129			3.1	1.5
92P 608S	el- 99	C7	100	100	100	100	100	100	100	100	95	34	9	4	1	100	98	84	46	18	0.14	0.110	0.022			6.3	1.5
92P 609S	61- 81	C6	FRACTIONS NOT DETERIMINE0																								

DEPTH (In.)	(WEIGHT FRACTIONS) <------PCT of WHOLE SOIL-----> >2- (26)	250 -UP (27)	250 -75 (28)	E75 -2 (29)	SOIL (mm) 75 -20 (36)	20 -5 (31)	5 -2 (32)	<2 (33)	-<75 mm FRACTION-- <--PCT OF <75 mm-> 75 -2 (34)	75 -20 (35)	20 -5 (36)	5 -2 (37)	<2 (38)	(39)
0- 7	TR	—	—	—	--	--				--	--			
7- 17	TR	--	--	--	--	--				--	--			
17- 28	TR	--	--	--	--	--				--	--			
28- 35	- -	- -	- -	- -	--	--				--	--			
35- 42	--	--	--	--	--	--				--	--			
42- 56	--	--	--	--	--	--				--	--			
56- 61	--	--	--		--	--				--	--			
61- 66	--	--	--	--	--	--				--	--			
66- 72		--	--	--	--	--				--	--			
72- 74	II	--	--	--	--	--				--	--			
74- 81		—	—	—	--	--				--	--			
81- 99					--	--				--	--			
					--	--				--	--			

(WEIGHT PER UNIT VOLUME O/CC) ------WHOLE SOIL------ SOIL SURVEY 1/3 BAR (40)	OVEN -DRY (41)	ENGINEERING MOIST (42)	SATURATED (43)	-------<2 mm FRACTION------- --SOIL SURVEY-- 1/3 BAR (44)	15 BAR (45)	OVEN -DRY (46)	ENGINEERING MOIST (47)	SATURATED (48)	(VOID) --RATIOS-- AT 1/3 SAR WHOLE SOIL (49)	<2 mm (50)

Soil Series: Biltmore
Soil Survey No.: S91NC-021-004 (SSL No.: 92P0084)
Classification: mixed, mesic Typic Udipsamment

Location: Buncombe County, NC; about 5 km S of Asheville on Biltmore Estate; about 80 m ENE of French Broad River
Latitude: 35-31-49-N Longitude: 082-33-31-W
MLRA: 130

Physiography: River Valley in Blue Ridge Mountains
Geomorphic Position: Flood Plain
Slope Characteristics: 1% plane
Elevation: 652 m MSL
Parent Material: alluvium from metamorphic material

Precipitation: 124 cm udic moisture regime
Water Table Depth: 175 cm apparent
Hydraulic Conductivity: very high
Drainage Class: well drained
Runoff: slow
Land Use: cropland
Stoniness: 0
Erosion: none
Particle Size Control Section: 25 to 100 cm
Vegetation Code(s): CROPS, CORN
Diagnostic Horizons: 0 to 20 cm ochric
Described By: Milton Martinez, Chip Smith, Mark Hudson
Date: 10/91

Ap--0 to 20 cm, 92P0610; dark yellowish brown (10YR 4/4) loamy sand; few medium distinct brownish yellow (10YR 6/6) mottles; weak fine granularstructure; very friable, non sticky, non plastic; many very fine and fine roots throughout, and *many* medium *roots* throughout; few fine interstitial pores; common very fine and fine plate like mica flakes; neutral (pH 7.0); abrupt smooth boundary.

Cl-20 to 40 cm, 92P0611; brownish yellow (10YR 6/6) sand; few medium distinct very pale brown (10YR 7/3) mottles; single gram; loose, non sticky, non plastic; few fine interstitial and tubular pores; charcoal stains; few very fine and fine plate like mica Bakes; slightly acid (pH 6.5); clear smooth boundary.

C2--40 to 58 cm, 92P0612; yellowish brown (10YR 5/6) sand: few medium distinct yellowish brown (10YR 5/6) mottles; single grain; loose, non sticky, non plastic; few fine interstitial and tubular pores: charcoal stains; few very fine and fine plate like mica flakes; slightly acid (pH 6.5); clear smooth boundary.

C3--58 to 65 cm, 92P0613; light yellowish brown (10YR 6/4) sand; single grain; loose, non sticky, non plastic; few fine interstitial and tubular pores; few very tine and fine plate like mica flakes; moderately acid (pH 6.0); abrupt smooth boundary.

C4--65 to 105 cm, 92P0614; yellowish brown (10YR 5/6), dark yellowish brown (10YR 4/4), and light yellowish brown (10YR 6/4) sand; few fine faint brown (10YR 5/3) mottles: single grain; loose, non sticky, non plastic; few very

*** PRIMARY CHARACTERIZATION OATA ***

S91NC- 21-004 (BUNCOMBE COUNTY, NORTH CAROLINA)

PRINT DATE 03/23/92

SAMPLED AS : BILTMORE ; MIXED, MESIC TYPIC UDIPSAMMENT
REVISED TO : ;

NSSL - PROJECT 92P13, NCWTN-BUNCORBE CO.
- PEOON 92P 84, SAMPLES 92P 610- 617
- GENERAL *METHODS* 1B1A,2A1,2B

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

SAMPLE NO.	DEPTH (CM)	HORIZON	-1-- TOTAL CLAY LT .002	-2-- TOTAL SILT .002 -.05	-3-- TOTAL SAND .05 -2	-4-- CLAY FINE LT .0002	-5-- CLAY CO3 LT .002	-6-- SILT FINE .002 -.02	-7- SILT COARSE .02 -.05	-8-- SAND VF .05 -.10	-9-- SAND F .10 -.25	-10- SAND M .25 -.50	-11- SAND C .5 -1	-12- SAND VC 1 -2	-13- COARSE FRACTIONS (MM) WEIGHT 2 -5	-14- WEIGHT 5 -20	-15- WEIGHT 20 -75	-16- .1- 75	-17- (>2MM) WT PCT OF WHOLE SOIL
			<- - - PCT OF <2MM (3A1) - - ->												<- PCT OF <75MM(3B1)->				
92P 610S	B- 20	Ap	--	8.9	91'.1			4.0					1.9	TR		TR	--	77	TR
92P 611S	20- 40	Cl	--	6.1	93.9			2.5	4.9	14.3 14.2	46.4 48.2	28.5 29.8	1.7	TR	....	--	--	80	--
92P 612S	40-58	C2	--	4.3	95.7			1:s	3.6	9.9	99.9	42.8	2.9	8.1	- -	--	--	86	--
92P 613S	58- 65	C3	--	5.5	94.5			1.7	3.8	11.6	47.5	32.4	2.6	0.1	- -	--	--	83	--
92P 614S	65-105	C4	--	5.1	94.9			1.9	3.2	10.0	51.1	30.4		TR	- -	--	--	84	—
92P 6155	105-120	C5	0.4	5.2	94.4			2.3	2.9	15.7	52.8	24.4	2.3	TR	- -	--	--	79	--
92P 616S	128-135	C6	1.1	7.5	91.4			2.7	4.8	16.4	49.6	23.3	2.1	TR	- -	--	--	75	—
92P 617S	135-175	C7	2.1	5.9	92.8			1.0	4.1	15.4	52.9	22.2	1.4	0.1	- -	--	--	77	--

DEPTH (CR)	ORGN C 6AIc PCT	TOTAL N 6B3a <2MM	EXTR P 6S3 PPM	TOTAL S 6R3a	DITH-CIT EXTRACTABLE FE 6C2b	AL 6G7a	MN 6D2a	(RATIO/CLAY) CEC 8D1	15 BAR 8D1	(ATTERBERG) LIMITS LL 4F1 PCT	PI 4F <0.4MM	BULK DENSITY FIELD MOIST 4A3a	1/3 BAR 4A1d	OVEN DRY 4AIh	COLE WHOLE SOIL 4D1 CM/CM	WATER CONTENT FIELD MOIST 4B4	1/10 BAR 4B1c	1/3 BAR 4B1c	15 BAR 4B2a	WRD WHOLE SOIL 4C1 CM/CM
				<- PERCENT OF <2MM -->								<-- G/CC --->				<-- PCT OF <2MM -->				
G- 20	0.41	8.826											1.63	1.63	0.073	8.4	16.9	7.6	1.8	8.09
20- 40	0.14	0.010										1.32				0.3			1.3	
40- 58	8.12	0.008										1.14				0.3			1.2	
58- 65	8.14	8.141																	1.3	
65-105	0.19											1.27				1.0			1.4	
105-120	0.22											1.15				8.4			1.8	
120-135	0.20							1.02	1.64			1.34				19.2			1.8	
135- 175	8.16							1.14	8.98			1.30				16.0			1.9	

AVERAGES, DEPTH 25-100: PCT CLAY 0 PCT .1-75MM 84

*** PRIMARY CHARACTERIZATION 0ATA ***

S91NC- 21-004 PRINT DATE 03/23/92
SAMPLED AS : BILTMORE ; MIXED,MESIC TYPIC UDIPSAMMENT
NATIONAL SOIL SURVEY LABORATORY ; PEDON 92P 84, SAMPLE 92P 610- 617

-1-- -2-- -3-- -4-- -5-- -6-- -7-- -8-- -9-- -10- -11- -12- -13- -14- -15- -16- -17- -18- -19- -20-

SAMPLE NUMBER	FRACTION	SAND - SILT MINERALOGY (2.0-0.002mm): OPTICAL GRAIN COUNT 7B1a Percent	INTERPRETATION
92P 610	FS	66 QZ65 FK16 BT 7 MS 6 PR 2 OT 2	SMIX
92P 610	FS	OP 1 RN 1 GNtr ZRtr CAtr TMtr	
92P 611	FS	62 QZ61 FK21 MS 7 Bt 7 PR 2 OT 1	SMIX
92P 611	FS	OP 1 ZRtr CAtr HNtr	
92P 612	FS	57 QZ55 FK20 Bt12 MS 6 PR 3 OT 2	SMIX
92P 612	FS	ZR 1 OP 1 HNtr CAtr GNtr CLtr	
92P 612	FS	TNTR	
92P 614	FS	64 QZ61 FK19 MS 8 BT 6 OP 2 PR 2	SMIX
92P 614	FS	OT 1 HN 1 ZR 1 TMTR CATR CNTR	
92P 617	FS	56 QZ56 FK19 BT13 MS 9 PR 1 HN 1	SMIX
92P 617	FS	OT 1 ZRtr OPtr TMtr CAtr GNtr	

(Column headings also include: X-RAY 7A2i Peak Size; THERMAL: DTA 7A3b Percent, TGA 7A4b Percent; TOT RE.)

35

FRACTION INTERPRETATION:

FS **Fine Sand, 0.1-0.25mm**

MINERAL INTERPRETATION:

QZ	quartz	FK	potas-feld	Bt	biotite	MS	● uscovlt.3	PA	pyroxene	OT	other
OP	opaques	NH	hornblende	GN	garnet	ZR	zircon	CA	calcite	TM	tourmaline
CL	chlorite										

RELATIVE PEAK SIZE: 5 very Large 4 Large 3 Medium 2 Small 1 Very Small 6 No Peaks

INTERPRETATION (BY HORIZON):
SMIX= MIXED SANDS

PEDON MINERALOGY
BASED ON SAND/SILT: MIXED
BASED ON CLAY:
FAMILY MINERALOGY: MIXED
COMMENTS:

*** SUPPLEMENTARY CHARACTERIZATION DATA ***

S91NC- 21-004 PRINT DATE 03/23/92
SAMPLED AS : BILTMORE ; MIXED, MESIC TYPIC UDIPSAMMENT
NATIONAL SOIL SURVEY LABORATORY ; PEDON 92P84, SAUPLE 92P610- 617

(V O L U M E F R A C T I O N S)(C/)(R A T I O S to C L A Y)(LINEAR EXTENSIBILITY)(WR O)
----WHOL'E s O I 5 (mm) 2- t.05-BLT R---(/N) --------<2 mm FRACTI 15 -- LE-- WHOLE SOIL --<2 mm-- WHOLE <2
DEPTH >2 250 250 75 75 20 -2 .05 .002 .002 PORES RAT FINE ---C E C-- BAR 1/3 <-1/3 BAR to (PCT)---> SOIL mm
(In.) -UP -75 -2 -20 -5 <2 D F -10 CLAY SUN NH4- 15 OVEN 15 OVEN
<---------------PCT of WHOLE SOIL----------------> CATS OAC 1120 BAR BAR -DRY BAR -DRY <--In/In->

DEPTH (In.)	51	52	53	54	55	56	57	58	59	60 5	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
0- 8	TR	--	--	--	--	TR	--	100	56	3		45	13	16										0.09	0.09
8- 16	--	--	--	--	--	--	--	100	51			45		14											
16- 23	--	--	--	--	--	--	--	100	52	2		45		15											
23- 26	--	--	--	--	--	--	--	100	52	3		45		1											
26- 41	--	--	--							3															
41- 47	--	--	--	--	--	--	--	100	52	4		45				6.00	5.00	4.50							
47- 53	--	--	--	--	--	--	--	100	50	3	1	45				1.02	1.82	1.64							
53- 69	—	—	—	--	--	--	--	100	50		1	45				1.19	1.14	0.90							

(W E I G H T F R A C T I O N S - C L A Y F R E E)(-TEXTURE--)(--P S D A(m)---)(PH)(-ELECTRICAL)(CUMULT. AMOUNTS)
(--W H O L E S O I L--) (--<2 mm F R A C T I O N ----)(DETERMINED)(SAND SILT CLAY) CA- RES- CON- SALT Inch of "20
DEPTH >2 75 20 2- .05- LT ------SANDS------- SILTS CL IN BY 2- .05- LT CL2 IST. DUCT. MG/ 1/3 BAR to
(In.) -2 -2 .05 .002 .002 VC C M F VF C F AY FIELD PSDA .05 .002 .002 .01M OHMS MMHOS KG 15BR AIRDRY
PCT of >2mm+SAND+SILT > <------PCT of SAND+SILT-------><---<2 mm--><---PCT of 2mm---><-------- <2 mm -------><WholeSoil>

DEPTH (In.)	76	77	78	79	80	81	82	83	84	85	86	07 5	88	89	90	91 S	92	93	94	95	96	97	98	99	100
0- 8				91	9			2	28	46	14	4	4		LS	S	91.1	8.9	--	5.6					
8- 16				94	6		TR	2	30	40	14	3	2		S		93.9	6.1	--	5.4					
16- 23				96	4		TR	3	43	40	10	4	1		S	S	95.7	4.3	--	5.4					
23- 26				94	5			3	32	47	12		2		S	S	94.5	5.5	--	5.4					
26- 41				95	5	TR		3	30	51	11	3	2		S	FS	94.9	5.1	--	5.5					
41- 47				95				2	24	52	16	3	2	TR	LS	FS	94.4	5.2	0.4	5.6					
47- 53				92	8	1		2	24	50	17	5	3	1	LS	S	91.4	7.5	1.1	5.5					
53- 69				94	6	2	TR	1	23	54	16	4	2	2	LS	FS	92.0	5.9	2.1	5.7					

GEOGRAPHICALLY ASSOCIATED SOILS: These include the Braddock, Brevard, Colvard, Elsinboro. Hatboro. Iotla, Rosman, late, Toxaway, and Transylvania series. Graddock. Brevard, Elsinboro. and Tate soils have an argillic

Soil Series: Wayah
Soil Survey No.: S91-NC-021-005 (SSL Pedon No.: 92P0085)
Classification: coarse-loamy, mixed, frigid Typic Haplumbrept

Location: Buncombe County, NC, NE of Asheville on Blue Ridge Parkway, 0.85 miles NE of Blue Ridge Parkway on Craggey Gardens picnic area road in sharp curve, 50' E of road.
Latitude: 35-42-05-N Longitude: 082-23-23-W
MLRA: 130

Physiography: Blue Ridge Mountains
Geomorphic Position: on upper third of sideslope
Slope Characteristics: 35% north facing undulating, 340° azimuth
Elevation: 1692 m MSL
Parent Material: local colluvium from metamorphic material

Precipitation: 160 cm udic moisture regime
Water Table Depth: > 200 cm
Hydraulic Conductivity: high
Drainage Class: well drained
Runoff: moderate
Land Use: forest land not grazed
Stoniness: 1
Erosion: slight
Particle Size Control Section: 25 to 100 cm
Diagnostic Horizons: 0 to 39 cm umbric, 64 to 117 cm cambic
Described By: Mark S. Hudson, Milton Martinez, John B. Allison
Date: 10/91
Notes: Vegetation: sugar maple, yellow birch. About 20 m N and 2 m lower in elevation than Wayah S92NC-21-6.

Oi-5 to 2 cm; no sample.

Oe--2 to 0 cm; 92P0618.

Al--O to 8 cm, 92P0619 (O-4 cm) and 92P0620 (4-8 cm); black (10YR 2/1) loam; weak fine granular structure; very friable! non sticky, non plastic; many very fine and fine roots throughout, and common medium and coarse roots throughout; many very *fine* and fine interstitial and tubular pores; few very fine and tine plate like mica fla *f*

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

******* P R I M A R Y C H A R A C T E R I Z A T I O N D A T A *** ****

S91NC- 21-005 **(BUNCOMBE** COUNTY, NORTH CAROLINA)

PRINT DATE **03/23/92**

SAMPLED AS : "AYAH ; **COARSE-LOAMY,** MIXED, FRIGID TYPIC HAPLUMBREPT
REVISED TO : ; COARSE-LOAMY. **OXIDIC,** FRIGID **ANDICHAPLORTHOD**

NSSL **-** PROJECT **92P13,** NCWTN-BUNCOMBE CO.
- PEOON **92P85,** SAMPLES **92P618-** 627
- GENERAL METHODS **1B1A,2A1,2B**

U. **S.** DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LAOORATORY
LINCOLN, NEBRASKA **68508-3866**

(- - -TOTAL - - -)(- -CLAY- -)(- -SILT- -)(- - - - - -SAND- - - - - -)(-COARSE FRACTIO' S(MM)-)(>2MM)

SAMPLE	DEPTH	"ORIZON	-1--	-2--	-3--	-4--	-5--	-6--	-7--	-8--	-9--	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
			CLAY LT	SILT .002	SAND .05	FINE LT	CO3 LT	FINE .002	COARSE .02	VF .05	F 10	M	C	VC	- - -	WEIGHT	- -	- -	- -	WT
																	1			2
										11.7			14.6			4		56	12
										10.8			7.7			1		42	7
										11.1			9.3			1		44	8
										14.9			10.1			1		59	16
										12.2			9.2			1		55	26
										12.8			10.2			7		60	26
										11.6			10.1			5			
										11.9			13.1			9			
										11.7			13.4			9			

				1.0	0.3	TR						0.80							
				2.5	0.6	TR						0.90							
				3.1	0.8	TR						1.10							
				3.2	1.0	TR						0.82	1.00	0.066					
				3.3	1.5	TR						0.95	1.06	0.035					
				2.4	1.4	TR						1.11	1.17	0.015					
				1.9	0.9	TR						1.19	1.24	0.012					
				1.5	0.6	TR						1.20	1.23	0.006					
				1.2	0.4	TR						1.16	1.21	0.011					
				1.1	0.3	TR													

1	11.5	
2	0.5	44.9
3	0.2	31.4
4	0.1	24.9
5	0.1	21.6
6	0.0	20.7
7		
8		
9		
10		

S91NC- 21-005

*** SUPPLEYENTARV CHARACTERIZATION DATA ***
(BUNCOHBE COUNTY, NORTH CAROLINA)

PRINT DATE 03/23/92

SAMPLED AS : WAVAH ; COARSE-LOAMY, MIXED. FRIGID TYPIC HAPLUHBREPT
REVISED TO : ; COARSE-LOAM'. OXODIC, FRIGID ANDIC HAPLORTHOD

NSSL - PROJECT 92P 13,
- PEDON 92P 85. SAMPLES 92P 618- 627
- GENERAL METHODS (ENGINEERING FRACTIONS ARE CALCULATED FROM USDA FRACTION SIZES)

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN. NEBRASKA 68508-3866

SAMPLE NO.	DEPTH (In.)	HORIZON	ENGINEERING PERCENTAGE PASSING SIEVE <-----, NCHES-----> 3	2	3/2	1	3/4	3/8	<-NUMBER-> 4	10	40	200	PSDA USDA <-MICRONS-> 20	5	2	CUMULATIVE CURVE FRACTIONS(<75mm) LESS THAN DIAMETERS(mm) <--- MILLIMETER ---> 1.	.5	.25	.10	.05	AT <--PERCENTILE--> 60	50	10	ATTER-BERG <-PCT> LL	PI	GRADATION UNI-FYTV CU	CUR-VTUR C C
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
92P 618S	1-	0	Oe FRACTIONS NOT DETERIMINED																								
92P 619S	0- 2	Oa	100	100	100	100	100	98	96	93	69	39	24	15	8	86	72	58	44	33	0.28	0.151	0.003			>100	1.9
92P 620S	2- 3	A1	100	100	100	99	99	99	98	97	83	53	39	28	20	94	86	73	58	47	0.12	0.060	0.001			>100	0.6
92P 621s	3- 7	A2	lee	99	99	98	97	97	96	95	79	51	36	22	12	92	83	70	56	45	0.13	0.068	0.001			97.7	0.7
92P 6225	7- 15	A3	100	97	95	92	90	90	89	88	71	35	19	10	4	84	75	61	41	28	0.24	0.153	0.005			40.6	2.6
92P 623.3	15- 25	BA	100	98	97	94	93	93	92	90	74	40	26	14	6	85	77	65	45	34	0.20	0.125	0.003			66.7	1.6
92P 624S	25- 35	Bw1	100	98	97	95	94	91	87	83	67	36	23	13	7	78	70	57	40	30	0.30	0.171	0.003			96.8	2.8
92P 6255	35- 46	Bw2	100	96	93	89	86	84	81	77	62	32	20	12	6	73	66	52	36	27	0.37	0.220	0.004			>100	3.1
92P 6265	46- 59	BC	100	97	95	91	89	85	80	73	55	24	14	8	4	68	58	44	28	19	0.57	0.332	0.008			70.2	2.8
92P 627S	59- 79	C	100	98	96	94	92	88	83	75	56	23	12	8	5	70	59	46	26	18	0.52	0.311	0.010			52.3	2.7

5

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DEPTH (In.)	(WEIGHT FRACTIONS) ---WHOLE SOIL (mm)- >2	250 -UP	250 -75	75 -2	75 -20	20 -5	5 -2	<2	-<75 mm FRACTION-- 75 -2	75 -20	20 -5	-2	<2		(WEIGHT PER UNIT VOLUME G/CC) ------WHOLE SOIL------ SOIL SURVEY 1/3 BAR	OVEN -DRY	ENGINEERING MOIST	SATUR -ATED	-------<2 mm FRACTION------- --SOIL SURVEY-- 1/3 BAR	15 BAR	OVEN -DRY	ENGINEERING MOIST	SATUR -ATED	(VOID) --RATIOS-- AT 1/3 BAR WHOLE SOIL	<2 mm
	<------PCT of "HOLE SOIL-----> 26	27	28	29	30	31	32	33	<--PCT OF <75 mm-> 34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
B- 2	13	3	3	7	--	4	3	07	7	--	4	3	93		0.98										
2- 3	7	2	2	3	1	1	1	93	3	1	1	1	97												
3- 1	8	--	3	5	3	1	1	92	5	3	1	1	95		0.87 1.15	1.05	1.35	1.54	0.82	0.96	1.00	1.31			
7- 15	16	2	2	12	10	1																			
15- 25	26	4	14	8	6	1	21	8474	12 10	10	11	21	8890		1.07 1.31	1.18 1.37	1.58 1.66	1.67 1.82	0.95 1.11	1.03 1.15	1.06 1.17	1.41 1.52	1.51 1.69	2.051.02	2.231.39
25- 35	27	6	6	15	5	6	4	73	17	6	7	4	83		1.40	1.45	1.74	1.87	1.19	1.23	1.24	1.58 1.59	1.74	0.4889	1.17923
35- 46	41	7	17	17	11	7	3	59	23	14	5	4	77		1.55	1.58	1.00	1.97	1.20	1.22	1.23	1.53	1.75	0.71	1.21
46- 59	42	3	17	22	9	8	6	58	27	11	9	7	73		1.52	1.57	1.78	1.95	1.16	1.20	1.21	1.50	1.72	0.74	1.28
59- 79	31	--	8	23	7		7	69	25	8	9	8	75		1.70										

Soil Series: Wayah
Soil Survey No.: S91-NC-021-006 (SSL Pedon No.: 92P0086)
Classification: coarse-loamy, mixed, frigid Typic Haplumbrept

Location: Buncombe County; NC; NE of Asheville on Blue Ridge Parkway, 0.85 miles NE of Blue Ridge Parkway on Craggey Gardens picnic grounds road in sharp curve, 50 E of road.
Latitude: 35-42-05-N Longitude: 082-23-23-W
MLRA: 130

Physiography: Blue Ridge Mountains
Geomorphic Position: on upper third of side slope
Slope Characteristics: 43% NNE facing at 340° azimuth, undulating
Elevation: 1694 m MSL
Parent Material: local colluvium from metamorphic material over residuum from metamorphic material

Precipitation: 162 cm udic moisture regime
Water Table Depth: > 180 cm
Hydraulic Conductivity: high
Drainage Class: well drained
Land Use: forest land not grazed
Stoniness: 1
Erosion: slight
Particle Size Control Section: 25 to 100 cm
Diagnostic Horizons: 0 to 30 cm umbric, 30 to 105 cm cambic
Described By: John B. Allison, Mark S. Hudson, Milton Martinez
Date: 10/91
Notes: Vegetation: sugar maple, Am. beech, yellow birch. Site is about 20 m S and 2 m higher in elevation than Wayah S92NC-21-5.

Oi--5 to 2 cm; no sample.

Oe--2 to 0 cm; 92P0628.

Oa--0 to 7 cm, 92P0629; black (2.5Y 2/0) loam; moderate medium granular structure; friable, non sticky, non plastic; many very fine and fine roots throughout, and many medium and coarse roots throughout; many very fine and tine interstitial and tubular pores; few very fine and fine plate like mica flakes; extremely acid (pH 4.0); abrupt wavy boundary.

Al-7 to 15 cm, 92P0630; very dark brown (10YR 2/2) loam; weak fine and medium subangular blocky structure; friable, non sticky, non plastic; few very fine and tine roots between peds, and common medium roots between peds, and few coarse roots between peds; common very fine and fine vesicular and tubular, and few medium vesicular and tubular pores; few very fine and fine plate like mica flakes; extremely acid

*** PRIMARY CHARACTERIZATION DATA ***

S91NC- 21-006 (BUNCOHOE COUNTY, NORTH CAROLINA)

SAMPLED AS : WAYAH ; COARSE-LOAMY, MIXED, FRIGID TYPIC NAPLUMBREPT
REVISED TO : ; COARSE-LOAMY, MIXED. FRIGID ANDIC HAPLDRTHOD

NSSL - PROJECT 92P 13, NCMTN-BUNCOMBE
- PEDON 92P 86,
- GENERAL METHODS

-1-- -2--

			2	3	14V
9.2	16.9	10.0	2	3	2V
11.0	15.4	9.7	2	1	4V
10.7	24.5	8.8	2		
10.4	22.7	10.7	4		
5.2	22.1	12.7	5		
4.5	23.6	13.8	8		
5.6	27.2	12.3	9		

1.5	0.3	
1.6	0.4	..
2.6	1.1	TR
2.2	1.3	TR
1.6	1.1	TR
1.3	0.5	TR
1.7	0.4	0.1
2.0	0.4	0.1

S91NC- 21-006

*** P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A *** (SUNCOMSE COUNTY, NORTH CAROLINA)

PRINT DATE 03/23/92

SAMPLED AS : WAYAH ; COARSE-LOAMY, MIXED. FRIGID TYPIC HAPLUMSREPT

NSSL - PROJECT 92P 13, NCMTN-BUNCOMBE CO.
- PEDON 92P 86, SAMPLES 92P 628- 635
- GENERAL METHODS 1B1A,2A1,2B

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

-1-- -2-- -3-- -4-- -5-- -6-- -7-- -8-- -9-- -10- -11- -12- -13- -14-

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*** SUPPLEMENTARY CHARACTERIZATION DATA ***

S91NC- 21-006 (BUNCOMBE COUNTY, NORTH CAROLINA)

PRINT DATE 03/23/92

SAMPLED AS : WAYAH ; COARSE-LOAMY, MIXED, FRIGID TYPIC HAPLUMBREPT
REVISED TO : ; COARSE-LOAMY, MIXED, FRIGID ANDIC HAPLORTHOD

NSSL - PROJECT 92P 13,
- PEDON 92P 86, SAMPLES 92P 628- 635
- GENERAL METHODS (ENGINEERING FRACTIONS ARE CALCULATED FROM USDA FRACTION SIZES)

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

SAMPLE	DEPTH	HORIZON	E N G I N E E R I N G P S D A PERCENTAGE PASSING SIEVE USDA FRACTIONS 3	2					CUMULATIVE CURVE FRACTIONS(<75mm) LESS THAN DIAMETERS(mm)			ATTERBERG	GRADATION UNI- CUR-
			99	98	98							63	48
			98	97	96							68	53
			98	97	96								
			98	96	95								
			91	85	81								
			88	81	76	55	38	14					
			87	79	74	54	41	15					

LOCATION UAYAH NC

Established Series
Rev. DJT:SAB:AG
12/91

WAYAH SERIES

The Wayah series consists of very deep, well drained. moderately rapidly permeable soils on ridges and side slopes at high elevations in the Southern Appalachian Mountains. They formed in residuum that is affected in the upper part by soil creep. .It is weathered from felsic to mafic igneous and hlgh grade metamorphic rocks such as mica gneiss. hornblende gneiss, high grade metagraywacke, and granite. Near the type location, mean annual temperature is about 40 degrees F.. and mean annual precipitation is 100 inches. Slope ranges from 2 to 95 percent.

TAXONOMIC CLASS: Coarse-loamy, mixed. frigid Typic Haplumbrepts

TYPICAL PEDON: Uayah sandy loam on a 20 percent southwest-facing side slope at an elevation of 6023 feet--forested. (Colors are for moist soil unless otherwise stated.)

Oi--4 to 2 inches; slightly decomposed leaves and twigs.

Oe--2 to 0 inches; partially decomposed organic litter and root mat.

Al--O to 10 inches; black (10YR 2/1) sandy loam. very dark gray (10YR 3/1) dry; weak fine granular structure: very friable; common fine and medium roots; 2 percent gravel by volume; few fine flakes of mica; 18 percent organic matter; extremely acid; clear wavy boundary.

A2--10 to 14 inches; very dark grayish brown (10YR 3/2) sandy loam, dark grayish brown (10YR 4/2) dry; weak medium granular structure: very friable; common fine and medium roots; 2 percent gravel by volume; few fine flakes of mica; very strongly acid: clear wavy boundary. (Combined thickness of the A horizon is 10 to 20 inches.)

Br-14 to 40 inches: dark yellowish brown (10YR 4/6) gravelly sandy loam; weak medium subangular blocky structure; very friable; few fine roots: 33 percent gravel; few fine flakes of mica; very strongly acid; gradual wavy boundary. (12 to 30 inches thick.1

Cl--40 to 46 inches; pale brown (10YR 6/3) gneiss saprolite that is gravelly sandy loam; few medium faint light gray (10YR 7/2) and white (10YR 8/2) mottles; massive rack controlled structure; very friable: 16 percent gravel; few fine flakes of mica; very strongly acid; gradual wavy boundary.

C2--46 to 65 inches: mottled yellowish brown (10YR 5/8), yellowish red (5YR 5/6), white (10YR 8/2) and pale brown

STOP 4 - BURTON SERIES

Classification: coarse-loamy, mixed, frigid Typic Haplumbrepts

Burton soils are moderately deep, coarse-loamy soils in the high mountains (>4,500 feet) that formed in residuum weathered from high-grade metamorphic or igneous rocks, and may be affected in the upper part by soil creep. The Burton series is classified in Typic Haplumbrepts although NSSL data for the pedons sampled for the tour (pedon 7) supports classification in coarse-loamy, oxidic, frigid Andic Haplorthods (using present criteria for a spodic horizon, Spodosols, andic soil properties, and Andic subgroups). NSSL data supports coarse-loamy, oxidic, frigid Andic Haplumbrepts for pedon 8.

Changes in Soil Taxonomy are being developed (oxidic) or have been proposed (Andic and Spodic Amendments) that will allow classification of Burton as a Typic Iiaplumbrept.

NOTES:

S91NC- 21-007

*** PRIMARY CHARACTERIZATION DATA
(BUNCOMBE COUNTY, NORTH CAROLINA)

PRINT DATE 03/23/92

SAMPLED AS : BURTON ; COARSE-LOAYY, MIXED, FRIGID TYPIC HAPLUMSREPT
REVISED TO : ; COARSE-LOAMY, OXIDIC, FRIGID ANDIC HAPLORTHOD

NSSL - PROJECT 92P 13, NCMTN-BUNCOMBE CO.
- PEDON 92P 87, SAMPLES 92P 636- 639
- GENERAL METHODS 1B1A, 2A1, 2B

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

SAMPLE NO.	DEPTH (CM)	HORIZON	-1-- (-- CLAY LT .002	-2-- -TOTAL SILT .002 -.05	-3-- ---)(SAND .05 -2	-4-- FIN LT .0002	-5-- -CLAY- CO3 LT .002	-6-- -)(FINE .002 -.02	-7-s -SILT- COARSE .02 -.05	-8-- -)(VF .05 -.10	-9-- F .10 -.25	-10- -SAND- M .25 -.50	-11- C .5 -1	-12- --)(VC 1 -2	-13- (-COARSE FRACTIONS(MM)-) WEIGHT 2 -5	-14- WEIGHT 5 -20	-15- WEIGHT 20 -75	-16- .1- 75	-17- (>2MM) WT PCT OF WHOLE SOIL
			<- - - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				SOIL
92P 6365	0- 7	Oa	le.6	24.4	65.0	1.8		16.6	7.8	lo.4	22.6	18.5	9.8	3.7	TR	TR	--	55	TR
92P 6375	7- 23	A1	.13.3	25.8	61.7	2.8		17.4	7.6	11.1	19.8	la.4	8.9	3.5	1	1	1	52	3
														5.4	2	1	2	54	5
92P 6385	38- 88	Bw	10.4	26.5	62.2	1.1		18.4	6.9	10.6	28.8	16.8	10.8	6.1	5	3	7V	62	15
													11.2						

ORGN TOTAL EXTR TOTAL (- -DITH-CIT -
P S

PI
4F

*** PRIMARY CHARACTERIZATION DATA ***

S91NC- 21-007 (BUNCOMBE COUNTY, NORTH CAROLINA)

PRINT DATE 03/23/92

SAMPLED AS : BURTON ; COARSE-LOAHV, MIXED, FRIGID TYPIC HAPLUMBREPT

NSSL - PROJECT 92P 13, NCMTN-BUNCOMBE CO.
- PEDON 92P 87, SAMPLES 92P 636- 639
- METHODS 1B1A, 2A1, 2B

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

SAMPLE	-1--	-2--	-3--	-4--	-5--	-6--	-7--	-8--	-9--	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	ACID OXALATE	EXTRACTION			PHOSPHOUS		KCL	TOTAL	(- -WATER CONTENT- -)				(---- WATER DISPERSIBLE ----)						MIN	AGGRT
	OPT DEN	FE	SI	AL	RET	CIT- ACID	MN	C	0.06 BAR	1- BAR	2- BAR	15 BAR	<--PIPETTE--> CLAY	SILT	SAND	<- HYDROMETER -> CLAY	SILT	SAND	SOIL CONT	STARL <5mm
	8l	6C9a	6V2	6G12	6S4	6S5	6D3	6A2d	4B1c	4B1a	4B1a	4B2b	<-	- - 3A1c						
							10.2													
							1.0													
					87		0.6													
					79		0.0													

S91NC- 21-007

*** SUPPLEMENTARY CHARACTERIZATION DATA ***
(BUNCOMBE COUNTY, NORTH CAROLINA)

PRINT DATE 03/23/92

SAMPLED AS : BURTON ; COARSE-LOAMY, MIXED, FRIGID TYPIC HAPLUWBREPT
REVISED TO : ; COARSE-LOAMY, OXIDIC, FRIGID ANDIC HAPLORTHOO

NSSL - PROJECT 92P13,
- PEDON 92P 87, SAMPLES 92P 636- 639
- GENERAL METHODS (ENGINEERING FRACTIONS ARE CALCULATED FRO" USDA FRACTION SIZES]

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

SAMPLE NO.	DEPTH (In.)	HORIZON	ENGINEERING PERCENTAGE PASSING SIEVE <-----INCHES-----> 3	2	3/2	1	3/4	3/a	<-NUMBER-> 4	10	40	208	PSDA <-MICRONS-> 20	5	2	USDA <--- MILLIMETER ---> 1.	.5	.25	.10	.05	CUMULATIVE CURVE FRACTIONS(<75mm) DIAMETERS(mm) AT6050 <--PERCENTILE-->			ATTER-BERG <-PCT> LL	PI	GRADATION UNI-FMTY C "	CUR-VTUR C C
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
92P 636S	0- 3	A1	100	100	100	100	lee	100	lee	100	82	41	27	17	11	96	86	68	45	35	0.18	8.121	0.002			>100	2.4
92P 637S	3- 9	A2	100	100	100	99	99	99	98	97	80	43	30	20	13	94	85	67	48	37	0.18	0.110	0.001			>100	2.8
92P 638S	9- 15		lee	99	99	98	98	98	97	95	76	41	28	la	11	90	80	64	46	36	0.21	8.124	0.002			> 100	1.7
92P 639S	15- 25	Bw	100	98	97	94	93	92	90	85	67	34	23	14	9	80	70	56	3a	29	0.31	0.186	8.002			>100	4.1

DEPTH (In.)	(WEIGHT FRACTIONS) ---WHOLE SOIL (mm)- >2	250 -UP	250 -75	75 -2	75 -20	20 -5	5 -2 <------PCT of WHOLE SOIL----->	<2	--<75 mm FRACTION-- 75 -2	75 -20	20 -5	5 -2 <--PCT OF <75 mm->	'2		(WEIGHT PER UNIT VOLUME G/CC) _-___-"HOLE SOIL------ SOIL SURVEY 1/3 BAR	OVEN -DRY	ENGINEERING MOIST	SATUR -ATED	-------<2 mm FRACTION------- --SOIL SURVEY-- 1/3 BAR	15 BAR	OVEN -DRY	ENGINEERING HOIST	SATUR -ATED	(VOID --RATIOS-- AT 1/3 OAR WHOLE SOIL	<2 mm)
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	4a	49	50
e- 3	TR 3	--	—	—	1	--	TR	100	-3	--	-1	TR	lee		1.45										
3- 9	5	--	_	53	2	1	21	95 97	5	1	1	21	95 97		0.92 0.92	1.16 1.67	1.38 1.46	1.57 1.57	0.900.88	1.071.00	1.13 1.03	1.44 1.34	1.56 1.55	1.88 1.88	2.81 1.94
9- 15						1				2															
15- 25	15	--	--	15	7	3	5	85	15	7	3	5	85		1.16	1.24	1.58	1.72	1.06	1.12	1.13	1.51	1.66	1.28	1.50

Soil Series: Burton
Soil Survey No.: S91-NC-021-008 (SSL Pedon No.: 92130088)
Classification: coarse-loamy, mixed, frigid Typic Haplumbrept

Location: Buncombe County, NC; 18 miles NE of Asheville on Blue Ridge Parkway, 0.25 miles W of Craggey Garden overlook to shelter, 600' S of shelter along trail.
Iatitude: 35-41-45-N Longitude: 082-22-00-W
MLRA: 130

Physiography: Blue Ridge Mountains
Geomorphic Position: ndge crest
Slope Characteristics: 10% convex
Elevation: 1856 m MSL
Parent Material: residuum from metamorphic material

Precipitation: 162 cm udic moisture regime
Water Table Depth: > 68 cm
Hydraulic Conductivity: high
Drainage Class: well drained
Runoff: moderate
Land Use: forest land not grazed
Stoniness: 2
Erosion: slight
Particle Size Control Section: 25 to 68 cm
Diagnostic Horizons: 0 to 38 cm umbric, 60 cm paralithic contact; 68 cm lithic contact
Described By: John Allison, Milton Martinez, Mark Hudson
Date: 10/91
Notes: Area is not forested; vegetation consists of catawba rhododendron, mountain laurel, blueberry, thornless blackberry(grasses called heath balds); trees in area are stunted due to climate and windswept: non commercial. About 15 m E of Burton S92NC-21-7.

Oe--5 to 0 cm; 92P0640; partially decomposed grass roots.

Al-0 *to* 18 cm, 92130641; very dark brown

*** PRIMARY CHARACTERIZATION DATA ***

S91NC- 21-008 PRINT DATE 03/23/92
SAMPLED AS : BURTON ; COARSE-LOAMY, NIXED, FRIGID TYPIC HAPLUHBREPT
NATIONAL SOIL SURVEY LABORATORY ; PEDON 92P 88, SANPLE 92P 640- 643

	-1--	-2--	-3--	-4--	-5--	-6--	-7--	-8--	g	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-	EXTR	(- - - -CEC - - -)			AL	-BASE SAT-		CDS AS	RES.		CDND.(-	- - -PH - - -)		
	CA	MG	NA	K	SUM	ITY	AL	SUM	NH4-	BASES	SAT	SUM	NH4	CAC03	OHMS		MMHOS	KCL	CACL2	H20
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OaC	+ AL			OaC	<2MM	/CM		/CM	IN	.01M	
(CM)	6N2e	602d	6P2b	6Q2b		6H5a	6G9b	5A3a	5ABb	5A3b	5G1	5C3	5C1	6Elg	BE1		8I	8C1g	8C1f	8C1f
	<- - - - - - -				-MEQ / 100 G	- - - - -				->	<- - - -	-PCT	- - - ->						1:2	1:1
5- 0	1.0	0.8	8.2	0.8	3.6	55.4	6.1	59.0	36.9	9.7	63	6	10					3.8	4.0	4.5
0- 18	8.2	0.1	TR	0.1	e.4	39.9	5.8	40.3	26.6	5.4	93	1	2					4.0	4.1	4.5
18- 38	--	0.1	8.1	0.1	0.3	35.3	4.2	35.6	21.7	4.5	93	1	1					4.1	4.2	4.6
38- 60	—	—	0.1	TR	0.1	16.8	1.8	16.9	12.0	1.9	95	1	1					4.3	4.5	4.9

(- - - -SPODIC HORIZON CRITERIA - - - - -)					(- - - - -STATE OF DECOMPOSITION- - - - -)
(- -NA PYROPHOSPHATE EXTRACTABLE- -)				INDEX	PH
C	FE	AL	FE	OF	
1.7	0.9	0.6	0.1		
1.4	0.2	0.4	0.1		
0.9	0.2	0.3	0.1		

*** PRIMARY CHARACTERIZATION DATA ***

S91NC- 21-008
SAUPLEO AS : BURTON ; COARSE-LOAMY, MIXED, FRIGID TYPIC HAPLUMBREPT
NATIONAL SOIL SURVEY LABORATORY ; PEDON 92P 88, SAMPLE 92P 640- 643

PRINT DATE 03/23/92

SAMPLE NUMBER	-1-- FRACTION	-2--	-3--	-4--	-5--	-6--	-7--	-8--	-9--	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	< - - - - - - - CLAY MINERALOGY (<.002mm) - - - - - - - >																			
		<- - - X-RAY - - - 7A2i peak size - - - ->						<- THERMAL DTA 7A6		ELEMENTAL							EGME	INTER		
92P 640	TCLY																			
92P 641	TCLY																			
92P 642	TCLY	MI 2	KK 2	VM 1	VR 1				KK34	GI21										
92P 643	TCLY	GI 3	KK 2	VR 1	VM 1	MI 1			KK27	GI32										

*** SUPPLEMENTARY CHARACTERIZATION DATA ***

S91NC- 21-008
SAMPLED As : BURTON ; COARSE-LGAYY, MIXED, FRIGID TYPIC HAPLUHBREPT
NATIONAL SOIL SURVEY LABORATORY ; PEDON 92P 88, SAMPLE 92P 640- 643

DEPTH (In.)	(VOLUME FRACTIONS) WHOLE SOIL >2 PCT 51	250-UP 52	250-75 53	75-2 54	75-20 55	(C/)(RATIOS to CLAY)				LINEAR EXTENSIBILITY WHOLE SOIL <-1/3 BAR to 15 BAR 70	OVEN-DRY 71	<2 mm (PCT) 15 BAR 72	OVEN-DRY 73	(WRD) WHOLE SOIL In/In 74	<2 mm 75
	11	3			3										
6- 15	10	--	4	5	3	8	23	22	FSL						
15- 24	11	--	:	9	3	8	17	15	SL						

The C horizon is saprolite that is commonly fine sandy loam, sandy loam. loam, loamy sand. or loamy fine sand in the fine-earth fraction. It is multicolored or similar in color to the Bw and BC horizons.

The R horizon is hard felsic to mafic, igneous or high grade metamorphic bedrock such as granite. gneiss. mica gneiss, hornblende gneiss, high grade metagraywacke, or amphibolite. Some pedons have a thin Cr horizon of soft bedrock above the R horizon.

COMPETING SERIES: These are the Oconaluftee. Tanasee and Uayah series. These soils are all deeper than 60 inches to bedrock. Oconaluftee soils formed from low grade metasedimentary rocks such as

Soil Series: Craggey
Soil Survey No.: S91-NC-021-009 (SSL Pedon No.: 92P0089)
Classification: loamy, mixed, frigid Lithic Haplumbrept

Location: Buncombe County, NC; 18.5 miles NE of Asheville on Blue Ridge Parkway, 0.25 miles W of overlook on Craggey Pinnacle Trail, 50' W of trail in grassy area.
Latitude: 35-14-42-N Longitude: 082-2240-W
MLRA: 130

Physiography: Blue Ridge Mountains
Geomorphic Position: on crest of spur ridge running NNW from Craggy Pinnacle
Slope Characteristics: 18% convex
Elevation: 1918 m MSL
Parent Material: residuum from metamorphic material

Precipitation: 162 cm udic moisture regime
Water Table Depth: >35 cm
Hydraulic Conductivity: high
Drainage Class: somewhat excessively drained
Runoff: rapid
Land Use: forest land not grazed
Stoniness: 2
Erosion: slight
Particle Size Control Section: 0 to 32 cm
Diagnostic Horizons: 0 to 32 cm umbric, 32 cm lithic contact
Described By: Milton Martinez, Mark Hudson
Date: 10/91
Notes: Vegetation: catawba rhododendron, mountain laurel, blueberry grass. About 10 m SSW of Craggy S91NC-21-10.

Oe--3 to 0 cm; 92P0644; partially decomposed OM, abundant grass, roots, and charcoal.

Al--O to 17 cm, 92P0645; very dark brown (10YR 2/2) loam; weak fine granular structure; very friable, slightly sticky, non plastic; many very fine roots throughout, and few medium roots throughout; few very fine and fine interstitial pores; common very fine and fine plate like mica flakes; extremely acid (pH 4.5); clear smooth boundary.

A2--17 to 32 cm, 92P0646; very dark grayish brown (10YR 3/2) sandy loam; weak medium granular structure; very friable, non sticky, non plastic; few very fine and fine roots between peds; few very fine and fine interstitial pores; 2-3 spots of decomposed rock fragments; common very tine and fine plate like mica flakes; very strongly acid (pH 5.0); clear wavy boundary.

R--32 cm.

1.4
2.0

83

*** PRIMARY CHARACTERIZATION DATA ***

S91NC- 21-009 PRINT DATE 03/23/92
SAMPLED AS : CRAGGY ; LOAMY. MIXED, FRIGID LITHIC NAPLUMBREPT
NATIONAL SOIL SURVEY LABORATORY ; PEDON 92P 89, SAMPLE 92P 644- 646

-1-- -2-- -3-- -4-- -5-- -6-- -7-- -8-- -9-- -10- -11- -12- -13- -14- -15- -16- -17- -18- -19- -20-

<- - - - - - - - - - - - - CLAY MINERALOGY (<.002mm) - - - - - - - - - - - - - - - >
FRACT < - - - - - X-RAY - - - - - >< - - THERMAL - - - >< - - - - - - ELEMENTAL - - - - - - - >< - -> EGME INTER
SAMPLE ION < >< - DTA - - >< - TGA - -> SiO2 AL203 Fe203 MgO CaO K20 Na20 < > RETN PRETA
< - - - - - 7A2i - - - - - - >< - ,A6 - >< - 7A4b - >< - - - - - - - - - - ZC3 - - - - - - - - - - >< > 702 TION
NUMBER <- - >< - - - - peak size - - - - - >< - - - Percent - - - >< - - - - - - - - - - Percent - - - - - - - - - >< - -><mg/g>< - ->

92P 644 TCLY 55
92P 645
92P 646 TCLY TCLY KK 1 VR 1 KK31 GI21 6.5 5.1 27 19 CMIX

<- SAND - SILT MINERALOGY (2.0-0.002mm) - - - - - - - - - - - - - - - - - - - >
FRACT < - - - - - X-RAY - - - >< - - - THERMAL - - - - >< - - - - - - - - OPTICAL - - - - - - - - - >< > INTER
SAMPLE ION < >< - DTA - - >< - TGA - - > TOT RE< - - - - - GRAIN COUNT - - - - - - >< > PRETA
< - - - - - 7A2I - - - - - >< - 7A3B - >< - 7A4B - >< - - - - - - - - - 7B1A - - - - - - - - - >< > TION
NUMBER < - - >< - - - Peak Size - - - >< - - - Percent - - - - >< - - - - - - - - - - Percent - - - - - - - - - >< - - - - - - - - >< - ->

92P 646 FS 11 Bt76 MS 9 QZ 9 PR 2 OT 2 OP 1 MICA
92P 646 FS GN 1

81

FRACTION INTERPRETATION:

TCLY Total Clay, <0.002mm FS Fine Sand, 0.1-0.25mm

MINERAL INTERPRETATION:

KK kaolinite VR vermiculite Bt biotite MS muscovite QZ quartz PR pyroxene
OT other OP opaques GN garnet

RELATIVE PEAK SIZE: 5 very Large 4 Large 3 Medium 2 Small 1 Very Small 6 No Peaks

INTERPRETATION (BY HORIZON):
MICA = MICACEOUS; CMIX = MIXED CLAYS

PEDON MINERALOGY
BASED ON SAND/SILT: MICACEOUS?
BASED ON CLAY: MIXED
FAMILY YINERALOGY: OXIDIC
COMMENTS: MICACEOUS DEPENDS ON MICA IN OTHER FRACTIONS

85

*** SUPPLEMENTARY CHARACTERIZATION DATA ***

S91NC- 21-009 PRINT DATE 03/23/92
SAMPLED AS : CRAGGY ; LOAMY, MIXED, FRIGID LITHIC HAPLUMBREPT
NATIONAL SOIL SURVEY LABORATORY ; PEDON 92P 89, SAMPLE 92P 644- 646

DEPTH (In.)	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
	(VOLUME FRACTIONS) WHOLE SOIL (mm) >2	250 -UP	250 -75	75 -2	75 -20	20 -5	5 -2	<2	2- .05	.05- .002	LT .002	at 1/3 B A R PORES D	F	(C/) (/N) RAT -10	(RATIOS to CLAY) FINE CLAY	CEC SUM CATS	NH4- OaC	1/3BAR 15 BAR H20	1:: BAR	(LINEAR EXTENSIBILITY) WHOLE SOIL <-1/3 BAR to (PCT)---> 15 BAR	OVEN -DRY	<2 mm 15 BAR	OVEN -DRY	(WR 0) WHOLE SOIL <--In/In->	<2 mm
	<--- PCT of WHOLE SOIL											--->													
0-7- 13 7	21	__	__	21	--_	TR 1	11	98 99	25 17	6 5	3	38 17	36 50	19 17	8.14	la.64 3.78	14.50 5.58	6.93 1.86	0.6103.786	4.6 4.4	7.1 5.1	4.6 4.6	7.2 5.3	0.21 0.43	0.21 0.43

DEPTH (In.)	76	77	78	79	80	81	a2	83	a4	85	a6	a7	88	a9	90	91	92	93	94	95	96	97	98	99	100
	(WEIGHT FRACTIONS-CLAY FREE) (--WHOLE SOIL--) >2	75 -2	20 -2	2- .05	.05- .002	LT .002	(--<2 mm FRACTION----) SANDS VC	C	N	F	VF	SILTS C	F	CLAY	(-TEXTURE--) (DETERMINED) IN FIELD	BY PSDA	(--PSA(mm)---) (SAND SILT CLAY) 2- .05	.05- .002	LT .002	(PH) CA CL2 .01M	(-ELECTRICAL) RES-IST. OHMS	RES-ON-DUCT. MMHOS	(CUMULT. AMOUNTS) SALT MG/	SALT KG	Inch of H20 1/3 BAR to 15BR AIRDRY
	PCT of >2mm+SAND+SILT >						<------PCT of SAND+SILT							-->	<---<2 mm-->		<---PCT of 2mm--->			<-------- <2 mm ------->			<Whole Soil		
1- 0																									
o- 7	2	2	2	73	24	13	9	15	19	20	12	9	16	1.3	L	SL	66.1	22.1	11.8	4.2					
7- 13	6	6	6	77	16	1	10	18	20	23	ii	7	10	1	SL	LCOS	81.3	17.3	1.4	4.4					

CRITERIA FOR MOLLIC SUBGROUPS: CONTROL SECTION CENTIMETERS SAND TO CLAY RATIO ORGANIC CARBON PERCENT

* ✉ PRIMARY CHARACTERIZATION DATA ***
S91NC- 21-010 (BUNCOMBE COUNTY, NORTH CAROLINA)

PRINT DATE 03/23/92

SAMPLED AS : CRAGGY ;LOAMY,MIXED,FRIGIDLITHIC HAPLUWBREPT
REVISED TO : ; COARSE-LOAMY, MIXED, FRIGID ANDIC HAPLORTHOD

NSSL - PROJECT 92P 19, NCMTN-BUNCOWBE CO.
- PEDON 92P 90, SANPLES 92P 647-650
- GENERAL METHODS 1B1A,2A1,2B

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA :8508-3866

(- - -TOTAL - - -)(- -CLAY- -)(- -SILT- -)(- - - - - -SAND- - - - - -)(-COARSE FRACTIONS(MM)-)(>2MM)
<- - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - -> <- PCT OF <75MM(3B1)-> SOIL

SAMPLE NO.	DEPTH (CM)	HORIZON	-1--	-2--	-3--	-4-- CLAY LT .002	-5-- SILT .002 -.05	-6-- SAND .05 -2	-7-- LT .0002	-8-- E CO3 LT .002	-9-- FINE .002 -.02	-10- COARSE .02 -.05	-11- VF .05 -.10	-12- F .10 -.25	-13- M .25 -.50	-14- C .5 -1	-15- VC 1 -2	-16- -- 2 -5	-17- -- 5 -20	-18- WEIGHT 20 -75	-19- .1- 75	-20- WT PCT OF WHOLE SOIL
92P 647H	8- B	Oe																1	—	—		
92P 648S	0- B	A1				10.5	19.6	69.9	2.3	12.9		6.7	12.6	19.9	19.0	13.0	1 5.4	12V	TR	69		2:
92P 6495	8- 28	A2				7.4	17.7	74.9	0.3		11.1	6.6	10.5	17.9	19.9	19.4		7.2	TR	BV	69	21
92P 650S	28- 38	CR				--	9.2	90.8	__	4.1		5.1	11.1	25.1	24.5	20.1	10.0	14		8	a7	95

ORGN TOTAL EXTR TOTAL (- -DITH-CIT--)(RATIO/CLAY)(ATTERBERG)(- BULK DENSITY -) COLE (- --WATER CONTENT--) WRD
C N P s EXTRACTABLE 15 - PI 4F 1/10 1/3

92P 647H						0.7
92P 648S					1.5	0.6
92P 6495					1.0	
92P 650S					0.6	

S91NC- 21-010

*** PRIMARY CHARACTER12 AT I ON DATA ***
(BUNCOMBE COUNTY, NORTH CAROLINA)

PRINT DATE 03/23/92

SAMPLED AS : CRAGGY ; LOAMY, MIXED, FRIGID LITHIC HAPLUYBREPT

NSSL - PROJECT 92p 13, NCMTN-BUNCOMBE CO.
- PEDON 92P 90, SAMPLES 92P 647-650
- GENERAL METHODS 1B1A,2A1, 2B

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

SAMPLE NO.	HZ	-1-- ACID OPT DEN BJ	-2-- OXALATE EXTRACTION FE 6C9a	-3-- SJ 6V2	-4-- AL 6G12	-5-- PHOSPHOUS RET	-6-- CIT- ACID	-7-- K C L MN	-8--	-9-- TOTAL C	-10- (- -WATER CONTENT- -) 0.06 BAR	-11- 1-1- BAR	-12- 2- BAR	-13- 15 BAR	-14- (- - -- WATER DISPERSIBLE ----) <-- PIPETTE --> CLAY	-15- SILT	-16- SAND	-17- <- HYDROMETER -> CLAY	-18- SILT	-19- SAND	-20- NIN SOIL CONT	AGGRT STABL <5mm
												45.6										
												28.0										
												19.7										
												6.2										

S91NC- 21-010

*** SUPPLEMENTARY CHARACTERIZATION DATA ***
(BUNCOMBE COUNTY, NORTH CAROLINA)

PRINT DATE 03/23/92

SAMPLED AS : CRAGGY ; LOAMY, NIXED, FRIGID LITHIC HAPLUNSREPT
REVISED TO : ; COARSE-LOAMY, NIXED, FRIGID ANDIC HAPLORTHOD

NSSL - PROJECT 92P 13,
- PEOON 92P 90, SAMPLES 92P 647-650
- GENERAL METHODS (ENGINEERING FRACTIONS ARE CALCULATED FROM USDA FRACTION SIZES)

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN. NEBRASKA 68508-3866

			ENGINEERING PSDA											CUMULATIVE CURVE FRACTIONS(<75mm)				ATTER-	GRADATION
			PERCENTAGE PASSING SIEVE										USDA	LESS THAN				BERG	UNI- CUR-
SAMPLE	DEPTH	HORIZON	a	2	3/2	1	3/4	3/8	4	le	40	200	20	5	2	1.	.5		

LOCATION CRAGGEY NC

Established Series
Rev. HJ8:DLN:AG
12/91

CRAGGEY SERIES

The Craggey series consists of somewhat excessively drained. shallow. loamy soils on ridges and side slopes at high elevations in the Southern Appalachian Mountains. They formed in residuum that is affected by soil creep and is weathered from felsic to mafic igneous and high grade metamorphic rocks such as granite. mica gneiss, mica schist. hornblende gneiss. gneiss. amphibolite. and high grade metagraywacke. Near the type location, mean annual precipitation is 52 inches and mean annual air temperature Is 45 degrees F. Slopes range from 8 to 95 percent.

TAXONOMIC CLASS: Loamy, mixed. frigid Lithic Haplumbrepts

TYPICAL PEDON: Craggey loam on a 70 percent side slope--forested. (Colors are for moist soil unless otherwise stated.)

A--O to 12 inches; black (5YR 2/1)

BUNCOMBE COUNTY, NORTH CAROLINA
(PROJECT CP92-NC019)

ANDIC = 1+2+3 (SG = 1+2)
1. Al+.5Fe >= 2.0% (SG >=

st	series	lab_id	lab_class	pm	ox_si
WA	Newbell	84P 176	Frigid Andic Xerochrepts	volcanic ash	.24 .58 .70
WA	Newbell	84P 177	Frigid Andic Xerochrepts	volcanic ash	.47 .77 .78
WA	Ramparter	87P 759	Thermic Typic Vitrandepts	volcanic ash or igneous residuum	.11 .45 .97 1.29
WA	Raught	84P 919	Mesic Andic Haploxerults	Not given	.46
WA	Raught Tuff	84P 910	Mesic Ultic Haploxeralfs	Not given	.28 .30 .38 .40
WA	Resner	84P 169	nixed Entic Cryandepts	eolian over glacial till	.60 1.16 1.32 .98
WA	Satus	87P 62	Frigid Andic Haploxeralfs	volcanic ash	.34 .45
WA	Wedge	87P 755	Cindery Typic Cryorthods	volcanic ash	.03 .43 1.02 1.83 1.33

Summary of **oxalate** silica data by state:

North Carolina: Average high value is .085%

Oregon: Average high value is .624%

Washington: Average high value is .633X

Data Definitions:

st = State
series = Series Name
lab_id = NSSL Lab ID#
lab_class = Assigned NSSL Lab Classification
pm = Parent Material
ox_si = Measured Oxalate Silica Values (%) by NSSL
ox_si_h = Higest Measured Oxalate Silica Value (%) by NSSL
glass = Whether any layer had at least 5 percent volcanic glass (Y = Yes & N = No).

ICOMOD CIRCULAR 10

MARCH 25, 1991

TENTATIVE DEFINITION
SPODIC MATERIAL MORPHOLOGY

Spodic materials are in an illuvial

CAE. Other Aquods that have a cemented layer. whii does not slake in water after drying, in 90 percent or more Of each pedon with its upper boundary within 100 cm of the mineral soil surface.
Duraquods

CAF. Other Aquods ma have endosaturation.
Endoaquods

CAG. Other Aquods.
Epiaquods

Alaquods

Key tc subgroups

CABA. Alaquods that have a lithic contact within 50 cm of the mineral soil surface.
Lithic Alaquods

CABB. Other Alaquods that have a cemented layer. which does not slake in water after drying, in 90 percent or more of each pedon with its upper boundary within 100 cm cf the mineral soil surface.
Duric Alaquods

CABC. Other Alaquods that have a histic epipedo".
Histic Alaquods

CABD. Other Alaquods that:

1. Have an argillic or kandic horizon underlying the spodic materials and have base saturation cf 35 percent or more (by sum cf cations) in some part of the argillic a, kandic horizon: and

2 Have a layer starting at the mineral soil surface that has a sandy particle-size class throughout and extends to at least the upper boundary of the spodic materials, and the upper boundary of the spodic materials is between 75 and 125 cm below the soil surface.
Arenic Ultic Alaquods

CABF. Other Alaquods that have a layer starting at the mineral soil surface that has a sandy particle-size class throughout and extends to at least the upper boundary of the spodic materials, and the upper boundary of the spodic materials is between 75 and 125 cm below the soil surface.

CABK. Other Alaquods.

Cryaquods

CACD. Other Fragiaquods.

Typic Fragiaquods

Placaquods

Key to subgroups

CADA. Placaquods that have andic soil properties throughout horizons which have a cumulative thickness of 25 cm or more within 75 cm Of the mineral soil surface or upper boundary of an organic layer that meets andic soil properties. *whichever is* shallower.

Andic Placaquods

CADB. Other Placaquods.

Typic Placaquods

Cryods

KEY TO GREAT GROUPS

CBA. Cryods that have a placic horizon within 100 cm of the soil surface in 50 percent or more of each pedon.

Placocryods

CBB. Other Cryods that have the upper boundary of a cemented layer, which does not slake in water after drying, that is present in 90 percent or more of each pedon, within 100 cm of the mineral soil surface

[redacted]

CBC. Other Cryods that have 6 percent or more organic carbon throughout a layer 10 cm or more thick within the spodic materials.

Humicryods

CBD. Other Cryods.

Haplocryods

Duricryods

Key to subgroups

CBBA. Duricryods that have andic soil properties throughout horizons which have a cumulative thickness of 25 cm or more within 75 cm of the mineral soil surface or upper boundary of an organic layer that meets andic soil properties, whichever is shallower.

Andic Duricryods

CBBB. Other Duricryods that have 6 percent or more organic carbon in a layer 10 cm or more thick within the spodic materials.

Humic Duricryods

CBBC. Other Duricryods.

Typic Duricryods

Haplocryods

Key to subgroups

CBDA. Haplocryods that have a lithic contact within 50 cm of the mineral soil surface.

Lithic Haplocryods

CBDB. Other Haplocryods mat have a mean annual soil temperature of 0°C or less.

Pergelic Haplocryods

CBDC. Other Haplocryods that have andic soil properties throughout horizons which have a cumulative thickness of 25 cm or more within 75 cm of the mineral soil surface or upper boundary of an organic lay-a, that meets andic soil properties, whichever

Humicryods

Key to subgroups

CBCD. Other Humicryods.

Orthods

KM TO GREAT GROUPS

CDA. Orthods that have a placic horizon within 100 cm of the soil surface in 50 percent or more of each pedon.

Placorthods

CDB. Other Orthods mat have a cemented layer, which does not slake in water after drying, in *90 percent or more of each pedon with its upper* boundary within 100 cm of me mineral soil surface.

Durorthods

CDC. Other Orthods that have a fragipan.

Fragiorthods

CDD. Other Orthods that have an OWE of *0.25* or more *and* Fe_o of less than 0.10 throughout me spodic materials.

Alorthods

CDE. Other Orthods.

Haplorthods

Alorthods

Key to subgroups

CDDA. Alorthods that:

1. Have a layer starting at the mineral soil surface mat has a sandy particle-size class throughout and extends to at least me upper boundary of the spodic materials, and ma upper boundary of the spodic materials is between 75 and 125 cm below the soil surface; *and*

2. Have an argillic or kandic horizon below the spodic materials.

Arenic Ultic Alorthods

CDDB. Other Alorthods that have a layer starting at the mineral soil surface that has a sandy particle-size *class throughout and extends to at least the upper* boundary of the spodic materials, and the upper boundary of the spodic materials is between 75 and 125 cm below the soil surface.

Arenic Alorthods

CDDC. Other Alorthods that:

1. Have a layer starting at the mineral soil surface that has a sandy particle-size class throughout and extends to at least the upper boundary of the spodic materials, and the upper boundary of the spodic materials is more than 125 cm below the soil surface; *and*

2. Have both:

a. A weighted average of less than *0.6 percent organic carbon in the matrix* of the upper 30 cm of the Spodic materials or throughout the spodic materials if less than 30 cm thick; *and*

b. Less than 3 percent organic carbon in the upper 2 cm of the spodic materials in 10 percent or more of each pedon.

Grossarenic Entic Alorthods

CDDD. Other Alorthods that have both:

a. A weighted average of less than 0.6 percent organic carbon in the matrix of the upper 30 cm of the Spodic materials or throughout the spodic materials if less than 30 cm thick; *and*

b. Less than 3 percent organic carbon in the upper 2 cm of the spodic materials in 10 percent or more of each pedon.

Entic Alorthods

CDDE. Other Alorthods that have a layer starting at the mineral soil surface that has a sandy particle-size class throughout and extends to at least the upper boundary of the spodic materials, and the upper boundary of the spodic materials is more than 125 cm below the soil surface.

Grossarenic Alorthods

CDOF. Other Alorthods mat have a surface horizon *more than 30 cm thick* mat *meets all requirements* Of a plaggen epipedon except thickness.

Plaggeptic Alorthods

CDDG. *Other Alorthods* ma, *have an argillic or kandic* horizon underlying me spodic materials and have base saturation of 35 percent or more (by sum of cations) in some part of me argillic or kandic horizon.

Alfic Alorthods

2. Have a lithic contact within 50 cm of the mineral soil surface.

Entic Lithic Haplorthods

CDEB. Other Haplorthods mat have a lithic contact within 50 cm of the mineral soil surface.

Lithic Haplorthods

CDEC. Other Haplorthods that have andic soil properties throughout horizons which have a cumulative thickness of 25 a or more within 75 cm of the mineral soil surface or upper boundary of a" organic layer that meets andic soil properties, whichever is shallower.

Andic Haplorthods

CDED. Other Haplorthods that have a horizon 15 cm or more thick below the spodic materials end within 100 cm of the soil surface that has a brittle matrix when wet

Aqualfic Haplorthods

Suborders

- Aquods
- Cryods
- Humods
- Orthods

Great Groups

- Cryaquods
- Alaquods
- Fragiaquods
- Placaquods
- Duraquods
- Endoaquods
- Epiaquods

Alaquods

- Lithic Alaquods
- Histic Alaquods
- Alfic Arenic Alaquods
- Arenic Ultic Alaquods
- Arenic Alaquods
- Grossarenic Alaquods
- Alfic Alaquods
- Ultic Alaquods
- Aeric Alaquods
- Typic Alaquods

Cryaquods

- Lithic Cryaquods
- Pergelic Cryaquods
- Andic Cryaquods
- Typic Cryaquods

Duraquods

- Histic Duraquods
- Andic Duraquods
- Aeric Duraquods
- Typic Duraquods

Endoaquods

- Histic Endoaquods
- Andic Endoaquods
- Aeric Endoaquods
- Typic Endoaquods

Epiaquods

- Lithic Epiaquods
- Histic Epiaquods
- Andic Epiaquods
- Alfic Epiaquods
- Ultic Epiaquods
- Aeric Epiaquods
- Typic Epiaquods

Fragiaquods

- Histic Fragiaquods
- Plaggeptic Fragiaquods
- Alfic Fragiaquods
- Typic Fragiaquods

Placaquods

- Andic Placaquods
- Typic Placaquods

Cryods

- Placocryods
- Duricryods
- Humicryods
- Haplocryods

Duricryods

- Andic Duricryods
- Humic Duricryods
- Typic Duricryods

Haplocryods

- Lithic Haplocryods
- Pergelic Haplocryods
- Andic Haplocryods
- Typic Haplocryods

Humicryods

- Lithic Humicryods
- Pergelic Humicryods
- Andic Humicryods
- Typic Humicryods

Placocryods

- Andic Placocryods
- Humic Placocryods
- Typic Placocryods

Humods

- Placohumods
- Durihumods
- Fragihumods
- Haplohumods

Durihumods

- Andic Durihumods
- Typic Durihumods

Fragihumcds

- Typic Fragihumods

Haplohumods

- Lithic Haplohumods

NATIONAL COOPERATIVE SOIL SURVEY

Southern Regional Conference Proceedings

San Juan, Puerto Rico
June 18-22. 1990

United States
Department of
Agriculture

Soil
Conservation
Service

Proceedings of Southern Regional Technical Work-Planning Conference of the National Cooperative Soil Survey

San Juan, Puerto Rico
June 18-22, 1990

FOREWORD

The 1990 Southern Regional Technical Work Planning Conference of the National Cooperative Soil Survey was held at the TraveLodge Hotel in San Juan, Puerto Rico, from 18 through 22 June 1990.

The purpose of the conference was to provide a forum for southern States representatives of the National Cooperative Soil Survey for discussing soil survey related technical and scientific advances, as well as current issues and perspectives for the future. The work of the various conference committees, and the dialogue and the sharing of experiences resulted in a series of recommendations and proposals that should result in significant improvements in the soil survey in the Southern Region. Yet, as these recommendations are submitted to the National Cooperative Soil Survey Conference, they may well impact soil survey policy and procedures at the national level.

The conference commenced with the customary Opening Session which was followed by two inspiring keynote addresses and two days of group discussions, committee reports and business meetings. The compressed format of the conference was adopted to accommodate two days of field trips to see tropical soils, ecosystems and agriculture: a half-day trip to the tropical rainforest in the Luquillo Mountains on the north-east corner of Puerto Rico, and one along the northern, westerns and southern shores, and across the central mountains of the island. These trips and a variety of extracurricular activities complemented the discussion sessions and helped make the conference not only a successful technical meeting but also a memorable scenic and social event.

We should like to express our thanks and appreciation to Joe Nichols for advice and guidance willingly provided in developing the program and establishing conference committees and their charges. We also thank those colleagues who served as committee chairs for their time and efforts before, during and after the conference. We thank Warren Lynn of the National Soil Survey Laboratory for compiling a comprehensive tour guide for the field trips. And last, but certainly not least, we thank all participants of the conference for their attendance and contributions.

The proceedings contain the transcripts of the remarks presented during the Opening Session, the two keynote addresses, the reports of the conference committees, the report of the Soil Taxonomy committee, and miscellaneous statements.

North Carolina will host the 1992 conference. Horace Smith, State Soil Scientist, will serve as conference chairman and Stanley W. Buol, Professor of Soil Science at North Carolina State University, as vice chairman.

Fred H. Beinroth
University of Puerto Rico
Chairman

Gilberto Acevedo
SCS, Caribbean Area
Vice Chairman

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OPENING COMMENTS OF MIGUEL LUGO-LOPEZ AT THE SOUTHERN REGIONAL WORK PLANNING CONFERENCE OF THE NATIONAL COOPERATIVE BOIL SURVEY

June 18, 1990 - TraveLodge Hotel

Mr. Chairman, Director Hernández, Mr. Roth, Director Larson, Dean Emino, ladies and gentlemen:

It is indeed an honor to be invited to speak before this group of scientists and administrators involved in the Southern Regional Work Planning Conference of the National Cooperative Soil Survey. The occasion brings back fond memories of my own participation in soil survey throughout the years. I am also reminded of the prestige and leardership role of the National Cooperative Soil Survey--a position earned over years of service to agriculture and others. I began my career teaching at the University of Puerto Rico, College of Agricultural Sciences but soon I joined the Agricultural Experiment Station as a soil scientist. I became deeply interested in soil genesis and classification, and thus got involved in the Cooperative Soil Survey, and in the process, was indoctrinated into the mysteries of soil classification by local people such as Fernando Abruña, Juan A. Bonnet and others. At one moment or the other, I was able to share and learn from some people like Marlin G. Cline and Guy Smith.

At one time I served as a liaison officer between the UPR Station and the SCS. I remember participating in the SCS resource inventory and in some of the early studies on the potential of the soils for agricultural development. As I became more entangled, however, in the planning and management of research, teaching, and extension programs and later even in the complexity of student affairs, I began to drift away from soil science including soil survey. As awareness of this situation developed, I attempted to keep in touch with my peers and not fall too far behind. Thanks to friends at SCS and the College I managed to learn some of the intrincancies of the 5th Approximation which eventually evolved into the U.S. Soil Taxonomy. I tried to avoid slipping into what has been called organizational dry rot.

All in all, looking back through the years, I am happy that the College has been able to keep and strengthen a long and friendly association with SCS. This relationship has been fruitful. The College has been both beneficiary and contributor. These linkages with the USDA go back to the days when soil survey was the responsibility of the Bureau of Chemistry and Soils. The first soil survey of Puerto Rico was initiated in 1928, completed in 1936 and published in 1942 as a cooperative effort between the USDA and the UPR-Agricultural Experiment Station. Further collaboration was particularly productive during the years of active soil survey in Puerto Rico wich ended in 1975. The output: six excellent publications on the soils of the major regions of Puerto Rico. These reports have been extremely useful not only for agriculture, but for other purposes as well.

While I was on the administrative staff of the Agricultural Experiment Station I came across Fred Beinroth. His student credentials were impressive. We have been able, luckily, to keep him on the staff and his performance has been one of excellence. At the University, we are proud of his achievements and of the worldwide recognition he has received.

In a related but earlier situation, I also came across a youngster, then recently graduated from the University at Mayaguez, with a keen interest in the study of soils. We worked together for several years and this was a productive period for both of us. Eventually, he joined the SCS. I like to think of him as a Station man working for SCS. I take it as part of the deal. In a sense, he was my pupil, but now-a-days he is not my pupil, but my teacher. I really feel proud of Gilberto Acevedo.

With these two persons working jointly, the College and the SCS have taken long strides. You can sense the excellent working relationships that they have woven far and beyond the strictly structural framework of both SCS and UPR. Of course, I am obviously biased, but I sincerely believe that the progress of soil classification and soil survey in Puerto Rico has been largely due to the high level of committment and dedication of these two persons.

Knowing both Fred and Gilbert.0 so well, I think they might be kind of embarrassed with this unexpected personal tribute of recognition. I really believe, however, that this is a tribute that they long deserve and, in a way, I owed it to both of them.

Let me now give two specific examples of our contributions in this partnership with SCS and also comment briefly on ideas that we entertain for further cooperative studies. One thing we provided was the Spanish translation of the Soil Survey Report of the Mayaguez Area which was a boon to farmers and other users. We also studied the Island's soil moisture regimes, which is of utmost importance in terms of refining the classification of our soils. This was done in spite of financial and human constraints--mainly very limited funding and only four graduate students in soil science. These constraints prevent our present level of collaboration to be as significant as we want it to be.

At this time, nine of our undergraduate students are doing their summer practicum at various SCS offices. Conversely, for the SCS, our graduates constitute a significant resource for recruitment.

Perhaps our single most important contribution to SCS in recent years has been made indirectly through the work of Fred Beinroth. He initiated the series of international soil classification workshops which paved the way for the establishment of the Soil Management Support Services which has had significant national and international impact in soil survey and classification. We are happy that the Program Leader of SMSS, Dr. Hari Eswaran, is here with us.

Our final comment: the College is happy to be a partner in the National Cooperative Soil Survey and we hope to be able to increase our level or participation in the future as it appears to be a particularly exciting time for soil survey. The tools and techniques of the information age--database management systems, geographic information systems, expert systems, simulation models--will all profoundly change the way soil survey information is used and at the same time reaffirm its value and indispensability.

I will just say one more word: On behalf of the Dean and the academic and scientific staff of the College of Agricultural Sciences: Welcome to Puerto Rico. Best wishes and have a successful conference.

Thank you.

Comments for the South Regional Work Planning Conference

My best wishes for a successful Southern Regional Work Planning Conference of the National Cooperative Soil Survey. The name is a mouthful, but it shows the cooperative effort of the soil survey and the intent of this meeting.

I understand that quite a number of soil survey and interpretation concepts now used were developed in earlier versions of this conference.

As a former state conservationist, I understand the importance of a cooperative effort. The cooperative soil survey funds provided by cities, counties, and states is a glowing example of cooperation. Laboratory data from state experiment stations is another example of cooperation. Our work with the U.S. Forest Service gives us yet another example of cooperation. In these relationships, we have exciting challenges ahead of us.

The use of soil surveys is changing at a rapid rate. I went to a meeting last month in Houston, Texas. The emphasis was on wetlands. Houston has a 170 mile highway loop being held up because of a few acres of wetlands. A large part of the Texas highway funds for this loop was unavailable until environmental impact studies were made.

The use of soil surveys for hydric soils, and wetland determinations places a monetary importance on the survey not dreamed of when many of these surveys were made. The swamp buster regulations of the 1985 Food Security Act requires an interpretation of hydric or non-hydric for soil mapping units. The maps and the interpretation must be correct because a farmer can lose important cost-share benefits as a result of decisions based on soil survey maps and interpretations.

SCS's planning systems for our field office technical guides are undergoing a major change. We believe they will offer us new tools for protecting soil, but also water, air, animals and plants. Soil interpretations must meet this challenge with new soil measurements and new predictions of behavior. Your committee on soil data bases for models is working to determine as many of these measurements and predictions as possible.

The committee on Geographic Information Systems is timely. We have filled a new position in GIS on the soils staff and expect soon to have a GIS position on our Ecological Sciences and Planning Staff. These GIS specialists, along with scientists in our National Cartographic Center, will assist in making GIS work for you.

I understand that you also have a committee on communication. If we don't communicate effectively our work becomes harder and less effective. We are all interested in improving the soil survey through better communications. We, at the South National Technical Center, are trying to go beyond just a good job with Total Quality Management. We are committed to serving you in most up-to-date methods. Our measurement of success will be the degree to which we meet your expectations.

Paul F. Larson
Director
SCS-SNTC

WELCOME COMMENTS
1990 SOUTHERN REGIONAL SOIL SURVEY
WORK PLANNING CONFERENCE

Everett R. Emino, Administrator Advisor
Southern Region Information Exchange Group-22, Soil Survey

It is a pleasure for me to be with you today as you start the 1990 Southern Regional Soil Survey Work Planning Conference.

Three years ago I was appointed as Administrative Advisor to the Southern Regional Information Exchange Group-22 on the Soil Survey. This is my second meeting with you since you meet every other year. As Administrative Advisor I represent the Association of Southern Experiment Station Directors and facilitate the participation of Soil Scientists, from the Southern Land-Grant Universities. In fact several of your Directors called me about this meeting requesting information before authorizing the expenditure of Experiment Stations funds. Since I see scientists from those stations it appears my encouragement was useful.

The Southern Directors approved a 1 year extension of SRIEG22 and will consider a 3 year renewal next May. I hope to discuss this issue at our business meeting on Wednesday.

You more so than I, recognize that soil is essential to the production of food, fiber and forest products and to the health and well-being of humans and animals. Our national research plan indicates soil, along with water and air, is a basic natural resource that when poorly treated not only reduces the productivity of croplands and forests, but also adversely affects basic aspects of the environment such as water quality. Also recreation, land development potential, and wildlife habitat are directly related to soil resources.

Protection and wise use of our soil resource is in the best interest of all citizens. In fact, the need for optimizing the use of and conserving the soil resource base has never been greater. The heightened awareness of the American public that soil is a natural resource should help you as you go about your business of being soil scientists.

The 1990 Farm Bill is filled with soil related issues, for example: ground and surface water quality, protection of wetlands, sustainable agriculture, and Acreage Conservation Reserve concepts. Under environment and health appears, I quote "occurrence, fate, and transport of chemicals in soils."

Soil survey is fundamentally contributing to the stewardship of our soil resources.

As Administrative Advisor, I am here to help and I look forward to working with you.

NATIONAL COOPERATIVE SOIL SURVEY AND ITS NEW CHALLENGES

The theme of the National Cooperative Soil Survey Conference held in Lincoln, Nebraska last July was The Soil Survey of the Future. The task forces were challenged to present ideas of where the NCSS efforts should be going. Those recommendations are what I consider the New Challenges for NCSS, and I am pleased to report that many of the issues laid before the conference are already being addressed.

First and foremost, and it addresses many of the issues from the conference, is that the entire soil survey program **has made** a significant change in its philosophy of operation. The soil survey program is no longer a program designed solely to produce a soil survey report. It is now a program designed to support the collection, management, and maintenance of soil survey information and to provide that information in the formats appropriate to address the needs of the clients.

The Soil Survey database and software development initiative being directed by Dave Anderson is addressing the needs of Users of Soil Survey information. It is looking at ways of managing soils information, to include entering all primary soils data into the data base, and using that data to provide information reflecting the accuracy and reliability of the soils information in the system.

In addressing the needs of users of soils information one theme comes back again and again, and that is the needs are in constant change and evolution. Recent examples of this are reflected in the information being added to the Soils Interpretation Records. This includes items such as CEC, bulk density, organic matter content etc. New uses include determining the effect of soils on the infiltration of pesticides into the ground water, identification of highly erodible lands, identification of wetlands, and the impact of soils on low input sustainable agriculture. Again, Dave Andersons' group is addressing ways to make the new National Soils Information System (NASIS) adaptable to changes in information inventoried as well as the ways that information may be interpreted. The National Soil Survey Interpretations staff headed by Mauri Mausbach, meanwhile, is looking at ways to generate new interpretations and is determining the soil properties needed to support those interpretations.

The soil survey staffs in the states of Colorado, Kansas, Oklahoma, and New Mexico are cooperating in an effort to update soil surveys on a regional basis. In this case the effort is to update the soil surveys in MLRA 77. This project is not exactly the same as that recommended by the

Task Force on Model Soil Surveys, but it does provide a forum to try new approaches to soil surveying. This approach will lead to the development of uniform legends and provide better descriptions of soils, as they will be looked at across their entire range of occurrence instead of only on that part that occurs within some political (state or county) delineation. This concept also includes an effort to design map units on natural landscape units. All of these features lend themselves to use in a G.I.S.

Gary Muckel from the SCS West NTC is helping organize a symposium for the ASA meetings this fall on soil quality standards. This information will be helpful as we begin to address some of the issues of low input sustainable agriculture. The National Soil Survey Center is also working on developing concepts for soil quality standards in base saturation, erosion rates (improving on the concepts of T), and is building on the Forest Service work with bulk density.

Soil Survey publication formats are being modified. Now Publications are now being developed in standard, tabular, and semi-tabular formats(including color inside and outside), and a task force has been established to develop the two volume publication format recommended by the Task Force on the Adequacy of Soil Survey Delivery Systems.

All of these efforts are being conducted in an atmosphere of awareness of increasing needs by an increasing number of clients, both public and private, for more information that is more accurate and more reliable.

I couldn't be more excited about the future of the National Cooperative Soil Survey. For the first time since I have been attending these meetings I can see the Soil Survey aggressively responding to a broad spectrum of the issues identified by both regional and national conferences. These issues are also reflected in the 4 major objectives being used to guide the direction of the Soil Conservation Soil Survey Division: 1. Improve methods and products to meet expanding user needs 2. Provide new knowledge, procedures, concepts, data sets, and relationships to support the use of soil information 3. Provide technical soil services (support in the application of soil survey information), and train users of soils information and 4. Implement, support, and maintain soil survey activities.

Status Report

1. STATSGO: Most States are competingtatvTSGOaps and attribute data sets. They are to keep STATSGO as a high priority for gettingtit operational. Dennis

Lytle has and will soon distribute a new status map showing the states progress.

2. GPS: Global Positioning technology is being tested by Jimmy Doolittle of the National Soil Investigations staff. One unit is being tested in Massachusetts and New Hampshire in cooperation with the Mass. D.O.T. It is being tested as a tool to help soil surveyors locate themselves in areas with a dense canopy cover, to locate significant landscape breaks, and to locate pedon sites. It has the capability of providing locations by latitude and longitude, and it is using the LOW C technology which presently helps in the landing of aircraft,

3. Total Acres in the United States 2,281,717,165
   Total Acres mapped at the end of FY-90 1,625,545,146

Approximately 70% of the U.S. is covered by soils maps.
Mapping is progressing at a rate of about 40,000,000 acres per year.

4. Total Acres of Private lands in the U.S. 1,570,934,614
   Total Acres mapped at the end of FY-90 1,362,382,794
   Acres remaining to be mapped 208,551,820

Approximately 87% of the private land in the U.S. is covered by soil maps.
Mapping is progressing at a rate of about 31,000,000 acres per year.

5. Total Acres of Federal Lands in the U.S. 644‘774,495
   Total Acres mapped at the end of FY-90 376,492,047
   Acres remaining to be mapped 268,282,448

Approximately 58% of the Federal Land in the U.S. is covered by soil maps.
Mapping is progressing at a rate of about 6,367,000 acres per year.

6. Total Acres of Cropland in the U.S. 431,198,338
   Total Acres mapped at the end of FY-86 372,701,539
   Acres remaining to map at the end of FY-86 58,496,892
   Acres mapped in FY-81 17,821,979
   Acres mapped in FY-88 21,085,225
   Acres mapped in FY-89 18,864,151
   Acres mapped in FY-90 1,379,864

7. Total Acres mapped by SCS per year:

1984	42.1 million
1985	40.7 million
1986	41.3 million
1987	37.0 million
1988	38.8 million
1989	36.0 million
1990	39.3 million

Beginning in 1986 the emphasis for SCS was shifted to mapping cropland. The following figures show the percentage of the acres mapped by SCS that were cropland:

1986	21%
1987	48%
1988	54%
1989	52%
1990	4%

The decrease in numbers of total acres mapped during the 1987-1989 period reflect the inefficiencies in mapping cropland only. Inefficiencies primarily were 1. not block mapping, and 2. detailing soil scientists into areas where they had no previous mapping experience.

8. SCS Soil Survey Funding:

1984	53.4 million	a 1.6% increase over a three year period with inflation at about 3% per year = loss of 7.4%
1985	54.8 million	
1986	54.3 million	
1987	58.1 million	A 25% increase over a 4 year period with inflation at about 3% per year = gain of 13%
1988	67.7 million	
3989	68.0 million	
1990	68.0 million	

The funding increases in 1987 and 1988 were provided to cover losses due to inflation, increased operational costs, and for meeting the cropland mapping needs of the 1985 Food Security Act. This funding was used to hire additional soil scientists, contract for mapping, and pay for detailing of soil scientists into states with high cropland mapping workloads.

9. The numbers of SCS soil scientists reflect the status of the soil survey budget. During years 1984-1967 the numbers of soil scientists in SCS declined from 1,341 to 1,155. With the increases in funding for the 1985 Food Security Act the numbers have increased to 1,359.

10. The drop in numbers of soil scientists from 1984 to 1987 was reflected in the drop in the number of acres mapped per year. This trend was accelerated by the emphasis placed on mapping of croplands. The trends for the number of acres

mapped per individual soil scientist, however actually began to increase prior to the Food Security Act cropland mapping initiative. This increase in efficiency by individual soil scientists reflected the implementation of productivity improvement initiatives such as better management of soil survey projects, providing word processing equipment for manuscript development, better availability of field equipment, and a better understanding of the soil mapping process by the individual soil scientists. This trend is expected to continue now that the emphasis is again being placed on project mapping with the croplands completed.

11. The number of soil survey reports published each year increased from 61 in 1984 to 78 in 1986 and 1987. In 1988 the amount of funding for publication was reduced and diverted to cropland mapping. This was reflected in a decline in the number of publications to 70. In 1989 the funding was restored and publications rose to 79. During the period of 1987, 1988, and 1989 manuscript development processes have been improved and desk top publishing equipment has reduced the time and the cost associated with manuscript editing and formatting. At the same time more flexibility in manuscript formatting, color covers, color plates inside the publications, and improvements in paper quality have been achieved. The cost savings are reflected in the number of publications that can be published. Presently we are anticipating about 110 publication this year.

William Roth
NHQ-Soils Division

MANAGING TROPICAL FORESTS IN A TIME OF CLIMATE CHANGE

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ABSTRACT

Tropical forests are both agents and victims of global climate change. The concept of the energy *signature* is used to convey a holistic view of global change issues. The energy signature is the spectrum of all factors (energy and matter fluxes) that converge on a given area of the Earth's surface. Its effects on ecosystems depend on synergy, intensity, and recurrence of its components. Tropical forests have high resiliency when functioning within the limits of their energy signatures. The bases of tropical forest resiliency arc high biodiversity, fast rates of biomass and nutrient turnover, biotic control of nutrient cycles and forest regeneration, and flexibility afforded by self-design. Tropical forests are sensitive to changes in their energy signature. Cross primary productivity and biomass accumulation have inverse relationships and biodiversity has a direct relationships with water availability. All arc thus sensitive to climate change. However, because the tropics am diverse climatically, not all climate change will be negative. The historical evolution of landscapes shows that: (1) humans are important agents of change, (2) a landscape reflects human activity, (3) a natural landscape is impossible to identify, (4) a landscape does not return to its original condition once it changes, (5) the function of the landscape is more resilient than its species composition, and (6) each culture learns to value and treasure its own landscape. The management strategies for coping with global change must include the following: (1) looking at change from a global perspective regardless of the scale at which management takes place, (2) maximizing biomass accumulation on the landscape, (3) focusing on the biosphere reserve concept of UNESCO's Man and the Biosphere Program, (4) locating biosphere reserves in transitional life zones with protected corridors between these zones and maximizing the number of life zones with protected areas, (5) locating long-term ventures at the centers of life zones where relative climate change will be smaller, (6)

does not change, (9) focusing research and management activities on the proper time and space scales, and (10) managing the landscape to conserve its ability to respond to further environmental change and to support humans over long time periods, particularly in scenarios without fossil fuels.

INTRODUCTION

To discuss management of tropical forests in the context of global climatic change is paradoxical because tropical forests are subject to other types of environmental change that, then, make them agents of global climatic change. Global forces that impact tropical forests include the international economic system, changes in the structure and distribution of human populations, and an increasing impetus for the development of natural resources to satisfy human needs and wants. Because the area of tropical forests is finite, the expansion of urban, agricultural, and other human-dominated systems occurs at the expense of the tropical forest. It is fallacious to expect that all tropical forest lands and their species will be preserved. Land use patterns are changing in the tropics and will result in altered landscapes with smaller areas of mature forests and larger, developed areas of human-dominated ecosystems and damaged lands. These changes in turn affect the global environment and have the potential of inducing global climate change.

Management of tropical forests at a time of global climate change must consider two components of the problem: (1) forest response to climate and other global change and (2) forest effects on climate change. Forest response to climate change includes the many agents of forest change in the tropics as well as any synergy between climate change and the forest's capacity to absorb additional human impacts. In the short space allotted here, I will outline the elements of this paradox and suggest strategies for tropical forest management at a time of global changes of all kinds (climatic, land use, and human perceptions and actions).

DEFINING CHANGE

The Changing Energy Signature

Life on Earth depends on the continuous flux of energy and materials. All forms of energy and matter, powered mostly by the sun and directed by genetic codes within cells, organize and disorganize into the shapes and functions that we call ecosystems, All environmental factors such as light, temperature, rainfall, gases, and nutrients, contribute to the maintenance of ecosystems.

intensity and frqutncy of their &livery, and their synergy am **defined** as **tbe energy signature** of that surface. In **fact,** the energy signature is what is commonly called ***the environment,*** but it is useful to think of the environment in **terms** of an energy signature because: (1) it conveys the notion that the environment of a given place on Earth, **like** a signature, is unique, (2) it underscores that the driving force for the biota is **the** integral of all the factors that impinge on the system without denying that each factor has a role to play depending on its nature, intensity, and **periodicity;** and, (3) it provides a powerful analytical **procedure** to study the relationship between the biota and its environment, namely, the **use** of energy units to weight the **relative** importance of each component of the environment. For most organisms, particularly animals, their energy signature includes other living organisms. However, to simplify this discussion, I will use energy signature to mean the physical environment and wlll use biotic **response** to focus on the role of organisms.

The enormous diversity of ecosystem types in the world suggests that energy signatures differ over large spatial and temporal scales. Dramatic changes in ecosystem structure and function occur when the energy signature changes due to changes in the nature, intensity, and/or frequency of individual energy signature component**s).** For example, the **presence** or absence of frost, salinity, fire, or inundation causes enormous effects on the diversity, abundance, and function of organisms in ecosystems. But even without changing the nature of the factors that comprise the energy signature, variations in **the** intensity of a few factors can greatly influence ecosystem **structure** and function. Thus, tropical forest species diversity increases with increasing rainfall and **biotemperature** and reaches a maximum in conditions associated with rain forests ***(sensu*** Holdridge, **i.e.,** over 4,000 mm of annual rainfall and a mean annual biotcmperature of **24°C)**. Similarly, the structure of rain forests changes when the frequency of catastrophic factors such as &ought, heavy rains, or wind storms, change. Forest **structure** and biomass decrease when the frequency of these events **increases.**

There is no mason to dismiss **the** possibility that each square meter of Earth is **different** from all others because the energy **signature** converging on **the Earth's surface** is not the same from place to place. Any factor that comprises the energy **signature,** its intensity, or its frequency of **recurrence** is bound to change either in space or in **time** and, in so doling, change in some way the energy signature of the location. **The** extent of the spatial scale span in which **we recognize** organismic life on Earth ranges over 16 orders of magnitude, from **10E-8** m **(viruses)** to **10E7** m (the planet). Similarly, the span of the temporal scale ranges from nanoseconds for biochemical **reactions** to millennia for evolutionary and soil **forming** processes.

Science is limited in its understanding of life's properties at **all** of these **spacial** and temporal scales. Our understanding is **particularly** weak in the relations between organisms and their environments, in the clear separation of scales of time and space when analyzing these problems, in the **understanding** of synergy among factors and the biota, and even in the measurement of energy **signatures** at different scales of biotic activity. Because of these limitations, it is extremely difficult for us to assess the biotic implications of the climatic changes that are occurring in the world today. The situation is complicated further by the fact that human activity is also a component of the energy signature of most ecosystems, and its importance is likely to increase over time.

Our success in anticipating the correct strategies for dealing with global climate change will depend on analyzing the problem at the proper scale and not mixing or confusing scales of interaction between the biota and its energy signature. As an example, consider the issue **of** CO_2 enrichment of the atmosphere. One approach is to study short-term, individual plant response to increased CO_2. Such studies demonstrate increased photosynthetic output and changes in water use efficiency. These are important scientific contributions to understanding the response of individual plants as well as populations of plants **(spacial** scales of **10E-5** m to **10E1** m and temporal scales of minutes to months). However, they contribute very little information to understanding whole ecosystem and landscape responses to CO_2 enrichment (spatial scales of **10E2** m tolOE7 **m).** In this example. the population study is irrelevant to a global perspective because the net carbon exchange of the landscape is influenced by other processes not present at the population level (an ecosystem is more than the sum of its parts!). To answer the pressing question of how the Earth's biota **will** respond to increasing CO_2 in the atmosphere, experiments at whole ecosystem levels must be conducted over time **periods** that exceed years.

Furthermore, it is also important to consider synergy among components of the energy signature of ecosystems and avoid the temptation to **analyze** the problem as a single factor issue (e.g., temperature or moisture or atmospheric gases). Finally, because of the complexity of interaction and the enormous capacity of the biota to &al with change, it behooves us not to assume ***a priori*** that any climatic change will be detrimental or unprecedented. Either assumption is likely to be incorrect. Instead, the focus should be on understanding change and its implications for the functioning of the biota and for our own strategies for using resources.

FOREST RESPONSE

Forest Resiliency

Tropical forests are resilient. They recover rapidly from acute perturbation and they adjust, although in altered states, to chronic perturbations. Among the large diversity of tropical forest types, one can find examples of forests that have adapted to a multiplicity of extreme conditions including fire, hurricanes, salinity and tidal inundation, drought, and intensive harvesting. Over millennia the tropical forest biome has dealt with change, including catastrophic change, and has continued to thrive in spite of changes in its energy signature. The resiliency of the tropical forest cannot be ignored because biotic resiliency is the key to the design of successful strategies to deal with global climate change.

The bases for tropical forest resiliency are many. First, the energy signature of tropical climates appears to be optimal for the development of biological diversity. No other part of the planet supports as much biodiversity as the tropics. Some tropical forests appear to be particularly rich in species, and these locations are characterized by high temperatures and high water availability. Biodiversity, reaches minimal values in environments where the energy signature is dominated by stress factors that am extremely intense or recur frequently.

Species groups change when the energy signature changes beyond as yet undefined thresholds (meaning that certain species assemblages are not resistant to environmental change). Yet, in spite of this lack of resistance, high biological diversity provides the second basis for the resiliency of tropical forests. The greater number of species (both in terms of numbers of species per unit area within a forest type and changes of species groups in response to different energy signatures) provide resiliency to the ecosystem because they represent mote biological or genetic options to deal with environmental change. The genetic code of each species controls a suite of biotic responses to particular conditions of the environment. Therefore. the more species there are in a particular forest, the more capacity the system has to respond to environmental change. A corollary is that tropical systems have a high redundancy of biotic functions. This fact adds to the system's resiliency because, if a species disappears, the likelihood is high that there is another available to fill its niche in the system.

A third basis for the resiliency of tropical forests is their high rates of biomass and nutrient turnover. Tropical forest biomass turns over on an average of once every 30 yr or less. Even dry and cloud forests, with low rates of metabolism, turnover biomass rapidly because they have smaller biomass accumulation. The turn over of nutrients is usually faster than the turnover of biomass, particularly for limiting nutrients such as phosphorus. By turning over biomass and nutrients rapidly, tropical forests have the capacity to adjust metabolically and nutritionally to changes in energy signatures.

A fourth basis for the resiliency of tropical forests is the large amount of biological work involved in the system's nutrient and reproductive cycles. For example, many tropical forests are not limited by nitrogen as are temperate forests. One reason for this difference is the abundance of nitrogen-fixing organisms. Pollinators and seed dispersers are also extremely abundant and account for much of the regeneration of forests. The same can be said about the role of mycorrhizal fungi and de-composers which are responsible for tight nutrient cycles, an advantage for survival in high rainfall environments. The biotic control of ecosystem processes, another byproduct of high biodiversity, buffers tropical forests from environmental variability.

Finally, tropical forests derive resiliency from the process of self-design, a term used hem to describe the multidirectionality of successional recovery after perturbation. Assuming that sources of propagules are available, the diversity and rate of propagule input to a damaged forest site is usually much larger than the final biodiversity that the stand will sustain. The diversity of genetic input is the basis of self-design in natural and artificially regenerated ecosystems. It allows for competition for resources and for the eventual matching of plants and animals with the particular energy signature of the site. The final outcome of the recovery or rehabilitation is almost impossible to predict because there are many potential roads to maturity when so many species interact with the environment. If the site changes after the perturbation, the likelihood that exotic species will gain dominance over native species increases. Self-design does not allow prediction of the species composition of mature forest states, but it invariably results in familiar ecosystem functions. At the time of forest maturity, nutrient cycles will be closed, nutrient use efficiency will be high, primary productivity and respiration rates will reach predictable values, and forest physiognomy will be similar to that of the original forest.

Forest Fragility

Most public concern over the fate of tropical forests rests on forest fragility. Like all biotic ecosystems, tropical forests have limits of performance that, when exceeded, expose the system to change, degradation, destruction, or transformation to other states. These thresholds of tolerance are the basis for arguing that tropical forests are fragile. We must also understand the basis of fragility as another key to the development of successful management strategies for dealing with climate change.

If the energy signature remains unchanged, it is difficult to find a basis for the fragility of tropical forests because the forest would function normally within limits set by site conditions. But, as soon as conditions change, the system will react and also change. First, the response is internal. Rates of processes will change without any apparent external effect. Eventually, changes in rates of processes materialize in the health and status of organisms and populations. The result can be species substitutions and, eventually, fundamental changes in the ecosystem. These changes can occur within the context of a forest. They can result in a different kind of forest, or if the change is radical, the nature of the ecosystem itself may change to something else such as a grassland, a lake, or a shrubland.

The characteristics of tropical forests that give the system resiliency are also the most sensitive ones to drastic changes in energy signature. For example, biodiversity is likely to change if rainfall or temperature change significantly. Biomass storage and gross primary productivity are also sensitive to climatic change. All three ecosystem parameters decrease with decreasing water availability as a function of temperature and precipitation. If either of these three ecosystem parameters change, so will the total amount of work that the system can perform. However, we don't know the magnitude of the possible change. And, changes in biodiversity, gross primary productivity, or biomass accumulation as a result of changes in the climatic energy signature need not always be negative. For example, drainage of a wetland is lethal to wetland species but can result in a more productive and species-rich bottomland forest. In short, a negative change for one system may be positive for another.

The evaluation of ecosystem change as positive or negative, or of forest characteristics as indicators of resiliency or fragility quickly becomes an exercise in value judgement, impossible to reconcile scientifically. A consideration of landscapes illustrates this point.

Human-Dominated Landscapes

The landscapes of Earth have changed considerably over the millennia. In fact, change has been so prevalent that it is fairly ible to such understanding for most landscapes. It is becoming increasingly obvious that landscapes have changed dramatically over time, particularly since the significance of humans as catalytic agents of change increased Human activity changes the energy signature of vast land areas forcing the biota to respond to the evolution of human culture, energy use, and technology. In some instances, a new biota is introduced to replace the native one, or new environments are created in which exotic species displace natives. Seldom, if ever, do landscapes return to their original species composition after a major disturbance.

As an example, it is known that vast areas of tropical forests in response of the islands landscape is still in progress. For example, the canopy of the secondary forests that emerged after agricultural fields were abandoned is dominated by species used by people. The original forest cover was almost totally deciited by the agrarian life style. Yet, the understory of this agrarian forest is composed of native species reminiscent of the species composition of forests prior to agricultural development. Today's understory species will form the canopy of tomorrow's forests. '

However, the original forest will never be restored in Puerto Rico. The present landscape has gained a significant fraction of exotic and naturalized plant and animal species, has lost native plant and animal biodiversity. has probably lost many types of forests but gained new ones, and has a new proportion of developed to undeveloped lands. The island changed from 100 percent forest cover to mostly forested lands during the dominance of indigenous people. Agrarian people reduced the original forest cover to less than 10 percent, with about 1 percent in virgin condition and the rest as managed forests, usually coffee shade. Today, the fossil fuel economy is reaching an apparent balance of 35 percent forest cover in the landscape..

The historical lessons are. clear. Change in the landscape's energy signature is accompanied by irreversible losses, but also by gains. Species will be lost and resources will be commuted irreversibly to accommodate the people's life styles. But new groups of species will form different kinds of forests, and a new landscape will evolve which is consider& beautiful, useful, natural, and valuable by many. Humans have the opportunity to determine where the net balance between developed and undeveloped land should be as well where the wilderness will be located. Through management of the energy signature, people can influence the nature of the new landscapes. The resiliency of natural ecosystems assures both a continued partnership with people and familiar forest physiognomies performing familiar functions and continuously adapting to change.

Will all this historical legacy change with expected scenarios of climate change? Will future changes in the energy signature be unprecedented? Catastrophic? Change the rules of the game irreversibly? The answer to these. questions appear to be: "It's unlikely, but no one is in a position to provide answers with certainty." The best we can do is to adopt management strategies that will increase the probabilities that landscapes can adjust regardless of the magnitude or direction of climate change. And, we must conserve landscapes in states that are as close to optimal for our long term survival as possible.

FOREST EFFECTS

Tropical Forests as Agents of Climate Change

Tropical forests influence the worlds biogeochemical cycles and climate because of their large **area (equivalent** to **half** of the world's forests and about 25 percent of the world's ecosystems), the **magnitude** of their carbon storage and water yield, and the rapid turnover **rate** of organic matter and nutrients discussed above. In the absence of human influence, tropical forests were probably sinks of carbon and nutrients and greatly accelerated the flux of water throughout the world. Experiments with closed **terrestrial** microcosms suggest that different mixtures of plant, animal, and microbe species reach **different atmospheric** steady states **relative** to CO_2 accumulation. **These** experiments support the ides that the **biota** gives feedback to its energy signature by influencing the atmosphere and biogeochemical cycles. Studies of water and cloud movement over the **Amazon** basin support a similar conclusion relative to biotic influence over the water cycle and heat balance. Accumulation of fossil fuels further illustrate the ability of the biota to influence the **biogeochemistry** of the world

Human influence over tropical forests has a twofold effect on the global role of forest lands. The most studied is the creation of atmospheric carbon sources as a result of deforestation, oxidation of exposed soils, and **burning** of biomass. These processes increase atmospheric CO_2 and contribute to global warming. Yet, at any time, these activities of humans occur in a small fraction of the total tropical forest biome. About 1 percent per year of the tropical biome is so affected. The largest fraction of the biome is either recovering following human perturbation, supporting mature tropical forests, or being converted to other uses such as pastures. This dominant sector of the landscape has not been properly **evaluated** relative to its contribution to the global carbon balance.

There are solid arguments to support the notion that most of the tropical biome is an atmospheric carbon sink. The sinks occur in the following sectors of the biome: (1) wood accumulation in rapidly growing secondary **forest** stands and in slower growing mature stands, (2) soil organic matter accumulation in secondary forests and pastures (pastures and grasslands accumulate **enormous** quantities of soil organic matter, sometimes more than the original forest they replaced), and (3) runoff leaching from moist, wet, and **rain** forest life **zones. The sum of all these potential sinks add** up to **>1Pg C,** or the same order of magnitude as the carbon production by deforestation.

More research is n&d on the function of tropical forests as sinks of atmospheric CO_2. It is not obvious that the function of the whole biome is **detrimental** to the carbon balance of Earth. Tropical forests do play **a** positive role in climate control, and any management strategy must preserve the positive roles of these forests.

MANAGEMENTSTRATEGIES

Dealing with Global **Change**

The main cause of global change today is the energy use strategy based on fossil fuels. Because of the way energy is used, all components of the biosphere are changing in response to a new energy signature driven by fossil fuels. Change is occurring in the **atmosphere,** landscape, and oceans. A fundamental principle of tropical forest management must be to maintain future options of energy supplies in the form of biomass. Maximizing biomass storage in forests not only helps today's atmosphere but, more importantly. builds up needed cellulose supplies for the future when fossil fuels will cease to be cheap and easily available.

AU **forest** management actions must have a global perspective, even if management plans address mostly local management issues. The context must be global in recognition of **the** need to maintain the landscape as a buffer to human activityon the planet While it is clear **that** forests are not the main culprits in the gaseous changes taking place in the atmosphere., it is true that, if not properly managed, they could greatly exacerbate the situation.

In order to preserve biodiversity, it will be necessary **to increase tbe area of tropical forests under direct management.** Current preservation dogma would argue against such a strategy in the false believe that **management** and biodiversity are incompatible. The experience in the tropics says otherwise. Unmanaged lands are abused and eventually overutilized. More tropical forest lands must come under scientific management **requiring** a complete overhaul of forestry institutions and pmfessionals.

The biosphere reserve concept of **UNESCO's** Man and **the** Biosphere Program should be adopted as a guiding concept for tropical forest management. The following principles of biosphere reserve management are appealing in this global context: (1) most of the land is dedicated to a core for the **preservation** of biodiversity. (2) uses of diffennt intensity are separated geographically, (3) human uses are allowed under the proper controls and in locations that facilitate sustainability, (4) intensive uses are recognized as **necessary** for human welfare (we need high yielding systems!),but they are buffered and located far from the core area for preservation, and (5) the management of **whole landscape units with people as integral parts of the landscape is encouraged**.

Dealing With Shifts in Life Zones

Current climatic models are uncertain about the extent and location of future climatic change. A safe assumption, ***however, is*** that boundaries of life xones (*sensu* Holdridge) or Holdridge's transitional life xones are more likely to show the effects of climate change than the center of the life zone. A given change in climatic parameters may shift transitional conditions from one type of life zone to another, while the same change in the center of the life zone may not be enough to change the life zone. From such scenario two management strategies emerge. First, the designation of biosphere reserves should include as many life xones as possible with protected corridors connecting life zones. Such a strategy maintains a biota adapted to climatic diversity, an insurance for coping with climate change because the associated pool of bindiversity will be broad enough to provide resiliency to change. Second, and in contrast to the strategy for biodiversity protection, long-term land commitments that involve capital intensive projects, such as irrigation canals, dams, or intensive plantations, should be located at the centers of life zones where conditions after climatic change are likely to be mom similar to initial conditions than at the periphery of a life zone. The worse scenario is to build a system that is dependent on the energy signature of a given life zone and have the life zone change midway through the project's life expectancy.

Dealing With Changing Frequencies of Climatic Factors

The temporal dimension of climate change must be addressed with management strategies that also involve temporal adjustment of human activities. Thus, the design life of structures and rotation time of yield systems become the principal tools for the management strategy. Examples would be either the shortening or lengthening of tree rotations in forestry activity depending on whether catastrophes have shorter or longer return times, and the design of culvert or flood control structures for different frequencies of events. Similarly, humans should buffer with vegetation those habitats that change quickly under *scenarios* of climatic change. Examples are riparian zones and stream channels. Like so many other strategies for dealing with climatic change, these suggestions make sense even in the absence of climate change. Thus, an underlying philosophy of land management for climatic change is to conduct sound land management practices which have inherent value in themselves even if the climate does not change.

THE SOIL RESOURCE: CHALLENGES AND PERSPECTIVES FOR THE 1990'S[1]

ECA RUNGE'

It is very good to be back in Puerto Rico. The last time I was here was the Tropical Soils Workshop which was held in August of 1969. A few of us Arvel Touchet, David Petri, B.L. Allen and Fred Beinroth were on that trip. I am very pleased to have the opportunity to speak to you on the title "Soil Resources: Challenges and Perspectives for the 1990's". I have divided my talk to you along several topics: Soil Research, Agricultural Sustainability, Economic Impact of Reduced Chemical Use, Soil Erosion, Demand Enhancement of Crop Commodities, Our Land Grant System and Our Future.

SOIL RESEARCH

Soil research must be first of all good science and soil use and interpretations must be based on fundamental relationships basic to soils. We are judged by our peers in a number of ways. First of all the time it takes to complete the problem or the task is one judgement, the number of people that it takes to carry out the task is another, and the money that it takes to complete the task is the other. We are expected to minimize the time, the people and the money necessary to carry out and solve any particular problem. Finally, no research problem is complete until it has been published and shared with our peers.

Soil research must be relevant to society's concerns and perceptions. This has always been true, but this is particularly true for the 1990's. I feel the 1990's will go down in history as the quality decade; water quality, food quality and air quality. Soils play a major role particularly in water quality. We know that soils can ameliorate chemicals that are added to control various weeds, insects and diseases and render them nontoxic to percolating water and the environment. The microorganisms in the soil plus wetting and drying actions in surface horizons break down organic debris and related organic and inorganic compounds as part of soil development.

We all remember the food quality scare, based on alar last year. While this was a media event, it certainly forewarns us of the concerns people have for what we do as agricutturalist's and soil scientist's The U.S. Congress is in the process of passing an air quality bill, which is designed to clean the air, particularly in our congested cities such as Houston, Los Angeles, Denver, etc. The 1990 farm bill will have an expanded focus on environmental concerns, particularly water.

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[1]Keynote address for the 1990 Southern Regional Technical Workshop Planning Conference, San Juan, Puerto Rico. June 18, 1990.

[2]E.C.A.

AGRICULTURAL SUSTAINABILITY

Another current concern is agricultural sustainability. Earlier we referred to Low Input Sustainable Agricultural practices, however, that earlier concern Is currently referred to by most people under sustainability issues. We all recognize the need to use inputs to make soils productive. For example, without fertilizer we would not have food surplus', but rather may be concerned about where our next meal would come from.

For agriculture to be sustainable, it must be economically feasible. Any practice that is not economically feasible will not be carried out. If it is economically feasible, we also need to minimize any insult to the environment for Input practices that are adopted. Practices can be designed so input use does not insult the environment. We refer to these practices now as Best Management Practices (BMP). Soil scientists have a major role to play in determining what **BMP's** and Integrated Crop Management Practices **(ICMP)** are adopted. SCS Is one of the lead agencies in determining farmer compliance to the **'85** farm bill. The 1990 farm bill **will** no doubt increase agency responsibility in these areas.

Let's take a look at history. How did we get to where we are on science and sustainability issues? I summarize the impact that science and technology have had on agriculture by ERAS.

The **Mechanical Era** started with the industrial revolution, but it didn't really affect agriculture until the turn of the century. Our machines have lead to a large reduction of laborers in agriculture.

The Plant **Breeding Era** started with **Mendel** and earlier, however, plant breeding as we know it today began having major impact on U.S. agriculture with hybrid corn. Plant breeders were at a disadvantage until the **Fertility Era** came along because they could not evaluate the genetic potential of their cultivars.

The **Fertility Era** started when manures were added to soils, but it was not until the closure of munitions plants in World War II that cheap nitrogen fertilizer became available in large quantities at favorable prices such that it could be applied to crops and increase production tremendously. Other nutrients are important, but cheap nitrogen in balance with other nutrients lead to higher yields of important crops.

The **Herbicide. Fungicide and Insecticide Era** started after World War II. DDT and **2-4D** were among the earliest chemicals In this era. We now have more effective herbicides, fungicides and Insecticides that can be utilized at lower rates and in more selected ways. They are often more environmentally friendly also.

The **Information and Biotechnology Era** began in the eighties. This era is affecting all of us at the present time and promises continued increases in crop productivity and labor.

The **results of all these eras, changes** in agricufture, have been to substitute labor used on the farm for purchased inputs and labor from off the farm. If we reevaluate any practice at the present we will need to understandhow we have substituted on farm labor for off farm inputs and labor. **It** will be impossible for agriculture to follow the practices used in the thirties and supply needed food and fiber. According to David Garst, President of Garst Seed Co., **it** took thirty minutes of labor to produce a bushel of corn, but today we can produce a bushel of corn with a fraction of a minutes labor.

Naturally **occuring** soil processes degrade toxic chemicals used in some of our agricultural production systems to non-toxic forms. We need to tell people this. Many people in our society are convinced that agricufture uses too many chemicals and/or uses them irresponsibly. What is the role of the **soil** scientist in this area? First of all we need to make sure that agriculture is environmentally responsible. It is our responsibility to obtain the necessary data and then make sure these data are utilized in the decision making process. Obviously we cannot generate all the data that is needed in a short period of time. We will have **to extropolate** data from one soil to others based on our knowledge of soils and soil processes. We need to be involved.

The Soil Conservation Service has a major role in rating soils for various uses and practices. You obviously have deadlines to meet and have inadequate data bases for the task. Even though you footnote your ratings saying that they were based on minimal data and that many of the ratings have been **interpollated,** it is usually ignored. In other words, the user of your data does not recognize that you have interpreted the soil rating from a meager data base. You find yourself in a "Catch 22 situation, you have to make the rating with little data and then the user forgets that you told him that.

ECONOMIC IMPACT OF REDUCED CHEMICAL USE

I would like to share with you the projected impact of reduced chemical use on crop production. My comments are based on the bulletin Economic ***Impacts*** of Reduced ***Chemical Use*** by Knutson, Taylor, **Penson** and Smith. This publication was just published in June 1990 and is the best information we have on what would happen to crop production if chemicals were substantially reduced in our agricultural production systems.

The authors concluded that consumers would spend $228 more per year per household if pesticides were curtailed and $428 more per year per household if pesticides and nitrogen fertilizer were curtailed. Food price increases would be in double digits similar to what they were in the **1970's.** Exports would be expected to drop **50%** or more for grain and cotton. Cultivated acreages are expected to increase 10% and erosion would increase. Crop producers **would** have increased incomes, but livestock producers would have decreased incomes. Crop production in the Southern states would decrease more than it would in the Northern states because of more insect, disease, and weed problems. Crop yields would fall and unit cost of production would increase.

Let me share with you some of this data. Crop producers would have an increase in income from $13.3 billion to 20.6 or 29.9 billion, while livestock producers would have a decrease in income from the present $25.7 billion to 16.6 or 13.2 billion. Corn production would be decreased in the north by 46 % and in the south by 72 %. Soybeans would be decreased by 33 % in the north and 51 % in the south. Rice would be decreased by 61 % in Arkansas and 72 % in California. Peanuts would be reduced 72 % on the High Plains while they would be decreased 79 % in the southeast. Stating this another way, corn would be reduced from 32 to 53 % and the unit cost would go up from 27 to 61 %. Soybeans would be down 37 % and unit cost would be up 45 %. Wheat would be down 24 to 36% and unit cost would be up 33 to 50%. Cotton yields would be down 39 to 62 % and unit cost would be up 54 to 116 %.

Obviously society must make decisions where many trade-offs must be considered. We need to first of all inform people what chemical/environmental problems exist and if they are concentrated in certain soil areas. We also need to tell them that we have done a considerable amount to reduce erosion on more sloping lands by increasing production on flatter lands and if we reduce production on the flatter lands, we will have an increase in erosion because we will have to farm more steeply sloping and less suited lands. BMP's must be tailored to specific soils and sites and will reduce environmental problems to acceptable levels in most instances.

SOIL EROSION

There is a lot of concern about soil erosion, particularly in the press. I imagine many of us have stood on the Mississippi River banks in New Orleans and have seen the plaque which tells you how many tons of soil are moving by per unit of time. The next question should be what can you and I do to reduce the amount of sediment in the Mississippi River at New Orleans? Actually we cannot do anything, because the energy of the water is such that it will pick up sediment if it has too little sediment and will deposit sediment if it has too much. The Corp of Engineers shape and maintain navigable river channels using such principles.

Obviously erosion is very important and we need to do everything we can to minimize it. Practically all erosion control devices and practices are designed to store the water in the place where it falls for a longer period of time. The water is either discharged over a longer period of time from the landscape or more of it infiltrates the soil. Once water is concentrated in the stream there is very little we can do from an erosion control standpoint except put in large lakes, such as the Corp of Engineers has done on many of our rivers to control flooding down stream.

We also need to realize that the Conservation Reserve Program, the Swamp Buster Program and the Sod Buster Programs of the 1965 farm bill are politically popular because they reduce excess crop production capacity under the name of preserving soils for the future. We need to endorse this; on the other hand we need to realize that many of these soils could be farmed with suitable BMP's if we needed the production for daily sustenance for people, animals, export or alternative uses such as ethanol.

DEMAND ENHANCEMENT OF CROP COMMODITIES

I would like to share with you a study that I have participated in with several of my colleagues at Texas A&M. We have studied demand enhancement as an alternative to supply control of major crop commodities. The most recent talk I gave was to the National Ag Leadership Conference in Washington, D.C in April. The title of my talk was "A New Paradigm for Agriculture: Demand an Alternative to Supply Control". We reasoned that if you can't predict the weather, you can't predict the supply of rain fed crops. 1966 was a good example of the disparity over what was expected and what was actually produced. We calculated that considerable amounts of money could be saved by shifting to a demand enhancing program verses our present supply control program and have many positive spinoffs for the US. Susan Wasson, an August 1990 M.S. graduate in Agricultural Economics at Texas A&M University, has calculated that using excess corn to produce ethanol is 6 to 9 times less expensive than deficiency payments. I will be happy to furnish you with copies of our studies. The only way to demand enhance current excess production is through ethanol and possibly ethyl-tertiary-butyl-ether (ETBE).

If we could remove the grey cloud of excess crop production hanging over those of us in production agriculture, we would enjoy a much more rational evaluation of how science impacts agriculture and how society benefits from the application of that science. Hopefully the future will allow us to do this.

OUR LAND-GRANT SYSTEM

Let's not forget our heritage. The land grant system was founded on the premise that we were to help the general mass of people obtain a better life through teaching, research and extension. We have done very well. We serve a pluralistic clientele base. We are very different from engineers who serve narrower clientele bases. We need to realize that our strength is the support we receive from our clientele base, from our students and from the general public because we help them solve problems that lead to a better life, a better and less expensive food supply, etc. Only 12% of our income is spent on food, the lowest in the world -- a tremendous achievement.

OUR FUTURE

Soil research for knowledge sake will continue but will have more meager funding than it has had in the past. Soil research funded along specific disciplinary lines will also be meager and research to support Soil Taxonomy will have similar difficulties. On the other hand, soil research that helps solve practical problems and is relevant to today's issues and concerns will be relatively generously funded. I believe it is relatively simple for soil scientists to consider themselves environmental soil scientists, where we utilize our science to solve relevant problems. Engineers have been doing this as a way of business for many, many years. If we adopt such an approach, we will increase our standing among our researchers as pedologists, as soil scientists, etc. Lets make some of these changes, it is in our best interest.

In the Cooperative Soil Survey Program, we spend a lot of time analyzing soil properties so we can make ratings for various uses. These are static interpretations of soils. On the other hand, we do **very** little to interpret soils in a more dynamic way. Obviously "Washington" would like to have all our soils interpreted uniformly so they are in a position to answer questions that come to them relative to soil and land use, environmental concerns, etc. On the other hand, indivlduals need contact with you so we need to have you in a more dynamic union with the people who have problems that can be solved by applying our knowledge base. We need to foster more dynamic recommendations in our soil survey program than we have. **I** hope that we make strides to do so. **It** is essential if we expect broad-based support.

Another part of our future is our students. More correctly, our students are our future. We need more of them, we need to prepare them better and we need to give more attention to undergraduate students in addition to graduate students. For years I have exit interviews with most of the students graduating with Bachelors of Science degrees from our department at Texas A&M. I have several standard questions that I ask them. Did you get your money's worth? Did we help you gain the self confidence that you need to take on the challenges of the future? As I visit with our graduates, it is easy for me to single out those graduates who have experience beyond course work. These students have worked for professors in the department on an hourly base or have summer work experiences or other part-time jobs. These students have more self confidence than do those students not having these extra experiences. They will be more successful in their careers and make major contributions to societies well-being.

We have need for a curriculum in Environmental Soil Science at Texas A&M. We are taking actions in that direction now. We also have a need for a Master of Agriculture similar to a MBA where we bring in graduates who have been on the job for several years. We need to more adequately round out their education so they can be more valuable to their employers, be more valuable to society as a result, and earn additional income.

Another question we need to ask ourselves is what do employers expect of our graduates. Obviously they expect more science, more experience, more self confidence, better leadership skills, better abilities to present themselves in front of groups, better understanding of business practices, etc. In short, they would like to have your 25 years of experience available and incorporated in the undergraduate as he leaves college. At the age of 21 or 22 this just is not possible. This means we need continuing education efforts more specifically targeted than we have in the past.

We need to be aware that we are of service to others. **I** mentioned **BMP's** and their site specificity. Rating soils on their potential to ameliorate chemicals without insulting the ground water is very Important in today's society. Our soil surveys continue to be under utilized. We need short courses to train people to use our soil surveys. In short, we need a more dynamic interpretation and interactive program than we have.

As President of Soil Science Society of America and more recently the American Society of Agronomy I have become involved in our ARCPAS program. ARCPAS is the American Registry for Certified Professionals in Agronomy, Crops and Soils. We are fortunate that the American Society of Agronomy has ARCPAS, not all societies have such a registry. For example, **Horticulturalists,** Weed Scientists, Range Scientists and most other disciplines do not have such registries. Members of these registries need continuing education oppurtunities. We need to update them and us. We need to be teachers as well as pupils.

SUMMARY

We need to spend more time thinking about and developing ways we can enhance the skills of our graduates on a continuing basis so they become more effective, more valuable to their employers and to society. We need to be less insular in our discipline. We need to listen to the needs of others. We need to wear the shoes of the clientele we serve. We need to insure that our colleagues have the self confidence to do more than they expected, to be more effective than they thought they could be, and to be more involved in more aspects of the soils universe which we know better than anyone else. We need to let people know that we know more about the top 2 to 5 meters of the earths surface than anyone else and design an effective and relevant education and interpretation program for them to utilize our expertise.

Soil is everywhere. Common things do not make the news. We need to be more dynamic, less static as well as less uniform in our interpretations. We need to balance uniformity with creativity.

I have enjoyed the chance to share these comments with you and look forward to interacting with you throughout the week.

Committee I Report 1990

Committee I - Communications in the National Cooperative Soil Survey

Committee Members:

Glenn E. Kelley, Chairman
Wayne H. Hudnall, Co-chairman

G. Acevedo	D. R. Mapes
M. Davis	J. C. Meetze
B. R. Brasher	D. L. Newton
H. Eswarn	J. D. Nichols
T. R. Gerald	J. Ragus
W. Henderson	W. Roth
A. Hyde	E. Runge
D. L. Jones	B. N. Stuckey
J. A. Kelley	L. west
J. Baker	H. Mount

Committee Chrge:

Propose **ways** to improve effectiveness of communications in the NCSS.

(a) Communications within scs-Soils and closely related disciplines.

(b) Communications between cooperators.

(c) Communications **between NCSS** and **associated agencies,** societies and closely allied sciences.

Purpose:

The purpose of the committee is primarily a fact-finding committee thatwillmake recommendations on how to improve communications among NCSS participants and users.

Approach:

The committee chairmen drafted a questionnaire that was distributed to all those on the southern regional soil survey work planning conference mailing list (105 individuals). There were 47 questionnaires returned or 44.760.

Results:

The results are organized as follows:

A. Summary of the questionnaire.

B. Recommendations based on the questionnaire and discussion at the conference.

(a) Summary of the questionnaire.

To the best knowledge of the chairman, there was at least one individual affiliated with each organization listed. The following is a tally of those who returned the questionnaire and their affiliation.

I. Affiliation

1 SCS staff, Washington
2 SCS staff, Lincoln
___ SCS staff, SNTC
27 SCS staff, state office
___ USFS staff, national
1 USFS staff, regional
7 University, land grant
2 University, non-land grant
ARS
TVA
7 Other, please specify ________

2 National Cartographic Center
1 **USFS -** Research
1 **USFS -** Forest Level
1 State Department, Soil Survey Section
2 Did not understand question

47 Total

II. Do you receive the information you need from the following in order to perform your duties. (yes or no as appropriate)

In general most individual and agencies received the information needed. There were some *no" responses. The least information is sent from the USFS, ARS and TVA. Many individuals did not know how or what the agencies contribute to the NCSS program.

III. The responses to what individuals are not receiving.

There were 25 responses. They have been summarized according to: 1. SCS, Washington, Lincoln and SNTC, 2. SCS and university laboratory, 3. U. S. Forest Service and 4. all other.

1. Soil Conservation Service, Washington, Lincoln and the South National Technical Center.

Since the realignment of the NTC's and the creation of the National Soil Survey Center, the Washington office does not seem to have the personnel or expertise to respond to inquires from states and individuals as efficiently and effectively as they did in the past.

It is very difficult to know who to call for what. By the time one determines who has the information, it is often too late to conveniently meet established deadlines.

It seems that these three groups are not sure of who is responsible for what or that one thinks the other will distribute the information. As a result the information is either not sent, sent late, or sent to only a few.

2. Soil Conservation Service and University Laboratories.

Lab data from these facilities are not distributed as quickly as they are needed. Often they are not received in time to make key decisions.

University research and laboratory reports are not received. A better distribution system needs to be implemented by the universities so that other state and federal agencies are included in their mailing lists.

3. U. S. Forest Service

Very little information is sent to universities and other cooperating agencies.

There is no organizational chart furnished to cooperators and it is difficult to impossible to find out whom to contact for information.

4. Others

ARS, TVA, EPA and other federal and state agencies that are cooperators in many states. Information generated by these cooperative projects could be useful to many other states, There does not appear to be an effective distribution system for the reports that result from these projects.

The non-landgrant universities cooperators are productive and generate data and information that is useful to other states. The information is sometimes circulated within the state, but should be distributed more widely.

There is not a direct cooperative agreement with TVA, EPA. ARS and other federal and state agencies nor private companies. A change in this arrangement could be beneficial.

Many times soil survey cooperators forget that there are others who assist and contribute to the cooperative soil survey, i.e. cartography, remote sensing and data processing. Sometimes, they do not receive information they need to efficiently assist the total program.

IV. What means of communications do you use to distribute information?

66%	Electronic BITNET, TELEMAIL, FAX, TXMAIL, FSDC, 3SD, Async, telephone
58%	Yearly Calendar - APO
29%	Monthly Calendar
8%	Weekly Calendar
92%	Verbal
44%	Bulletins, Newsletter, etc.
%	Other, US Mail, publications, memos, Work planning conferences.

Which are the most effective?

1. Verbal, 2. Electronics with hard copy, 3. APO, 4. Bulletins,

5. Letters, 6. Monthly calendar

V. What means of communications are used to furnish you information.

60%	Electronic, BITNET, TELEMAIL, FAX, Voicemail, TXMAIL
62%	Yearly calendar
%	Monthly calendar
4%	Weekly calendar
94%	Verbal
50%	Bulletins, Newsletter, etc.
35%	Other, U.S. Mail, publications, memos

Which of the above are the most effective.

1. Verbal, 2. Electronic with hard copy, 3. APO, 4. Letters, 5. Bulletins

VI. States in the southern region that have soil scientist organization, published a newsletter and the frequency it is published.

Alabama	No	
Arkansas	No	
Florida	Yes	once each year
Georgia	Yes	quarterly to members
Kentucky	Yes	once or twice each year
Louisiana	No	organization nor newsletter
Mississippi	No	
North Caroline	No	
Oklahoma	Yes	three or four times each year
Puerto Rico	No	
South Carolina	No	
Tennessee	Yes	once each year to members
Texas	Yes	quarterly newsletter to members
Virginia	?	

VII. Some regions have a regional newsletter.

39 yes Would you contribute information?
19 yes Would you assist in the preparations of a newsletter?

VIII. Should the NCSS cooperators be linked via some electronic system?
35 yes 72.9%

Would having access to the USDA-SCS electronic system be useful?
32 yes 66.7%

Would having access to the USDA-USFS electronic system be useful?
19 yes 39.6%

List the system(s) of electronic mail available to you.

Telemail 22, Bitnet 7. FAX 7. USFS 2, Soilnet 2, Async 2.

Are their other systems that would be useful to the NCSS?

Soilnet 6, Bitnet 5, Telemail 5, Async 2, Email 2, Grassnet 1, 3SD.OK, Soils.OK, GIS.OK, TXMAIL and Blest.

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Summary:

The overall communications among NCSS cooperators is in need of improvement. Within some state the communication is good to excellent end is a result of cooperators committed to see that communications channels remain open. This takes a concerted effort on the part of all parties. Communication is certainly a two-way line.

Communications between states, national agencies and universities are poor.

Recommendations:

2. It is recommended that the steering committee to the National Soil Survey Work Planning Conference consider establishing a committee to address apparent problems in communication within the National Cooperative Soil Survey. Of particular concern is distribution of technical policy and guidelines. This committee. should also consider broader circulation of newsletters issued by GIS, water quality, technical divisions of NSSC, etc. and to evaluate any appropriate electronic mail system that would be compatible to NCSS cooperators.

It is recommended that this committee by discontinued, but re-evaluated every 4 to 6 years to determine if it should be reactivated.

COMMITTEE 2 - SOIL DATA BASES FOR GIS

Committee Members:

B.L. Allan
Richard Babcock
Ken Bates
James Baker
Pete Biggam
Mary E. Collins, Chair
William Craddock
Jerry Daigle
Don Eagleston
William Edmonds
Hari Eswaran
Richard Folsche
Charles Fultz
Talbert Gilbert
E.N. Hayhurst
Wade Hurt
A.D. Karathanasis
Paul Martin
Frank Miller
Ken Murphy
Dan Neary
Darwin Newton
Joe Nichols
Jerry Ragus
Ray P. Sims
B.R. Smith
Horace Smith
Carter Steers, Vice-chair
B.N. Stuckey. Jr.
B.A. Touchet
Billy Wagner
Orville Whitaker
R.L. Wilkes
DeWayne Williams
Roy Vick

Charges:

1. Assess the impact and requirements of GIS methodology for land use planning and natural resources management relative to the soil survey data base with particular emphasis on:

o. The detail. accuracy, and consistency of primary and secondary soil data,

b. levels of generalization for interpretation at different scales, and

c. update procedures.

2. Recommend improvements.

The Decade of Opportunity for GIS:

The Decade of Opportunity for GIS - This is what the computer industry is calling the **1990's.** The phase could be expanded to "THE DECADE OF OPPORTUNITY FOR SOIL SURVEY DATA BASES IN **GIS."** It is estimated that this year **$1** billion will be spent on GIS. Hardware and software will represent only 25% of the total cost; data conversion and capture - 75%.

In the **1970's** everyone wanted to put the soil survey maps on the computer for various interpretative uses. The grid scale was in the neighborhood of 10 acres. Both commercially available hardware and software limited our progress. The 80's. it seemed, was a decade of change.... change in the sense that new hardware and software were available every week. Your computer was outdated before your order was delivered. You couldn't possibly keep up with what was on the market. Changes in software and hardware will still take place in this decade but these changes, we hope, will not be as disruptive.

What is Happening in GIS?

The answer to this question depends on the state, the agency, and what may be the most important factor, the funding associated with the GIS. The following is paraphrased from the responses.

Charge *1.*

A. Assess ***the impact and requirements of GIS methodology*** for laud use *planning* ***and natural*** *resources* ***management relative*** *to the soil survey* ***data base with particular*** emphasis on: ***A. The detail,*** accuracy, and ***consistency*** of ***primary*** *and* ***secondary*** *soil* ***data.***

Digitizing process is contingent on the hardware and software. Is the system of raster or vector data capture method? How are the data converted from one type to another?

The detailed soil survey is the most accurate and useful layer in a **GIS** for land use planning. But the standards for accuracy, detail, and consistency for special data require high technology, expensive equipment, and highly developed skilled personnel. This accuracy and detail is at a higher level than required for gathering soil data. The problem with GIS is that there is an implied assumption, probably psychological, of accuracy with the soils data.

University

Florida'

way you can built an historical record of the data. The University of Florida will be involved in "error studies" of the entered data.

Committee Recommendations:

Recommend that the responsibility for detail, accuracy, and consistency of primary and secondary data end when a physical copy is given to the user. Also, that documentation associated with the data be given at the same time.

B. Level of Generalization for Interpretation at Different Scales

Levels of generalization has long been a point of discussion. General soil maps are biased into groups such as landscape assemblages, slope sets, and vegetative associations. These map units should be tested and consistent characteristics determined and described.

We must continue to inform the users of our data that soil information is scale dependent. If a user misapplies or misinterprets our data, how do we advise them correctly? We need recommendations or guidelines on scale-dependent relationships.

As with any scale-dependent data, the ability to interpret accurately decreases as generalization increases. How do you **generalize** the tabular information? It may be necessary to input the data at several levels, beginning at the series (or map unit) then detailed association information, and finally a county-wide association level.

SCS is currently developing **STATSGO.** This is soils data by map unit, by soil association. Also, SCS has NATSGO. This generalizes soils data by land resource areas. Are these data bases of value and being used?

Committee Recommendations.

Recommend that the user know the level of the map scale and that the minimum delineation be specified, as well as a reliability statement.

C. *Update Procedures*

Who will be responsible to renovating the information? Until now soil scientists have had complete control of this data. With a larger percentage of the private sector building **GIS** systems and employing computer models to use and interpret ***our*** soils data, we are rapidly losing the close control we had on our product. In the future our data must be able to stand-up by itself no matter who uses it or the method in which it is used. Simply put, we must exhaust all avenues available to get the best data collected to users in a format that is easily utilized and understood. We can only look at the near future for improvements and most of the suggestions/comments (improvements) will be from our users.

Therefore, these questions arise. Whose property is the digitized data after the soil maps are digitized? Does the SCS have access to the data? Any charges? Who decides when an update is needed and who will be responsible for seeing that everyone gets the updated data? Can a county change the data on their own?

Committee Recommendations.

Recommend that the update procedures currently used be continued. Also, that a disclaimer state that this information is subject to future updates.

Charge *2. Recommended Improvements.*

Hardware Software **Developments - Because** of further advancements in the 'wares' and optical storage, the "trade value" of these data bases will increase exponentially. The number of software programs used in GIS has increased. In **1988** a survey was made of GIS software available. Sixty-two systems were reported, but not all were "true" information systems.

The soil data base must be expanded to included categories and interpretations not currently in use. Improvements must be made in ***conversion*** software.

The **GIS** systems used in the region should be compatible. Are there advantages of GRASS **vs** ARC INFO or other GIS systems?

Diffusion of GIS Information - GIS information will/must spread. In a S-shaped diffusion curve, **GIS** is only in the early "adopters" stage. (The beginning of the curve.) How does organizations or agencies decide to finance a GIS? Jeffress and Conway (1989) discusses four main areas in the diffusion of innovation: the innovation itself, communication channels, time, and the social group. Where are we in disseminating soil survey data on the S-shaped diffusion curve? Probably, we are on all areas on the curve.

Committee Recommendations.

--- Recommend that the National Cooperative Soil Survey Program establish a policy in giving out GIS soils data.

--- Recommend that consideration be given for financial support, as well as a commitment by our administrations in inputing soil survey data into a **GIS**.

--- Recommend that all states have a soil scientist that is responsible for the soils information and be assigned to the Soil's Staff until needed. At a later date a "neutral" staff for GIS be created.

--- Recommend that this committee be continued because of the escalating prominence of **GIS** in the future.

THOUGHTS ABOVT THE FUTURE OF GIS

This Committee was given the freedom to deviate slightly from the two Charges just reported on. We discussed additional items about the future of GIS not only in the Southern Region but also in the United States. We briefly discussed: (i) the legality of a **GIS**, (ii) five-dimensional data, and (iii) standardizing terminology (a GIS taxonomy). These items were addressed because of recent articles confronting these issues.

Legality of a GIS. "Public Access to **GIS**: An Emerging Legal Issue' is the title of a recent article by Archer and **Croswell** (1989). What legal questions are lawyers asking about GIS? **GIS** is about information and information has not been traditionally **been** treated as a commodity, especially when the government is the provider. When does raw data become information? Who owns and controls the information? The economics of information, defining information by-products and utilities, and legal problems that arise because of a limited vocabulary in GIS. There are judicial questions that must be answered before the GIS matures. There should be an analyses of the legal setting in which the particular GIS is established. These questions also have been raised by Onsrud **(1989).**

GIS is integrating "islands of information" in that all levels of government are talking to each other about sharing the information. Information management facilities of the future will likely be government managed utilities like sewer, water, etc.

Five Dimensio of GIS. We commonly work with two- **(X,Y)** or three- **(X,Y,Z)** dimensional data. But as "true" 3-D systems become possible, the Z-value will become not a one attribute value but will represent the true Earth elevation with characterizing datum superimposed. This is the idea of Davis and Williams **(1989).** The data attribute will be redesignated i.e., A-value for a fourth dimension. Also, "time" is making a run at becoming another "true" data attribute. A signal display could assimilate several periods of time assigned to one **(X,Y,Z,A)** data. This data dimension involving time could be called "t-value," Therefore, **GIS** in the future will be able to use **5** dimensions. The **X,Y,Z,** and A data will specify the position of the attribute while T will allow changes through time.

What will "Dynamic GIS allow us to do? It will allow us to animate the data by creating 'movies" of GIS displays. A sort of a holographic approach. A laser pointer mouse and natural language interface enters commands of "what-if" scenarios.

Taxonomy of Geographic Information Terminology. As the word "soil" means different things to different people, the definition of GIS has distinctive meanings. As the technology increases to develop, as well as its use, there is an increasing awareness to standardize terminology and develop a taxonomy. Obermeyer (1989) sets the foundation. The author and her colleagues associated with the National Center for Geographic Information and Analysis have the responsibility of defining and classifying terms identify with **GIS.** The Center will circulate the proposed taxonomy among experts in **GIS** for their review and comments, as well as gather additional information from organizations regarding their use of geographic data.

References

Archer, H. and P.L. **Croswell.** 1989. Public Access to Geographic Information Systems: An Emerging Legal Issue. **PE&RS** Vol. LV. No. II. pp. **1575-1581.**

Davis, B.E. and R. Williams. 1989. The Five Dimensions of GIS. **GIS/LIS** '89 Proceedings. pp. 50-58.

Jeffress, G.A. and D. C. Conway. **1989.** G.I.S. Innovation Diffusion. **GIS/LIS '89** Proceedings. pp. 430-437.

Obermeyer N.J. 1989. A Systemic Approach to the Taxonomy of Geographic Information Use. **GIS/LIS** '89 Proceedings. pp. **421-429.**

Onsrud, H.J. 1989. Legal and Liability Issues in Publicly Accessible Land Information Systems. **GIS/LIS** '89 Proceedings. pp. 295-300.

Young, J. 1989. Preserving the Future: The National Archives Perspective. **GIS/LIS** '89 Proceedings pp. **12-19.**

Committee III: Soils Data For Modeling

Chairmen: Earl Blakley and Dr. Fred Beinroth

Charges:

1. Evaluate the adequacy of soil survey data as the soil data base for environmental and agricultural models and knowledge-based systems (KBS), particularly as regards to:

   a. accuracy and completeness of primary data,

   b. spatial and temporal variability,

   C. default procedures for generating model or KBS required soil parameters not directly available from soil survey data base, and

   d. implications for field and laboratory operations of the NCSS.

2. Recommend remedial action.

Introduction

Modeling is a relatively new development in Soil Survey and is presenting new challenges. It is creating new uses for soil survey information and hopefully a greater appreciation for it.

Modeling is also creating the need for additional data parameters and more detailed information. Existing soils data bases often can not supply all the parameter needs for many of the models. Some properties need to be collected from pedon descriptions or site specific data collected where it is feasible. Additional parameters sometimes.need to be generated or estimated using primary soil properties that are available.

Soils requirements have been identified for several selected models (attachment 1). These models represent some of the more popular models for predicting soil erosion, hydrology, chemical movement and plant simulation. Models vary a lot in degree of sophistication and soil parameter needs. In the future, we likely can anticipate even more sophistication in both the models and data bases needed to drive them. The challenge ahead for NCSS is to try to come up with ways of providing the soils data needs.

Future Activity

Modeling needs have created a need for revision of our data base concepts. Work is underway on the design of the next generation soils data bases, which collectively, will be called the National Soil Information System (NASIS). NASIS is being developed to handle data gathered during the survey process, to collect the data, and then the dissemination of the data to satisfy user needs. It will have provision for handling both site specific and spatial data. User requirements are being developed and objectives defined. Development will be done in phases as resources permit.

Some aspects of the proposed NASIS system important to modeling are:

Cons ' ` ' ` of Data Bases - The SOI-5, series description and soil classification will be combined into one tabular data base. Additional data elements will be added as needed. This data base will provide the important soils parameters needed to drive the erosion, environmental, and plant simulation models.

Integration - The system will be comprised of several independent modules, all linked together. In addition, it will be linked to various external resource data bases so data can be easily exchanged.

Interpretations - Ratings criteria will be linked, but separated from the primary soils data. Interpretations for more uses will be generated, as needed, using standard rating programs.

Design of this data base has taken into account future modeling needs. It will not only provide the needed soils information for models, but also make the data more readily available to both the developers and users of models. Also, it has built-in flexibility so that additional data elements can be added as needed.

Charge 1a - Evaluate the adequacy of soil survey data as the soils data base for modeling in regards to accuracy and completeness of primary data.

The primary soils data base available for modeling is the SOI-5. It is widely used and referenced. Response to accuracy and confidence in SOI-5 data was mixed. There is some concern about the accuracy of this data base because some of it has been estimated. Some also feel the ranges in data values are too broad for use in modeling.

Another problem with the SOI-5 database is that it does not contain all the primary data elements needed for most models. Additional elements have been added periodically to make the data base more useful for modeling and interpretations. Other changes are still needed. For example, particle size parameters need to be added. It often takes a lot of time for states to fill data gaps once new parameters are added.

Several expressed the need for a single-value data base specifically for modelers. Also, a better delivery system is needed to disseminate data to potential users.

Most of us feel the National Soil Characterization Data Base would be very useful for supplying additional data to drive models. However, it has limitations in that not all soils have been sampled and analyzed. Presently, there are about 10,400 pedons in the data base sampled since 1978. SNTC states have 1628 pedons. The data base has limited accessibility at present. An effort was initiated a couple years back to redesign the data base for more flexibility and accessibility. In addition, procedures and standards are being developed to accommodate characterization data available from state labs. Planned delivery systems for the data will include CD-ROM. Pedon description data will be a part of this data base.

Its greatest use may be to provide a data base of reliable measured primary data to test default routines and to generate missing data elements for modeling.

Prior to distribution of the characterization data from NSSL, states must review the data to be sure it has been classified and properly named. Presently, less than one-half of the data from SNTC states has been classified to the family level. Some of this data does not fit present series concepts precisely, so this needs to be resolved in some manner. Data sets also need to be geo-referenced for future GIS application. Attachment 2 provides a status of data by state.

Charge lb - Evaluate the adequacy of soil survey data as to the soils data base for modeling in regards to spatial and temporal variability.

Spatial Variability

Due to the complexity of this subject it was decided more time would be needed to adequately address it. Hopefully, this can be pursued during the next conference.

Temporal Variability

Modeling has created a need for good, reliable, documentation to record temporal changes in surface and near surface soil properties for cropland, rangeland, and possibly other land uses. Presently very little of this kind of data exists. Collection of temporal data must be use-dependent and relate to management methods, crops and tillage equipment. This kind of data would enable modelers to simulate changes in soil parameters over time.

Collection of temporal data on a large scale would be a major undertaking. It would require a lot of time and resources. One question not yet resolved is how much data is needed? Should data be collected for all soils, or only for a selected few?

Perhaps the best approach might be to begin collecting data on a few soils and sites to develop and test the procedures for collection and storage of data. Then as the needs increase, consideration would be given to expanded data collection.

Collection of temporal data needs to be done in a carefully controlled, systematic way. Standard characterization data (texture, OM, mineralogy, etc.) should be available. Also, land use management and tillage methods must be identified and carefully defined. Sites would need to be monitored on a timed schedule. It was suggested that we should plan to collect as much different kinds of data as possible when a project is initiated.

Soil properties that could be measured:

- Bulk Density
- Intake rates
- Aggregation (dry and moist)
- Penetration resistance
- Crusting (thickness and strength)
- Shear strength
- Surface roughness
- Soil temperature
- Water retention
- Depth to water table
- Rooting (depth and biomass)
- Cracks (Vertisols)

Dr. Bob Grossman has developed simple field procedures for measuring many of the temporal properties. His work is well documented, and requires only limited equipment.

Finally, a methodology is needed so that data can be recorded in a standardized electronic format. It should have the capability for accepting resource data subsets put together by all NCSS agencies. This would assure continuity, allow rapid consolidation of data, and provide the opportunity for data sharing among agencies.

Charge 1c - Evaluate the adequacy of soil survey data as the soils data base for defaults for modeling in regards to generating model or KBS required soil parameters not directly available from soils data bases.

Most agree that there is no substitute for measured data and it should be used whenever possible in building and running models. However, it is not presently feasible to collect all the data needed. The alternative is to generate needed data values from data that is available. A lot of effort has been put into developing models and procedures to supply soils data where measured data is not available. Many models have default routines to generate data in the absence of a data base of measured data. Some kinds of data can be reliably estimated from existing primary data. However, there are some kinds of data that probably should not be generated, or if it is, be used with caution. The worst case scenario is to use default values that are unsatisfactory for specific applications.

The general feeling is that we need to encourage development of methods to generate data to supply missing data. However, methods used to generate default data need to be thoroughly tested against measured data whenever possible. Some of those in use have been tested very little. Eventually, we may be able to compile a list of methods that are reliable, and identify those that should be used with caution. There is a real need to do more testing of models, with emphasis on checking the routines used to generate default values.

Dr. Warren Lynn suggested that possibly some benchmark sites could be established where good, measured data was available. These sites could be made available to modelers for testing inputs and outputs and refining their models. Modelers would be encouraged to use these sites as a test to see how well the model performs. This would have merit for model development. ARS has used this method in model development. One problem with this however, is that there is no assurance the sites and data would be used if they were available.

Sensitivity Analysis

Dr. Larry West emphasized the need for evaluation of models for sensitivity to input parameters. It was pointed out that not all inputs have the same affect on model output. For many models, only a few inputs have a significant affect on the final output. Knowing which parameters are most sensitive helps in deciding where emphasis needs to be placed in providing data. Time and cost of gathering data must be weighed carefully against the benefits. Obviously, more emphasis should be placed in accuracy of data with those parameters important in output. Without this kind of analysis it is difficult to address the adequacy of data and what the greatest needs are. The WEPP model was cited as an example of extensive sensitivity analysis.

Charge 1d - Evaluate the adequacy of soil survey data as the soil data base for modeling in regards to implications for field and laboratory operations of the NCSS.

The general feeling is that additional data will be difficult to collect on a large scale without special emphasis and support. The resources are just not available. Several expressed concern that if resources are devoted to data collection then other programs would likely suffer. This is a vital concern.

Some feel that data collection should be done as part of other projects and activities as much as possible. Some data collection would require only a minor amount of time and could be worked in with routine activities. Other kinds of data collection would take more time, especially temporal data where repeat observations and measurements must be made.

Others have expressed concern that there needs to be a better balance of mapping and providing technical support services in soil survey. There is a need for more sampling, and special studies to collect data, especially for temporal properties. This would also strengthen interpretations.

Lab Assistance

The NCSS goal should be to obtain characterization data for all series. There is still a long way to go to accomplish this. An effort should be made as a minimum to collect data on all major series. In some states this has been done but in others it has not. As surveys are updated there should be a high priority to identify soils that need characterization data.

There is a need for a thorough review of existing data state by state. We should identify areas, perhaps by MLRA, where more data is needed.

States that are nearing completion of soil surveys will have an opportunity to shift emphasis and resources to interpretations and using soil surveys and data collection. This could possibly increase the need for laboratory support.

Communication With Modelers

Comments on the best approach to better communication with modelers was varied. How do we get feedback from them about their data needs? Several offered some suggestions. It was pointed out that many of the modelers may not have a good knowledge of soils. Also, some may not know what soils data is available or how to go about finding out about how to get it. In other instances, data may be used that is not very reliable.

It was suggested that workshops be considered as a possibility of sharing ideas and information. Another was to send out questionnaires to solicit information and feedback.

The WEPP model program was cited as an example of excellent cooperation between agencies in model development and testing. This effort involves several agencies. Its success can be related to a cooperative effort being made by all agencies. Cooperation is strengthened when a common interest or need exists. In this case, the need was for an improved soil erosion prediction method.

There is total agreement that we need to do a better job making soils data available to modelers. This would seem to strengthen the argument for better communications with them.

Charge 2 - Recommend Remedial Action.

RECOMMENDATIONS

1. Initiate collection of temporal soil property data in selected areas. Test and develop methodology to record the variability. Develop a data base and delivery system to support the activity.

2. Encourage acceleration in the use of the SCS-232, Computerized Soil Description system and Transect programs. Increase emphasis on recording map unit composition and landscape features including position, slope length and slope shape. Make provision in the SOI-6 database to record 100 percent composition for all map units.

3. Describe soils to greater depths with emphasis on better documentation of the substratum layers, including bedrock. A minimum depth of 2 meters is recommended where observations can be made,

4. Record more precise data on depth to water tables, and the time the water table is present. Treat the water table as a temporal property and monitor for extended periods.

5. Initiate a program to convert the official pedon (OSEDS) descriptions into tabular format and build a usable data base of pedon data for modeling and other uses.

6. Accelerate development of the National Soil Characterization Data Base with provision to include state laboratory data. High priority should be given to the review of NSSL data and resolve classification to the family level. We recommend assistance be provided by the National Soil Classification Staff to arrange for contracting or details to assist with this where practical. It is also recommended the data be geo-referenced.

7. Make an effort to establish better communication with modelers, to let them know what kinds of data exists, and solicit feedback on other kinds of data needed and how the data can be managed and exchanged.

8. Direct data gathering efforts into a set of benchmark sites for use in testing models. Sites would be identified where hard data is available or would be gathered to feed model inputs and to test outputs. Modelers would be encouraged to test their models on these sites. Possibly, some of the WEPP test sites could be used for benchmark sites.

9. Develop procedures for estimating missing soil data and model-required soil parameters not contained in standard soil data bases. The application of algorithms for model input should be stratified by classes of soil taxonomy of the appropriate categoric level. If possible, estimated values would include an expression of data variance.

Continuance of the Committee
It is recommended that the committee be continued in 1992, with emphasis on "spatial variability and modeling."

COMMITTEE-III PARTICIPANTS

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Ken Bates	David L. Jones
Frederick Beinroth	Warren Lynn
Earl Blakley	B. R. Smith
Benny R. Brasher	Horace Smith
William Craddock	Allan E. Tiarks
Craig Ditzler	Billy J. Wagner
Hari Eswaran	Larry West
Talbert R. Gerald	R. L. Wilkes

SUMMARY OF DATA ELEMENTS FOR SELECTED MODELS

Property	EPIC[1/]	WEPP[2/]	CREAMS[3/] (GLEAMS)	DRAIN MOD[4/]	IBSNAT/[5/] CERES	SITEQUAL[6/] (PTSITE)	SPUR[7/]
Horizon/thickness	X	X	X	X	X	X	X
Textural class	X	X	X	X	X	X	
Particle size	X	X	X	X	X	X	
Rock fragments	X	X	X	X	X	X	
Bulk density	X	X	X	X	X	X	
Porosity			X	X			X
pH	X		X		X	X	
OM(OC)	X	X	X	X	X	X	X
CaCO3	X						
N	X		X				X
P	X						
Al sat.					X		
S.A.R.				X			
E.C. Extract				X			
CEC	X	X		X			
Sum Bases	X						
K-factor	X		X				X
Curve Number	X		X		X		X
Albedo	X	X			X		
Water-1/3 bar	X	X	X	X			X
Water-15 bar	X	X	X	X			X
A.W.C.			X				X
Rooting depth	X	X	X	X		X	X
Permeability	X	X	X	X	X		X
Init. sat.	X	X					
Hyd. Group			X				
Classification						X	
Color					X	X	
Structure						X	
Consistence						X	
Mottling						X	
Compaction						X	
Depth-Water table						X	
Root Abundance					X		X
Stratification						X	
Topography						X	
Micro-relief						X	
Flooding						X	
Wetness/Drainage					X	X	
Slope %	X	X			X		X
Slope shape		X				X	
Slope length	X	X					X
Parent material						X	
Aspect						X	
Slope position						X	
Past land use						X	
Erosion						X	

MODEL DEFINITIONS

1/EPIC - Erosion Productivity Impact Calculator (ARS) - A comprehensive model developed to determine the relationship between soil erosion and soil productivity.

ALMANAC - (ARS) An advanced version of EPIC

2/WEPP - Water Erosion Prediction Program (ARS) - A new generation water'erosion model that uses process oriented, improved erosion prediction technology. Several versions will be available.

3/CREAMS - Chemicals, Runoff and Erosion from Agricultural Management Systems (ARS) - a model that predicts the delivery of runoff, sediment, pesticides, and nutrients. It is divided into three independent components: hydrology, erosion/sediment yield, and chemicals.

GLEAMS and SWRRB (ARS) models use similar soils data parameters.

4/DRAINMOD - Soil Drainage Model (SCS) DMSOIL is an expert system to generate soil hydraulic parameters, including soil water retention curves and hydraulic conductivity functions to drive the DRAINMOD model.

5/IBSNAT/CERES - International Benchmark Sites Network for Agrotechnology Transfer - Crop Environment Resource Synthesis - A family of crop simulation models with global application in semi-tropical and tropical regions. Crops include rice, wheat, grain sorghum, maize, peanuts, and soybeans.

6/SITEQUAL - Site Evaluation for Southern Hardwoods (USFS) - An interactive forestry program to evaluate site quality and production for selected hardwood species. The program calculates site index.

PTSITE (USFS) - Similar model being developed for Southern Pine Species (Loblolly and Longleaf).

7/SPUR - Simulation of Production and Utilization of Rangeland (ARS) - A comprehensive rangeland simulation model to provide information for rangeland management. It is composed of five modules: (1) climate, (2) hydrology, (3) plants, (4) animals, and (5) economics.

ERHYM-II (ARS) - A Range Hydrology model with similar soils data requirements.

*** NSSL DATABASE ***
PEDON COUNTS
01/May/90

STATE	TOTAL	PRE1978	<---- 1978 & up ---- 1978-UP	W/TAX	NO TAX	DESCRIPTION	CORRELATED ---->
ALABAMA	104	19	85	72	13	35	71
ARKANSAS	70	27	43	14	29	26	14
FLORIDA	155	94	61	4	57	13	4
GEORGIA	244	54	190	69	121	101	64
KENTUCKY	244	85	159	70	a9	100	71
LOUISIANA	230	124	106	71	35	32	37
MISSISSIPPI	163	123	40	30	10	29	29
NORTH CAROLINA	268	59	209	51	158	a6	51
OKLAHOHA	163	68	95	10	85	69	a
PUERTO RICO	188	100	88	1	87	58	0
SOUTH CAROLINA	85	30	55	14	41	21	11
TENNESSEE	228	168	60	15	45	52	15
TEXAS	706	273	433	240	193	255	229
VIRGIN ISLANDS	12	a	4	0	4	4	0
GRAND TOTALS ------>	2860	1232	1628	661	967	881	604

TOTAL .... All of the pedons in the NSSL Database.
PRE1978....... Pedons sampled prior to 1978 by the NSSL and it's predecessor laboratories.
1978-UP . . . . Pedons sampled by NSSL beginning in 1978.
W/TAX . . . . Pedons classified by states or TSC's on NSSL Soil-8 forms returned to NSSL.
NO TAX . ... Pedons not classified by states or TSC's.
DESCRIPTION . . Profile descriptions currently stored in the NSSL Database.
CORRELATED . . . Pedons with a correlated series name shown on NSSL Soil-a form returned to NSSL.

[redacted]

Estimating Missing Soil Data: How to Cope with An Incomplete Data Base

As DSSAT (Decision Support System for Agrotechnology Transfer) moves from the design stage to a utilization mode, it is confronted with the problems that prevail in the real world and particularly in the lesser developed countries. Preeminent among these problems is the scarcity of complete and accurate soil data; a dilemma that has been referred to as the "parameter crisis". The pm-pose of this article is to examine what can be done to overcome this predicament and thus facilitate the application of DSSAT under less than ideal conditions.

IBSNAT crop simulation models have been designed on the underlying rationale that they must function with a minimum of input data. This philosophy precipitated the concept of the minimum data set (MDS) and the selection and definition of variables that compose the MDS. Crop models in DSSAT require various soil physical parameterssuch as lower limit and drained upper limit of plant extractable water, surface albedo (or reflectance), and rainfall runoff curve number. These parameters are seldom measured except in research plots. For practical application, they can be estimated from soil characteristics more commonly measured using a procedure in DSSAT. For such applications, the following soil data are required:

- Soil classification according to Soil Taxonomy
- Depth and thickness of soil horizons
- Particle size distribution, including coarse fragments
- Bulkdensity
- Organic carbon
- Root abundance
- pH
- Aluminum saturation
- Color of surface horizon
- Slope
- Permeability and drainage class.

Although these data represent a modest fraction of the soil properties customarily determined in soil characterization programs, some of them are frequently not available for specific areas. There are basically two solutions to thii problem:

1) collect the data using traditional ways or newly developed techniques, or
2) make better use of existing data.

The traditional approach, soil survey and soil characterization, although conceptually the most de&-able, is not a practical solution in many instances as it is expensive and time consuming. The second approach is, to some extent, already practiced by IBSNAT and incorporated in the minimum data set detailed above. For example, soil texture, bulk density, and organic carbon are used to calculate the "drained upper limit" required by the model. While state-of-the-art soil survey techniques such as video image analysis and ground penetrating radar are now under development, they are not really functional for routine operations at this time. It thus appears that soil data gaps have to be more efficiently bridged by using existing information. The following is an attempt to outline approaches to soil data generation in the context of three scenarios with different levels of data availability.

SCENARIO 1:
A soil description and the Soil Taxonomy classification are available, but analytical data are missing.

Ii the Soil Taxonomy classification of the soil is known, preferably at the family level. the World Benchmark Soil Data Bank of the Soil Management Support Services of the USDA Soil Conservation Service can be searched for a soil of the same class. This data base is in DSSAT and now contains about 750 pedons of tropical and subtropical soils with characterization data. Ii a soil with an identical soil family classification is found, the characterization data for the analyzed soil can, by analogy, be applied to the soil of the same classification for which no data exist. Ii more than one identical soil is found, values are averaged Rarely, however, will a perfect match be found. In this case, the search has to be extended to soils of the same subgroup and, ii that also fails to produce an equivalent, to soils of the same great group. However, above the level of the great group, definitions are too broad to be meaningful for the purpose at hand.

Several of the model-required soil characteristics required for estimating soil parameters are morphological soil properties (slope, horizon depth, root abundance, color) that are indicated in the soil profile description. These descriptions also contain field estimates of the particle size distribution which, when made by an experienced soil scientist, are quite accurate. Because thevariability in soil texture even among members of the same family may be considerable, the site-specific field estimates are more reliable than the laboratory data from similar soils elsewhere.

The data from the soil profile descriptions are then combined with the analytical data derived from the data bank on the basis of taxonomic similarity to form what may be called a "synthetic minimum data set". The accuracy of this data set obviously depends on the degree of taxonomic similarity of the soil or soils from

continued on page 11

Missing Soil Data *continued from page 10*

mated, and inevitably also affects the quality of model output. DSSAT has procedures to search the existing data base and estimate soil parameters for the crop models under thii scenario.

If the data bank has no pedons of soils classified identically at the family, subgroup, or great group levels, the required parameters have to be inferred from the information contained, by definition, in the taxonomic name. For example, a soil classified as a Eutrustox must have a high base saturation in all parts within a depth of 125 cm of the soil surface. An accessory characteristic of this differentiating criterion is a pH around 6 and, consequently. not likely to have aluminum saturation. In fact, in most soils with pH (water) more than 5.5, KCl-extractable Al is likely to be absent. Aluminum saturation, therefore, is also likely to be absent. Furthermore, in many cases, data can beestimated from analyses of soils that, although classified differently, have similar properties. In the same region, for example, certain characterization data for a Hapludox and a Kandiudult are very similar. This deductive approach clearly presupposes judicious reasoning based on pedalogic experience. At some point in the future, DSSAT and other computer software may have the capability to guide users in the selection of the best set of parameters when the data bank has no pedons of soil classified the same as the soil in question. However, this capability is not available now.

SCENARIO 2:

There is a soil description, but no Soil Taxonomy classification.

If the soil has been classified according to other classification schemes (such as the FAO Legend for the Soil Map of the World, or the French classification), correlation with classes of Soil Taxonomy is relatively simple and, above the family level, quite accurate. If the soil has not been classified at all, its Soil Taxonomy classification has to be inferred from information in the soil description and environmental conditions. An example is if the soil description shows the soil to have wide cracks, somewhat dark color, apparent texture of clay, and a moist consistency that is very sticky and plastic, it is likely to be a Vertisol. Furthermore, if the soil chroma is low, it is even likely to be a Pelludert in a moist environment (climate) and a Pellustert in a drier environment. Pedalogic expertise is essential and even then there is still much scope for erroneous judgements. Eventually, regional expert systems need to be developed to improve this approach.

One of the reasons the Soil Taxonomy classification is required is that it is used to allow a stratified application of default procedures. The algorithms for calculating the drained upper limit, for example, isdifferent for Andisols, Mollisols, and Oxisols. Once the classification has been established, the procedure is the same as under Scenario 1.

SCENARIO 3:

There is no soil description, no soil classification, and no analytical data.

This worst-case scenario presents a major challenge, but the situation is not completely hopeless. Some kind of soil information is available in practically every country and so is information on the environmental conditions that control soil formation. Applying principles and theories of pedogenesis, information on climate, geology, terrain, and vegetation allows pedologists to infer processes and products of soil formation. Combining what is available with what can be logically deduced, can in many instances provide a reasonable, albeit general, notion of the salient properties of soil as well as an estimate of its Soil Taxonomy classification. Where information is scarce, however, these estimates become speculative and are, at best, educated guesses.

SUMMARY

The ideal minimum data set for a crop model is one that records the parameters for the point in space and time for which the model is applied. As this situation is rarely encountered, particularly in the developing countries, various default procedures of varying degrees of specificity must be used. DSSAT has procedures that can assist users in dealing with this problem in some cases, and others may be available in the future. However, there is a limit to what can be accurately estimated with surrogate procedures, and improvisation, no matter how ingenious, cannot substitute for solid primary data. This reaffirms the value of and necessity for reliable soil resource inventories, either produced conventionally in the field, or generated from other sources of relevant information such as satellite imagery.

It is also well to remember that model output is a function of model input, and consequently, the accuracy of model output declines with decreasing specificity of the soil information. Finally, even where complete, reliableand site-specific data sets exist, there is still the problem of spatial and, to a lesser degree, temporal variation of soil properties, often over short distances. That problem, however, will be the subject of another article in a future issue of *Agrotechnology Transfer*.

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References

Baumer, O.W. 1989. SCS Soil Parameters Preparation Program For DRAINMOD. DMSOIL USER'S MANUAL.

Beinroth, Fred il. 1990. Estimating Missing Soil Data: How to Cope With An Incomplete Data Base. AGROTECHNOLOGY TRANSFER, No. 11.

Beinroth, F.H., T.H. Gill, G. Uehara. 1986. Users Guide for the Minimum.Data Set Entry IBSNAT Technical Report# 3. Decision Support System for Agrotechnology Transfer (DSSAT).

Flach, Klaus W. 1985. Modeling and Soil Survey. Soil Survey Horizons. 1985. Vol. 26, pp. 15-20.

Foster, G.R. and L.J. Lane. 1987. User Requirements. USDA - Water Erosion Prediction Project (WEPP). NSERL Report No. 1.

Grossman, R.B. and F.B. Pringle. 1987. Describing Surface Soil Properties. Their Seasonal Changes and Implications for Management. Soil Survey Techniques, SSSA Special Publication No. 20.

Harrington, C.A. and B.M. Casson. 1986. SITEQUAL, A User's Guide. USFS General Tech. Report SO-62.

Jones, C.A. and J.R. Kiniry, 1986. CERES-Maize: A Simulation Model of Maize Growth and Development. Texas A&M University Press. College Station, Texas.

Knisel, W.G. 1980. CREAMS: A Field Scale Model For Chemicals, Runoff, and Erosion from Agricultural Management Systems. USDA Conserv. Res. Rep., No. 26. 643 pp.

Lane, L.J. and M.A. Nearing. 1989. USDA-Water Erosion Prediction Project, Hillslope Profile Model Documentation. NSERL Report No. 2, USDA-ARS.

Leonard, R.A., W.G. Knisel, and D.A. Still. 1987.. GLEAMS: Groundwater Loading Effects of Agricultural Management Systems. Trans. ASAE 30(5): 1403-1418

Williams, J.R., C.A. Jones, and P.T. Dyke. 1984. A Modeling Approach to Determining the Relationship Between Erosion and Soil Productivity. Transactions of ASAE 27(1): 129-144.

Wright, J. Ross and J.W. Skiles. 1987. SPUR: Simulation of Production and Utilization of Rangelands, Documentation, and Users Guide. USDA, ARS-63.

Young, R.A., C.A. Onstad, D.D. Bosch, and W.P. Anderson. 1989. AGNPS: A Nonpoint-Source Pollution Model for Evaluating Agricultural Watersheds. Journal of Soil and Water Conservation, Vol. 44, No. 2.

SOUTHERN REGIONAL TECHNICAL
WORK PIANNING CONFERENCE

SAN JUAN, PUERTO RICO
JUNE 18-22, 1990

COMMITEE V. REPORT - SOIL SURVEY AND MANAGEMENT OF FOREST LANDS

Chairman: Jim Keys

Committee Objective:

To continue previous committee and working group efforts in identifying interpretive needs and criteria for specific management practices.

Charges:

1. To develop criteria for specific interpretations of soil surveys for forest lands.

2. To recommend suitable alternatives of presenting forestry interpretations in soil survey reports.

Committee members were provided with interpretive needs which were identified by the Working Group for Woodland Interpretations, and asked to comment on the suggested level of application. Comments were also requested of available criteria. For Charge 2, members were asked to comment generally on better ways of presenting woodland interpretations in soil survey reports.

Responses to Charges:

	Responses	Committee Members
Forest Industry	1	6
Small Landowners	1	1
Forest Service	1	7
SCS	3	18
Universities	2	6
Total	**8**	**38**

Charge 1

Some committee comments relating to interpretive criteria were:

1. The interpretation Site Suitability for Chopping and Burning may not be needed as criteria was provided for the separate practices.

2. If compaction, rutting or puddling are to be used as limiting factors in rating site preparation practices, then the level of moisture content should be stated. A Susceptibility to Rutting interpretation could incorporate the limits of ground pressure before shear failure under near saturated, field capacity and 20% (dry) field capacity moisture contents.

3. The interpretation for Unsurfaced Roads should incorporate limitations for native road surfaces.

4. Site suitability ratings for various types of harvesting equipment could be combined into one interpretation dealing with traficability and ground pressure.

5. Some of the nutrients included within the Fertility interpretation will be differentially influenced by the listed soil properties. Nutrients could be broken down into groups (e.g., N; K, Ca, Mg; P; Fe, Mn, Cu) with somewhat similar behavior for interpretation.

6. The interpretation for insects and disease must be defined for specific groups such as nematodes, etc.

7. A rating of Reforestation Potential would have to consider the previous or current stand (vegetation) condition which is not necessarily related to soil characteristics and has a major impact on response, thinning, management intensity and regeneration system choice. Economics and equipment availability would also dictate the feasibility of many of these operations.

8. Many of the intensive management interpretations should be restricted to local areas.

9. Site index should be provided only on a local basis because industry data suggests that there is too much variation within any given soil series across the southeast.

10. Properties for *response" interpretations would have to relate to a particular species.

11. Throughout the recommendations there is an implicit inclusion of economics and expected stand conditions in suitability ratings. While this is difficult to completely eliminate, every effort should be made to do so. Economic conditions change and do not affect the chemical and biological efficacy of soil management. Stand conditions also vary and, except in the section on plant communities which deals with vegetation, should be removed from the list of interpretive needs.

12. Some information could be better presented in narrative format in the management section of the soil survey report and the mapping unit description rather than as tabular data.

Committee members who continued work during the conference were:

Larry Morris	Ken Wstterston	Ron Bauer	Frank Miller
Allen Tiarks	Jim Robinson	Richard Switzer	DeWayne Williams
Glenn Hickman	Warren Lynn		

The following interpretations were identified as having REGIONAL APPLICATION:

SOIL SITE CHARACTERISTICS

Susceptibility to Compaction
Susceptibility to Displacement
Susceptibility to Puddling
Susceptibility to Rutting

Resilience for Compaction
Resilience for Inherent Fertility
Resilience for Surface Erosion

Slope Stability
Windthrow

SITE PREPARATION

Mechanized Site Preparation and Planting Equipment
Surface Tillage
Subsurface Tillage

STAND ESTABLISHMENT

Hand Planting
Machine Planting

STAND TENDING

Suitability for “se of Soil Active Herbicides

HARVESTING

Equipment Operability for Logging Areas
Timber Haul Roads and Major Skid Trails
Total Tree Harvesting
Log Landings

Unsurfaced Roads
Limitations of Material for Road Construction and Maintenance

Criteria available for regional interpretations will require much more work and review by cooperators.

There was much discussion about the use of soil properties **vs** non-soil properties to describe limitations for interpreting specific management practices. It may be possible that some of the local interpretations used in rating site suitability will require only soil properties to describe limitations, but others could be handled by the soil potential concept.

Some discussion was centered on the fate of local interpretative needs. This committee's objective was **to** determine the interpretive needs of cooperators and criteria for specific management practices. We seem to have determined the needs, but is the present process effective in dealing with their fate? Will we have the same charge in years ahead? In most cases local interpretations are not being made for surveys. To increase the use of soil surveys the NCSS might direct more attention to making local interpretations rather than standard interpretations, and the criteria should be developed at the local level.

Charge 2:

In this charge we were looking for better ways of presenting woodland interpretations in soil survey reports. Two major comments were that much of the forestry information would be better presented in narrative form in the management section and the mapping unit description, and that there are innovative alternatives of presenting forestry interpretations in soil survey reports **which** could be compiled by someone in USDA for distribution to individual cooperators of NCSS.

Recommendations:

Continue work on woodland interpretations for specific practices concentrating on criteria and definitions for those that have regional application.

Compile innovative alternatives of presenting forestry interpretations from existing soil survey reports for distribution to cooperators in the Southern Cooperative Soil Survey.

As a new charge, look at the convention, criteria, and coordination of making local interpretations.

Attachments (2)

ATTACHMENT 1

1990 COMMITTEE COMMENTS TO WOODLAND INTERPRETATION NEEDS SOUTHERN REGION COOPERATIVE SOIL SURVEY

SOIL SITE CHARACTERISTICS

	LEVEL[1/]	COMMENT
Soil Degradation Potential	A,N	SC
Susceptibility to Compaction	A,R	R,L,NSP (rainfall).
Susceptibility to Displacement	A,R	R
Susceptibility to Puddling	A,R	R (Might want to combine with rutting interp
Recovery Potential	A,N	SC
Resilience for Compaction	A,R	
Resilience for Fertility	A,R	Should all nutrients be grouped for this interp? Define
Resilience for Surface Erosion	A,R	L,MLRA

Sediment Yield and Landform

SITE PREPARATION

[1/] This represents a majority of the responses received

ATTACHMENT 1 (Continued)
1990 COMMENTS TO WOODLAND INTERPRETATION NEEDS

	LEVEL	COMMENT
Bedding ...."	D,L	L
Drainage ...."	D,L	MU
Herbicide and Burning Methods (Site Suitability)...	D,R	
Summer Site Prep or Slash Burning......"	A,R	NSP
Chemical Site Prep...................."	D,N&R	NSP
Herbicide and Burn...................."	A,R&L	NSP

[redacted]

	LEVEL	COMMENT
Management Intensity....................."	A,L	NSP
Plantability....................(Site Suitability)...	A,R	
-Hand Planting...................."	A,R&L	NSP (Rate difficulty of planting site)
[redacted]		
Seedling Mortality..................................	A,R&L	D, NSP
Plant Competition..................................	A,R&L	D, RSP (Changes stand by stand due to species comp.)
Trees to Manage for..................................	A,N&R	
Potential Natural Vegetation......................	A,R	ID (Past mgt. WY not allow determination in South)
Community Type..................................	A,R	ID
Site Potential Productivity..........................	D,L	
Site Index (Estimated or Actual)..................	D,L	SC (Actual at lowest level avail.)
Xmas Trees..................................	A R	NSP, ID
Volume (Cubic Feet or Cords)......................	D,L	

ATTACHMENT 1 (Continued)
1990 COMMENTS TO WOODLAND INTERPRETATION NRPDS

STAND TENDING

	LEVEL	COMMENT
Fertilization ....(Response to)	D,L	NSP, SP
Thinning ...."..	D,L	NSP
Prescribed Burning (CUS) ...."..	A,L	NSP
Herbicide Use ...."..	A,R&L	NSP
Suitability for use of Soil Active Herbicides	A,N&R	(Determ

HARVESTING

	LEVEL	COMMENT
Equipment Operability for Logging Areas	A,N&R	
Operating Period	D,L	
Prefered Operating Season	D,L	
Most Limiting Season	D,L	
Timber Haul Roads and Major Skid Trails ....(Site Su[illegible]	[illegible]	
Skidders ...."	A,R	
High Flotation Equipment ......"	D,R&L	
Cable Equipment ....".	A,L	
Whole (Total) Tree Harvesting...(Site Suitability)	A,R	
Log Landings ....".	A,N	
Soil Drainage ....".	A,R&L	
Unsurfaced roads	A,N	D, R
Suitability for Native Road Surface	A,R	D, R
Susceptibility to Dustiness	A,L	L
Features Affecting Costs	A,L	R
Limitations of Material for Road Construction and Maintenance	A,N&R	R
Limitations to Excavation and Use as Subgrade	A,R	R
Limitations to Cut/Fill Maintenance	A,N&R	R
Cut/Fill Erosion	A,R	R
Cut/Fill Stability	A,R	R
Suitability for Cut/Fill for Revegetation	A,L	L (Ma

ATTACHMENT I (Continued)
1990 COMMENTS TO WOODLAND INTERPRETATION NEEDS

COMMENT CODES

LEVEL Please note if you (A)gree or (D)isagree, and what level [(L)ocal, (R)egional, or (N)ational] you would recommend. Sample Input: D.L.

COMMENT Choices for input include:

- **L** Dependent upon management objectives rather than soil properties. Site specific. Specific soil tests are also necessary for prescription.
- **SC** Separate criteria should be developed for these management practices.
- **MU** Can be addressed in map unit description.
- **NSP** Not interpreted by soil properties alone or at all. Soil properties are not the dominant factors. Interpretation could be dependent upon equipment or other consideration such as climate.
- **R** Should refer to another committee such as one dealing with engineering interps.
- **ID** Insufficent information and data to make interpretation.
- **D** Already covered by an existing interpretation.
- **SP** Should be treated locally by the soil potential concept.
- **NV** Not a valid interpretation for forest management.
- **MLRA** Criteria should be developed for the MLRA.

COMMITTEE V. MEMBERS

T.Arnold	E.Hayhurst	F.Miller	D.Sims
E.Blakley	G.Hickman	L.Morris	L.Swift
R.Bauer	R.Hinton	H.Mount	J.Robins
B. Edwards	C.Hollins	D.Neary	R.Switzer
J. Edwards	W.Hurt	D.Pettry	G.Turner
R.Folsch	J.Kushla	E.Obrien	A.Tiarks
T.Fox	G.Lane	R.Rightmyer	K.Watterston
A.Goodwin	D.Law	J.Robbins	D.Williams
R.Habberman	J.Long	J.Robinson	R.Vick
B.Harding	W.Lynn	T.Sarigumba	

Committee IV: Soil Water, Classification and Interpretation
SRTWPC

COMMITTEE CHARGES:

Charge 1: To Provide a Vehicle for Information Exchange Among Committee Members on the Following Soil/Water Related Topics:

- Monitoring Seasonally Wet Soils
- Guidelines for Wetland Interpretations
- Macropore Water & Solute Transport
- Septic Field Designs for Aquic Conditions
- Soil/Water Properties Governing Pesticide Movement
- New Proposed Criteria for SMR Classification

Charge 2: To make recommendations for Soil Survey activities and policies that facilitate procurement and transmission of water-related soil properties pertinent to soil classification, behavior and management interpretations.

Charge 3: To place Committee IV activities among highest national and regional priorities for next decade.

FORMAT **FOR** COMMITTEE ACTIVITIES:

To accomplish these charges, the chairman and co-chairman selected key individuals with expertise in given subject matter areas to develop position papers (extended abstracts) that outline pertinence of topic and soil survey needs to improve database, information content and interpretation accuracy. The following topics are considered as a part of the report with corresponding contributors:

- Monitoring Soils With and Without Aquic Conditions in the Gulf Coast Region - W.H. Hudnall & L.P. Wilding
- Guidelines for Establishing Wetland Interpretations Inferred from Aquic Moisture Conditions - M.J. Mausbach & R.W. Fenwick
- Guidelines for Assessing Soil/Water Properties Governing Pesticide Movement - D.W. Goss
- Macropores in Soils: Quantification and Affects on Water and Solute Transport - L.T. West
- Septic Tank Fitter Field Designs for Soils with Perched Aquic Conditions - E.M. Rutledge & B.J. Teppen
- Propose Criteria for Identification of SMR - Ron Paetzold

At the SRTWPC meetings in Puerto Rico, these topics were presented to Commlttee IV participants at large by each of the leaders or a designee. Attached are copies of the position papers which form the basis for recommendations that follow.

COMMITTEE RECOMMENDATIONS:

1. **Establish regional and national long-term (5-7 years) NCSS projects to verify seasonal wet soils and wetland conditions** - The projects should monitor depth, duration and periodicity dynamics of saturation and reduction. Monitored water tables should clearly differentiate perched (episaturation) from continuous (endosaturated) conditions. Water tables should be monitored to depths of at least 4-5 m. These results should be calibrated with soil morphology such that the data base can be utilized with long-term meteorological records in modeling these hydrological soil properties for definition of hydric soils and wetland delineation. The instrumentation and experimental designs of such work in the Gulf Coast Prairies of Texas and Louisiana should be considered as a model in the effort.

2. **Calibrate Macroporosity with hydraulic conductivity using soil morphology** as an **inference** -- In conducting this work special attention should be focused on continuity of pores as evidenced from morphological coatings, in-ped vs ex-ped pores, antecedent moisture conditions and quantification of macropores.

3. **Improve** estimates **of pesticide movement** In soils **by improving database** In so 1 -5 **file** -- Suggestions to accomplish this task are: (a) to provide narrower ranges for organic matter for all soil horizons (not simply surficial horizons); (b) provide narrower and more accurate estimates of hydraulic conductivity; (c) include drainable volume estimates; and (d) provide better estimates of biological activity.

4. Develoo more-es to link hvdrlc **soils** with **aquic soil conditio**ns so wetland **Interpretations may be developed** with **greater accuracy** -- This will require establishment of minimum water table depths, minimum anaerobic periods and man's anthropic influence on hydrological character of prior-converted wetland soils. This recommendation also requires better vertification of staruation, reduction and redoxinmorphic features of major soils placed with acquic soil moisture conditions in Soil Taxonomy before assignment to hydric soil classes is possible. Measurement of the dynamics of watertable fluxuations and reduction should be calibrated with redoximorphic features to differentiate relict from contemporaneous soil moisture conditions.

5. **<u>Improve guidelines for evaluation of soils for septic tank absorption fields</u>** -- This would be accomplished through goals addressed in recommendation #1 to monitor episaturated versus endosaturated water tables to depths of 4-5 m, to consider soil moisture regimes as a variable in such guidelines and to consider depth and duration of episaturated seasonal water tables.

6. **<u>Establish a subcommittee of Committee IV to study the suggestion that SMR's be revised to reflect specified depth(s)</u>** -- The thrust of this recommendation would be to eliminate current difinition of the SMR control section, eliminate linkage of SMR to STR and elimiate cracking criteria in Vertisols to define SMR In these soils. It would propose to include Xeric SMR as a special case of Ustic SMR. Such modified criteria for SMR would result in its application very similar to the STR criteria.

7. **<u>Committee IV be continued to address all or several of the above recommendations.</u>**

COMMITTEE PARTICIPANTS:

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APPENDED POSITION PAPERS:

SOILS WITH AND WITHOUT AQUIC CONDITIONS

W.H. Hudnall and L.P. Wilding

Introduction

The concept of the aquic soil moisture regime is being revised by the ICOMAQ to solve several problems in the definition and classification of soils previously summarized by Wilding and Rehage (1985) according to the Boil Taxonomy (1975). As a consequence, this research project was designed to study the aquic conditions in soils (a more suitable sites with a claypan at a depth different from the ones mentioned. Those piezometers Placed in flooded sites were constructed with an extra length of 0.25 m. Eight horizontal slits were cut at one end of the PVC pipe and a piece of geofabric was glued to it covering the slits and closing the end of the pipe. The other end of the piezometer was covered with a PVC cap with a small hole in its center.

Triplicate piezometers were installed at the depths mentioned above. An augerhole to the desired depth was made in order to place each piezometer. The bottom of the hole was filled with sand and the piezometer end with the slits was embedded in it, followed by a bentonite plug, a layer of soil and another bentonite plug at the surface.

A 5" diameter borehole was made to the depth of 2 m in all sites with a hand auger except at the Verdun series site where an extra borehole was dug to 3 m depth. In order to avoid the wall-sluffing of the borehole, the boreholes were lined with 5" drainage pipe. The water level was measured with a steel tape in the borehole. In the case of the piezometers, a plastic tube was inserted and lowered into the piezometer pipe **until it contacted the water surface and the depth to the water table was then discerned** by listening for the bubbling sound of air through the water.

Water Tension. The water tension was measured in triplicate with jet fill tensiometers placed in the soils at three different depths (0.25, 0.50 and 1.00 m). The tensiometers were filled and precalibrated in the lab. In order to install them, a probe was used to make holes of the same diameter as the tensiometer tubing. After the tensiometer was placed into the ground to the desired depth, the surface of the soil was sealed with bentonite around the tensiometer to avoid surface water to flow down along the piezometer's tube (Soil Moisture Corp.).

Reduction. The reduction was characterized by measuring the redox potentials directly with platinum electrodes or indirectly by testing in the field the presence of reduced iron with dyes. Redox potentials were measured with permanently installed platinum electrodes. The construction procedures were made according to Faulkner et al. (1956). The electrodes were tested in the lab in a pH-buffered, quinhydrone solution in order to know if they were giving good readings (Bohn, 1971). Any electrode differing more than 10 mV from the proper value at a given temperature was discarded.

Electrodes were installed in the field in Louisiana at 0.50 and 1.00 m depth in triplicate. In Texas, redox was measured at 25, 50 and 100 cm from fresh soil cores. For permanent installations, a hole half the depth desired was made with a probe and a sharpened metal rod was used to make the hole thinner and deeper to about 2 cm less than the desired depth of the exposed platinum tip of the electrode. Following this, a ¼" copper tube was placed over the lead of the electrode until the end of the

the soil surface. The readings were taken after some minutes when the reading drift decreased so that an equilibrated value could be recorded. The meter values from the soil were adjusted by adding +244 Mv to the readings In order to base redox potentials on the standard hydrogen reference electrode.

Three dyes were used in the field in order to test the presence of reduced iron ions: 1% potassium ferric cyanide $K_3Fe(CN)_6$ water solution, 0.2% α -- a dipyridyl solution in 10% acetic acid, and 0.5% benzidine (biphenyl,4,4' diamino) solution in ethyl alcohol. These three solutions were sprayed on the freshly broken surface of field-wet samples taken at 0.25, 0.50 and 2.09 m depth.

Potassium ferric cyanide and benzidine (yellow solution) reacted giving a solid dark blue dye, while α -- a dipyridyl, (pink solution) reacted giving a strong red color in the presence of reduced iron in the soil samples. The best results were obtained with benzidine and α -- α dipyridyl which had a distinct and strong reaction compared to potassium ferric cyanide that most of the time gave weak reactions. Therefore, the testing with potassium ferric cyanide was discontinued.

Soil Water Sampling. In Louisiana, the water from each piezometer was depleted with a hand pump connected to a vacuum collecting chamber and transferred to plastic labeled bottles. In Texas, water samples were not analyzed.

In the lab, the samples were filtrated through a 0.45 µm membrane filter, poured into polyethylene test tubes and analyzed by Inductively Coupled Plasma Atomic Emission Spectrometric Method (ICP). The elements determined were Ca, Mg, K, Na, Fe, hln, Al, Pb, Cd, Co, P, As and their concentrations expressed in mg element/Kg sample (EPA, 1982). In Texas, water samples were not analyzed.

Temperature. In order to determine the soil temperature regime, soil samples were taken with a probe at 0.50 and 1.00 depths and the temperature was measured with a dial bi-metal thermometer. The stem of the thermometer was inserted at least 10 cm into the fresh soil sample as soon as possible without taking it from the sampling tool and after a few seconds, the temperature was recorded.

Results and Discussion

Louislana. A close relation among rainfall, water table depth, soil suction and redox potential was found at all sites. High amounts of rainfall corresponded with the rising of the water tables after a lag period. Crowley series with soybean and rice cropping were not expected to be wet from below, however, due to the tremendous amount of rain, the water table rose and was measured twice at both sites. The number of observations were not enough to see a clear functioning of perched water tables in those soils having Bt horizons.

Low soil matrix suction values were obtained for most sampling periods. There has not been a rupture of the water column in the tensiometers at most of the sites at any depth except for a brief period during the summer. The greatest variations in matrix suction were found at 0.25 m where the wetting-drying cycles were shorter than for the other two depths. The exception was the Crowley series under rice cropping, which stayed at 0 matrix suction at 0.25 m after flooding, and showed epiaquic saturation by contrast with higher suction values at 0.50 and 1.00 m.

Redox potentials showed that most Of the soils have undergone reducing conditions that are within the range that iron and manganese are reduced. Redox potentials followed the fluctuation in rainfall, Water table and soil suction. Wet periods are in correspondence wlth low Eh (reduction) and dry periods with high Eh values (oxidation). These Eh values were lower at 0.50 m than at 2.00 m depth for the same date.

The dyes utilized to determine reducing condiiions had fair results. Potassium ferrocyanide did not work well. It gave weak reactions and was replaced by benzidine, which by contrast, reacted in almost all conditions except for Moreland and Beauregard soils where none of the three dyes applied reacted. Alpha-alpha dipyridyl gave the best results. However, its problems of photochemical reduction and exposure to the air of the fresh broken sample made the results obtained not completely reliable.

From the analytical data obtained from the water samples, the total concentration of iron was the only one that was plotted for every site at the depths where there was enough data to be plotted, except for Crowley series/soybean. Due to drainage conditions, the data available was too scarce to be repotted. In spite of the fluctuating amounts of this element in solution, it was shown at all sites that at 2 m depth, the total iron in solution rose under the reduced conditions produced by the rising of the water tables or the stagnation of water on the soil surface, i.e. Fausse, Crowley/rice and Moreland.

The soil temperature records show that the Verdun and Fausse series with forest management had lower records of temperature than the other series with agricultural management. The rough measurement was satisfactory to check if the soils have a thermic temperature regime. Some of the soils have a hyperthermic temperature regime.

Texas. In general, sites (Pelluderts - Lake Charles and Beaumont, and Argiaqualfs - Bernard) near Beaumont, at the Texas Agricultural Experiment Station Research and Development Center, experienced endosaturation at variable levels responding to seasonal fall and winter rainfall and significant summer rainfall events. These soils had variable periods of Fe reduction that did not correspond directly to periods of saturation. Frequently, surface horizons and zones above a plowpan were reduced when subjacent horizons were not. Saturation occurred for much longer periods than Fe reduction. At no period during the monitoring did oxygen readings reach 0%, even though Fe reduction was observed at the same depth. This disequilibrium is because the reduction process commonly occurs at microsites rather than throughout the whole soil matrix. Water table depths as observed from an open bore hole are not reliable measurements in these soils. Eh measurements made on fresh cores did not prove reliable and plans are now underway to instrument sites with permanent Pt electrodes. Irrigated sites for rice production (Lake Charles and Beaumont) had similar water table levels as unirrigated fallow areas except for periods of flooding of the irrigated sites. Likewise, cropped (soybeans) and fallow analogues on the Bernard soil had similar water table levels.

At sites in Harris County (Katy and Wockley soils - Aquic Paleudalfs and Plinthaquic Paleudalfs, respectively), the soils experienced brief periods of episaturation even though the weather record for the monitoring period closely approximated long-term weather records. These soils were not saturated sufficiently long to induce reduction of Fe in spite of the fact that they exhibited evidence of redoximorphic features commonly associated with aquic soils. These features may be from relict gleying conditions.

In the lower Gulf Coast near Victoria, only one of the five soils being monitored (Cieno -Typic Ochraqualf) exhibited saturation and reduction. For this soil, the system was episaturated. Typic Albaqualfs (Nada and Telfener) exhibited redoximorphic features but were neither saturated nor reduced. The Vertic Ochraqualf (Dacasta) had brief periods of episaturation but lacked evidence of reduction of Fe so it too failed the aquic criteria in spite of ample redoximorphic features. These results for the Victoria area must be tempered by the fact that the mean annual rainfall for the monitoring period was about 25% lower than the long-term average. The Lake Charles soil (Typic Pelluderts) also had brief periods of episaturation but lacked evidence of Fe reduction during the monltoring period. Hence, longer periods of monitoring are necessary to determine whether the redoximorphic features in these soils are contemporaneous or relict.

Several problems encountered in this study in Texas, especially with the cracking clayey soils were:

1. Differentiating moving water fronts from true water tables.
2. Differing responses from tensiometers vs. piezometers.
3. Apparent cracks forming leakage conduits along shallow piezometer tubes.
4. Freezing of tensiometers during winter periods.
5. Crayfish activity along piezometers and tensiometers.
6. Spatial variability on a close interval basis of a few meters or less.
7. Long lag times in oxygen diffusion through these slowly permeable soils.

References

Bohn, H.L. 1971. Redox potentials. Soil Sci. 112:34-45.

Bouma, J. 1990. ICOMAQ Circular Letter No. 10. Wageningen Agricultural University. March, 1990.

EPA. 1982. Inductively Coupled Plasma - Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes, Method 200.7. Research and Development. Metals pp. 20-27.

Faulkner, S.P., W.H. Patrick, Jr., W.B. Parker, E.M. Gambrell and A.P. Gambrell. 1986. Characterization of Soil Processes in Bottomland Hardwood Wetland-Nonwetland and Transition Zones in the Lower Mississippi Valley. Laboratory for Wetland Soils and Sediments, Center for Wetland Resources. Louisiana State University, Baton Rouge. pp. 22-27.

Soil Moisture Equipment Corp. 1986. Operating Instructions: Jet Fill Tensiometer 2725A. Santa Barbara, CA. 6pp.

Soil Survey Staff. 1975. Soil Taxonomy, Agriculture Handbook No. 436. Washington, DC. 754pp.

Wilding, L.P. and J.A. Rehage. 1985. Pedogenesis of soils with moisture regimes. Proc. of International Workshop on Wetland Soils: Characterization, Classification and Utilization. IRRI. Los Baños, Philippines. pp. 139-157, 122.

Aquic Conditions

Aquic conditions indicate that the soil currently experiences periods of saturation and reduction unless artificially drained. These conditions are to be identified, except In an artificially drained soil, by:

transported by water movement. Oxidation patterns are a function of patterns of water movement in the reduced state and of the locations where oxygen occurs In aerated soil. Patterns are also determined by more rapid reduction of manganese as compared with iron and a more rapid oxidation of iron upon aeration. Iron and manganese ions may be removed from the soil after reduction. Then, oxidation does not result in Iron or manganese precipitation. Processes described hare result In characteristic color patterns which era defined In the keys. Oxidation of reduced Iron and manganese may result in soft masses or in hard concretions or nodules. Both are described In tens of redox concentrations, as defined in the Soil Survey Manual.

GUIDELINES FOR ESTABLISHING WETLAND INTERPRETATIONS INFERRED FROM AQUIC MOISTURE REGIMES

M.J. Mausbach & R.W. Fenwick

Wetness is a factor to be considered in many uses of soil and appears as a restrictive feature in most soil interpretations made as pan of the National Cooperative Soil Survey (NCSS). Wetness is a criterion for hydric soils, hydrologic groups, potential frost action, land capabilii class and subclass, building sites, recreation areas, waste disposal and water management. For most interpretations, wetness is assessed at the series level of Soil Taxonomy from information on water table depth and period of occurrence. Aquic moisture regimes are used for more general interpretative classes can be made using Soil Taxonomy. Criteria for two hydrologic groups include the aquic suborder and aquic and aeric subgroup modifiers. For example, aquic and aeric subgroups are mostly in hydrologic group C and typic subgroups of aquic suborders are mostly in hydrologic group D. Hydrologic groups are used in models such as CREAMS and GLEAMS and are used to define soil-pesticide runoff and leaching potentials.

Guidelines for potential frost action are arranged by soil moisture regimes. All particle size classes, except fragmental, are rated high potential if in an aquic moisture regime and a cold climate. Conversely, soil in ustic and aridic moisture regimes do not have a high potential for frost action regardless of climate.

The definitions of some subgroups allow for both an aquic and nonaquic moisture regime. For example, a pachic or a cumulic subgroup takes precedence over an aquic subgroup. Aquic and aeric subgroups indicate gradations of wetness from typic subgroups and should be easily recognized for use in making interpretations. For hydric soils, it is important to relate these subgroups to depth and duration of a water table and to anaerobic conditions. The duration of anaerobic conditions is crucial to the growth of hydrophytic plants. A period of 7 days or more of saturation is generally considered the length of time necessary to kill most cultivated crops. A minimum period for anaerobic conditions should be in the definition of aquic moisture regime and these periods need to be related to general depth of saturation for the typic, aquic and aeric subgroups.

For water quality interpretations, it is necessary to know if the water table is perched or if it is part of the ground water system. A perched or stagnate water table that is independent of a regional water table may represent areas that do not have as high a potential for ground water contamination as soils with an apparent water table.

References

Bouma, J. 1990. ICOMAQ Circular Letter No. 9. Wageningen Agricultural University. March, 1990.

Smith, Guy D. 1988. The Guy Smith Interviews: Rationale for Concepts in Soil Taxonomy. T.R. Forbes (ed.). SMSS Technical Monograph 11. USDA-SCS, Soil Management Support Services and Cornell University.

Soil Conservation Service. 1987. Hydric Soils of the United States. In cooperation with the National Technical Committee for Hydric Soils. USDA-SCS, Washington, D.C.

Soil Survey Staff. 1987. Keys to Soil Taxonomy. SMSS Technical Monograph 8. USAID and USDA-SCS Soil Management Support Services with Cornell University. Ithaca, NY.

Soil Survey Staff. 1983. National Soils Handbook. USDA-SCS, Washington, D.C.

GUIDELINES FOR ASSESSING THE IMPORTANCE OF SOIL/WATER PROPERTIES THAT GOVERN PESTICIDE MOVEMENT IN

References

Aller, L.B., J.H. Lehr and R.H. Petty. 1985. DRASTIC: A Standardized System for Evaluating Ground Water Pollution Potential Using Hydrogeologic Setting. Robert

MACROPORES IN SOILS:
QUANTIFICATION AND EFFECTS ON WATER AND SOLUTE TRANSPORT

L.T. West

The term "macropores" refers to 'relatively large pores present in soils in a number of forms including void space between structural units, cracks formed by desiccation or freeze-thaw cycles, active or abandoned root channels, and faunal (earthworms, insects, mites, etc.) burrows. Most soils contain macropores though they normally comprise less than 1% of the totai soil voiume (Bouma et al., 1982). Even though they are a minor component of soil, macropores may account for a large portion of the total movement of water and solutes through the soil. Because to their effect on water movement. Macropores are receiving much attention as possible conduits for movement of contaminants to ground water.

The lower size limit for macropores is arbitrary because there is normally no sharp break in pore size distribution. Minimum equivalent diameters ranging from 0.03 to 3.0 mm have been reported for macropores (Beven and Germann, 1982) though the lower size limit for macropores is normally considered to be about 0.03 to 0.075 mm. Because the minimum diameter is arbitrary, macropores may be better defined on their functionality in moving water and solutes at sufficiently high rates that mixing and transfer between the macropores and finer matrix pores would be limited (White, 1985). Hypothetical flow rates for cylindrical pores of various diameters is shown in Table 1. These flow rates are not observed under natural conditions because of numerous factors including lack of pore continuity.

Table 1. Hyootheticai flow rates for pores with various diameter.

Pore Diameter	Draining Tension	Potential Flow Rate
mm	bars	mm/hr
0.02	0.15	4
0.2	0.015	440
2.0	0.0015	44,000

No practical field method to describe macropores is readily available although attempts are often made to describe quantity, size and shape of pores in pedon descriptions. Often, these descriptions address only inped pores and do not evaluate pores along the faces of peds. Descriptions of soil structure and cracking patterns may be used to infer between ped porosity. Pore continuity is difficult to evaluate in the field, but greater numbers and larger diameters of macropores generally increases the probability of continuity. Presence of clay films or skeietans on ped faces or in pores may also indicate macropore continuity (Bouma et al., 1982).

Under laboratory and controlled field conditions, quantity of macropores in various soil layers has been determined by direct observation of undisturbed soil often coupled with image analysis techniques to determine pore size, shape and orientation (Bullock and Thomasson, 1979). Extrapolation of these two-dimensional observations to three-dimension pore patterns is difficult, but advances have been made recently In mathematically extrapolating from two to three dimensions using serological techniques and models. Dyes, such as methylene blue, coupled with micromorphic observations have also been used to indicate the size, shape and area of macropores that are continuous and conductive. Volume of conductive macropores is often less than 1/2 of the total macropore volume.

Flow through macropores occurs when the water application rate exceeds the infiltration rate into the matrix of the soil. Depending on pore size and water application rate, macropore flow may occur either as thin films along pore walls or may completely fill the pore (Bourns et al., 1992; Whiie, 1995). such flow is not subjected to capillarii and has a higher velocity than flow through the soil matii.

Thus, water along with any dissolved or suspended material traveled through macropores at greater rates than predicted by normal flow equations. This type of flow has been referred to as channeling, short circuit flow, bypass flow, or partial displacement. Flow equations derived to describe water movement through soil with macropores often separate the soil water Into "mobile" (macropore) and "immobile" (matrix) components.

Because macropore flow limits both volume of soil in contact with water and the time of this contact, actual sorption capacity for solutes in water moving through soil macropores is greatly reduced. Transfer of water and solutes between macropores and the matrix depends on antecedent soil water content, the hydraulic conductivity of the matrix, the location of the solute relative to the pore wall (within peds or at ped surfaces), the contact area between macropore flow and matrix water, and the diffusion rate of solute between the mobile and immobile water (White, 1982). Clay films or other ped coatings may restrict the rate of exchange between macropores and the matrix (Bouma et al., 1982).

Because of the number of factors affecting exchange of water and solutes between macropores and the matrix, movement and redistribution of solutes by macropore flow is site and condition dependent and is difficult to predict. Quantity of macropores and their continuity are variable over short distances and methods to quantify these parameters are expensive and time-consuming. Methodology to determine the rate of exchange of water and solutes between macropores and the matrix has not been fully developed or equipment needed to monitor these Small scale processes is not available.

Models that describe movement of water and solutes through soils with macropores have been developed. Because of the lack and variability of input data, however, these models depend heavily on curve fitting techniques to Separate macropore from matrix flow and often do not effectively describe water and solute movement when applied to soils and locations other than those used for their development. A greater understanding of macropore distribution as well as transfer processes between macropores and the matrix must be achieved before models can accurately predict water and solute movement for soils containing macropores.

References

Beven, K. and P. Germann. Macropores and water flow in soils. Water Resour. Res. l&1311-1325.

Bouma, J., R.F. Paetzold, and R.B. Grossman. 1982. Measuring hydraulic conductivity for use in soil survey. USDA-SCS. Soil Survey Invest. Report No. 38.

Bullock, P., and A.J. Thomasson. 1979. Rothamsted studies of soil structure. II. Measurement and characterization of macroporostty by image analysis and comparison with data from water retention measurements. J. Soil. Sci. 30:391-414.

White, R.E. 1985. The influence of macropores on transport of dissoived and suspended matter through soil. Advances in Soil Science 3:95-120.

SEPTIC TANK FILTER FIELD DESIGNS FOR SOILS WITH PERCHED AQUIC CONDITIONS

E.M. Rutledge & B.J. Teppen

Many soils have hydraulically limiting subsurface horizons such as fragipans or clayey argillic horizons. In areas where the udic moisture regime is dominant, many of these soils perch water for limited periods in and above these hydraulically limiting horizons. Often, criteria for siting septic tank filter fields do not differentiate between perched seasonal water tables, which are only in near-surface zones, and true water tables, ones from which domestic waters can be extracted. We propose that this distinction be made and that septic tank filter fields can be utiliied on some soils which have perched seasonal water tables. Data from Virginia (Reneau and Pettry, 1975), as well as our data (Rutledge et al., 1983), suggest that the hydraulically limiting subsurface horizons which cause the perched seasonal water tables also serve to protect the groundwater. Effluent is retained longer above the limiting horizon; the prolonged effluent retention enhances decomposition of organics and die-off of pathogenic organisms in the effluent.

Soils used for septic tank filter fields must transmit two hydraulic loads: the effluent load and the climatic load, which is the infiltrated precipitation minus evapotranspiration losses. The effluent load is relatively constant, but the climatic load varies throughout the year. Filter fields undergo hydraulic stress when the climatic load is maximum, and these stress periods limit the filter field design (Rutledge et al., 1987). During such periods, the combined hydraulic loads exceed the transmission rate of the hydraulically-limiting subsurface horizon. The filter field must have the capacity to store effluent for the duration of these stress periods. For example, our research suggests that the ability to store about 20 days of effluent from the household will be satisfactory for one group of soils (Rutledge et al., 1988).

Effluent storage occurs both in the bed and in the adjacent soil. During stress, the effluent rises in the bed and spreads into the soil (Rutledge et al., 1983). Storage volumes are calculated above the morphological evidence of the seasonal water table. The concept of effluent storage as a design goal provides a rational basis for comparison of filter field designs, including the effects of variable bed width and bed spacing.

With a narrow bed (60 cm, for example), most of the effluent storage during stress occurs in the soil adjacent lo the bed. Doubling the bed width does not provide a proportional increase in storage, since storage in the soil remains constant and only that in the bed is increased. Thus, narrow beds provide the most storage per bed bottom area (Rutledge et al., 1988). As effluent spreads from the bed into the adjacent soil, it may interact with effluent from adjoining beds. This interaction reduces the lateral spreading of the effluent end therefore reduces the storage capacity of the soil, so beds spaced far enough apart to avoid effluent interaction provide the most storage volume per bed bottom area. Our research combines these two principles to indicate that the most economical filter field designs for soils with perched seasonal water tables are ones with narrow beds placed far enough apart that effluent from adjacent beds does not interact. However, if land area is limited, beds may be placed more closely and more bed area constructed, thus increasing the cost, but decreasing the land area requirement. As spacing between beds decreases, eventually, One large bed is formed. A single large bed minimizes land area on level soils but rapidly becomes inefficient as soil slope increases.

The storage approach to designing septic tank filter fields is for soils with hydraulically limiting subsurface horizons which normally perch water for some period(s) in most years. In freely drained soils, a "crust," which builds at the bed-soil interface, restricts movement of effluent from the bed into the soil and limits hydraulic loading (U.S. E.P.A., 1980). Thus, with other factors constant, effluent loading rates increase as the depths to morphological indicators of wetness increase until the loading rata is limited by the ability of affluent to move from the bed to the soil, i.e. by 'crusting.' In other words, storage limits filter field design for soils with hydraulically limiting subsurface horizons, and the "crust' limits the design for freely drained soils.

References

Raneau, R.B., Jr. and D.E. Pettry. 1975. Movement of coliform bacteria from septic tank effluent through selected coastal plains soils of Virginia. J. Environ. Qual. 4:41-44.

Rutledge, E.M., CL. Griffis, C.R. Mote, C.R. Bell, D.K. Shoemaker and N.L. Glover. 1987. Climate as a factor in siting septic tank filter fields. *In* J.R. Harris (ed.) On-Site Wastewater Treatment, Proceedings of the Fiih Natl. Sym. on Individual and Small Community Sewage Systems. Am. Soc. Agric. Eng., St. Joseph, MI.

Rutledge, E.M., CR. Mote, M.S. Hirsch, H.D. Scott and D.T. Mitchell. 1983. Disposal of household wastewater in soils of high stone content. 1977-1980. Publ. 99. Arkansas Water Resources Research Center, University of Arkansas, Fayetteville.

Rutledge, E.M., BJ. Teppen, D.C. Wolf and CR. Mote. 1988. Storage of effluent in septic tank filter fields. Agronomy Abstracts, Am. Soc. Agron., Madison, WI. p. 46.

EPA. 1980. Design Manual - Onsite Wastewater Treatment and Disposal Systems. U.S. Environ. Protection Agency, Washington, DC.

SOIL MOISTURE REGIMES: SUGGESTIONS FOR IMPROVEMENT

R.F. Paetzold

The present definitions of soil moisture regimes are at best awkward. The nature of the definition makes determination of the soil moisture control section boundaries difficult. Determination of the number of days either cumulative or consecutive that the water content in all or some part of the soil moisture control section is above or below 1500 kPa tension is likewise difficult, especially when measurements are taken at only a few depths (often only one or two) and at intervals of two weeks or longer. I believe that it is possible to simplify the present definitions pertaining to soil water regimes and still retain the desired grouping of similar soils that was the objective of the present definitions.

Currently, few, if any soil classifications, are made in which the soil moisture regime is determined strictly from the definitions given in the Soil Taxonomy (Soil Survey Staff, 1975). The implication is that the definitions pertaining to the soil moisture regime are not usable, i.e. they require more information than is available, they are too complex, etc., or they give soil classification that are not in accordance with the concepts of the regimes or both. If the soil moisture regime is a soil property, then there should be a set of usable definitions based on criteria that give "correct" classifications when applied. Assuming that the concepts of the present regimes are satisfactory, then any change in the definitions should be made such that soils are placed into the regimes that the concepts indicate are correct, i.e. the present classification of most soils should not be changed to accommodate any new definitions.

It was never the intent of the Soil Taxonomy authors that either the boundaries of the soil moisture control section or its water state should be measured (Smith, 1986). The present definition of the soil moisture control section was chosen to simplify calculations in water balance models [specifically Newhall's model, (Newhall, 1980)], potentially useful in determining soil water regimes. Therefore, the soil water control section should be considered an abstract concept. For "bucket" models, such as Newhall's, the actual location of the boundaries are not needed and in fact are irrelevant. The soil moisture control section definition treats the soil as if it were a series of buckets with the first or top bucket having a fixed capacity of 25 mm and the second bucket or soil moisture control section having a fixed capacity of 50 mm. Aside from shallow soils (those with a lithic, paraliihic, petrocalcic, etc., within the limits of the soil moisture control section), all soil moisture control sections are treated as buckets with a capacity of 50 mm. This greatly simplifies calculation Of moisture status from climatic data, but makes it difficult to measure in the field. The definition creates a problem with the soil moisture regimes, in that for all practical purposes, it makes the soil moisture regime purely a function of climate rather than a soil property.

Soil moisture regimes currently are based on number of days that all or part of the moisture control section is dry or moist. Redefining the regimes based on mean annual and mean seasonal soil water potentials at a single depth would simplify determinations in many ways. Monthly measurements of soil Water potential would give acceptable averages. The investigator would not need to measure the number of days that the soil temperature exceeded certain limits. Furthermore, he would not need daily measurements to determine the number of days during these time intervals (or during the 4 months following the summer and winter solstices) that all Or Pan of the soil moisture control section was wetter or dryer than -1500 kPa soil water matric potential. In addition, the instrument most often used for soil moisture measurement is the resistance block. Resistance blocks are better suited to determining soil water potential than water content and they work best in the range of -10 to -1000 kPa. Basing soil moisture regimes on mean annual and seasonal soil water potential would make better use of the available instrumentation.

If we examine soil temperature, we see that the temperature is a measure of energy and that the temperature gradient is the driving force for heat flow. The analogous situation for soil water is that the water potential is a measure of energy and that the water potential gradient is the driving force for water flow. The use of soil water matric potential as the parameter defining soil moisture regimes would be consistent with the use of temperature as the parameter defining soil temperature regimes.

Soil temperature is determined at 50 cm because at this depth, daily variations and most short term weather variations are damped out, leaving only seasonal variations in soil temperature. For soil water, the depth at which variations due to individual events are damped out appears to be in the neighborhood of 75 to 100 cm. Determinations in this depth range can be used to give mean annual and mean seasonal water potentials. Measurements can be made at a single depth as they are for soil temperature. Measuring soil water potential at a single depth has various advantages. The depth is constant for all soils, thus eliminating any confusion or uncertainty over where measurements should be made. In practice, most measurements for soil moisture regime determination are made at only one depth, anyway. However, some investigators make measurements at the top of the soil moisture control section and some make measurements in the middle of it.

Soil moisture regimes should not be linked to soil temperature. The linkage of soil moisture regime to soil temperature (or time of year) was an attempt to introduce seasonality into the definitions, i.e. it was thought that soil water status during the growing season was paramount. The inclusion of soil temperature in the soil moisture regime definitions creates unnecessary complications, particularly in the colder climates. The use of seasonal variations in soil water potential can provide all the information necessary for soil moisture regime classification. The soil moisture regime and the soil temperature regime together should paint a complete picture of the soil climate.

Finally, I would like to see soil temperature and moisture measured at two depths. The second measurement depth, I believe, should be around 10 cm. The soil classification could be based on a single depth with the additional depth giving extra information that could be useful for various purposes. If two depths were used, gradients, and thus the direction of flow, could be determined. In the case of soil moisture, data from this depth could be useful for soils in arid climates where the soil may be too dry at 75 cm or deeper to separate intergrades.

The basic tenets of the present soil moisture regimes are good. In order to implement these new criteria for the soil moisture regimes, data on the variation of soil water potential at a depth in the range of 75 to 100 cm must be studied for a variety of soils. The boundaries of the soil moisture regimes and the intergrades must be defined in terms of mean annual and seasonal soil water potential. I believe that Guy Smith thought that if the Soil Taxonomy could present a first approximation Of the soil climate regimes, refinements would be made to improve them. We are now at the point where these refinements need to be made.

1990 Southern Regional Technical Work Planning Conference

Minesoil Classification and Interpretation Committee
J.T. Ammons and D. L. Newton

Committee Members: Horace Smith, Lee Daniels, Gaylon L. Lane, Glenn Kelley, Jimmy W. Frie, Larry Weet, and Robert L. Wilkes.

Committee Charges:

1. Determine what soil characteristics are changed by the mining process and how the resultant properties can be used in Soil Taxonomy and soil survey interpretation for reclamation, revegetation, and maintenanoe.

2. Evaluate the applicability of differentiae developed in the NCSS for minesoils of the Southern Region.

Overview

In accordance with the committee charges, we must first identify the property base of minesoils. Many researchers have worked on minesoils throughout the U.S. (see partial reference list). Minesoil classification has been attempted on minesoils created from a variety of overburdens representing a wide range of chemical and physical properties. Minesoil properties and their interpretation have been reported in various symposia and special conferences. These publications are not always widely distributed to the scientific community, but they contain much information on how minesoil properties are interpreted for post-mining land use.

Approach

The minesoil classification and interpretation committee of the southern region is the best resource for identifying publications from special meetings where minesoil information is presented. For this reason, we are asking each member to send references to the chairman of the committee 60 that a master list can be established. A partial list is attached which represents a small portion of the information available. Many scientists *in* the southern region have already responded by sending reference6 on minesoils (see attached list). This literature will be summarized and sent to the committee for input. There is a wealth of valuable information that can be consulted. This will save valuable time in making a decision on the direction the southern region will take on minesoils.

Summary of Meeting Discussion

After meeting with the minesoil committee, we decided to break each committee charge into the following subheadings:

Charge 1.

a. Chemical characteristics.

b. Hydrology.

c. Physical properties.

d. Landscape configuration.

Charge 2.

a. Series criteria.

b. Classifying at a higher category.

Under the subheading of chemical characteristics, the overall group felt that acid-base accounting and conductivity measurements should routinely be conducted on minesoils. This could be added as part of the criteria a6 a higher taxon is developed. These measurements may help differentiate these disturbed soils from native soils.

Hydrology of minesoils was discussed at length. The relationship between deep mine and surface mine subsidence was discussed in detail. Generally, the group decided that most surface mine subsidence happened within a year after placement. Evaluation of underground mine subsidence probably will not be pursued by the committee.

Physical properties including compaction and bulk densities are related to subsidence and other post-mining uses. Pressure to use minesoil for urban land uses is resulting in new alternative systems for septic tanks and construction techniques for houses and commercial buildings. Interpretations need to be developed for these uses.

Post-mining landscapes influence a variety of interpretations. Infiltration, seepage, landslides, and subsidence are all influenced by the landscape configuration created by deep land disturbances. Interpretations need to be developed for minesoil landscapes based on properties and landscape configuration.

Series criteria, as used by the NCSS to map minesoils, has some applicability for minesoils created by controlled placement of uniform overburden. The consensus of the committee is that these soils would be better mapped at a higher level of taxonomy.
This is especially true of minesoils constructed of heterogenous overburden. Older minesoils probably will be better inventoried at a higher level of taxonomy. The committee suggested that properties for a higher level be developed after all literature is reviewed (all regions). Additionally, drastically disturbed and shallow disturbance should be separated in the taxonomy due to the

difference in the degree of weathering of the materials.

Recommendations

1. The committee should be continued as part of the work planning conference.

2. The name of the committee should be changed to "Drastically Altered Soils: Their Classification and Interpretation".

3. The committee should be split into taxonomy and interpretations.

4. Criteria should be developed for classification after a complete review of the literature.

5. All land disturbance should be considered in the development of this Classification system.

6. The committee report should be presented to the national soil survey work planning conference.

Reference List

Adamo, D. C. 1986. Properties of Soils and Mineral Concentration of Forages on Reclaimed Surface Mines. H.S. (Sencindiver).

Ammons, J. T., Eric F. Perry, and R. M. Smith. 1979. "Soil Water and Root Development on Characterized Classes of Minesoils." Final Report. USDA-SEA by Agreement Number 684-15-16. West Virginia University, Division of Plant Sciences. Morgantown, WV.

Ammons, J.T. 1979. Minesoil Properties, Root Growth, and Land Use Implications. Ph.D. diss. West Virginia Univ., Morgantown (Diss. Abstr., 40:2936B)

Ammons, J. T., J. C. Sencindiver, and R. M. Smith. 1979. Topsoiling and Land Use. Landmarc. 2(3):17-20.

Ammons, J. T. and Paul A. Shelton. 1985. Disturbed Soil Classification-Divide Section. Tennessee Tombigbee Waterway. Better Reclamation with Trees Symposium. SIU-C, Amax Coal and Purdue University. pp. 127-143.

Ammons, J. T., and E. F. Perry. 1979. The Relationship of Overburden Analysis to Minesoil Properties in Post Mining Land Use. In Surface Coal Mining and Reclamation. McGraw-Hill, Inc. New York, NY.

Ammons, J. T., T. A. Keeney, and R. M. Smith. 1985. Minesoil Properties Affecting Rootgrowth. Better Reclamation with Trees Symposium SIU-C, AMAX Coal Co., and Purdue University. pp. 111-126.

Ammons, J.T. and J. C. Sencindiver. 1990. Minesoil Mapping at the Family Level Using a Proposed Classification System. J. Soil and Water Conservation (in press).

Anderson, D.W. 1977. Early Stages of Soil Formation on Glacial Till Mine Spoils in a Semi-Arid Climate. Geoderma, 19:11-19.

Askenasy, P. E., 1977. Soil Factors Influencing Row Crop Production and Phosphate Absorption on Leveled Lignite Mine Spoil Banks. Doctoral dissertation, Texas A & M University.

Barnhisel, R. I. 1972. Sampling Surface Mined Coal Spoils, University of Kentucky. KY. Agri. Exp. Sta. Bulletin. AGR 41.

Barnhisel, R.I. and H.F. Massey. 1969. Chemical, Mineralogical, and Physical Properties of Eastern Kentucky Acid-Forming Coal Spoil Materials. Soil Sci. 108:367-372.

Bearden, E. D.1984. A Comparison of Variability of Undisturbed and Surface Mined Soils in Freestone County, Texas. Texas A & M University. M.S. Thesis.

Beverage, W.W. and T.D. Yoakum. 1980. Soil survey of Harrison and

Taylor Counties, West Virginia. USDA-SCS in coop. with WV Agri. and For. Exp. Sta.

Cole, C. P. 1976. Overburden and Minesoil Properties in Relation to Original Soil Profiles, with Special Attention to Soil Structure. M.S.Thesis. West Virginia University. Morgantown, WV.

Daniels, W.L. and D.F. Amos. 1981. Napping, Characterization and Genesis of *Mine* Soils on a Reclamation Research Area in Wise County, Virginia. Symposium on Surface Mining Hydrology, Sedimentation, and Reclamation. Lexington, Ky.

Delp, C. H. 1978.

Hons, F. M. 1978. Chemical and Physical Properties of Lignite Spoils and Their Influence Upon Successful Reclamation. Doctoral Dissertation, Texas A & M University.

Hossner, L. R., et al. 1980. Chemical and Mineralogy of Lignite Overburden. Texas A & M University.

Indorante, S.J. and I.J. Jansen. 1984. Perceiving and Defining Soils on Disturbed Lands. Soil Sci. Soc. Am. J. 48:1334-1337.

Indorante, S.J. and I.J. Jansen. 1981. Soil Variability on Surface-Mined and Undisturbed Land in Southern Illinois. Soil Sci. Soc. Am. J. 45:564-568.

Kaiser, W. R. 1974. Texas Lignite: Near Surface and Deep-basin Resource. Bureau of Economic Geology, Report of Investigation No. 79. University of Texas, Austin.

Kennedy, A. S., et al., 1977. Surface-mined Land Reclamation Methods in Reclamation and Use of Disturbed Land in the Southwest.

Kohnke, H. 1950. The Reclamation of Coal Mine Spoil. Advances in Agronomy, Vol II. New York, Academic Press. pp.317-349.

Lyle, E.S. Jr. 1980. Minesoil Classification. In. D.G. Simpson and W.P. Plass (ed.). Proceedings of seminar on the role of overburden analysis in surface mining. Wheeling, WV. Bureau of Mines Info. Cir. 8863. U.S. Dept. of Interior. Washington, DC. p. 38-51.

McCallister, D. L. 1981. Alternation of Exchangeable Cation Distribution and Associated Chemical Changes in Acidifying Surface Mined Soils. Texas A & M University. Ph.D. Dissertation.

Paraday, F.E. and N.E. Hargis. 1989. Reclamation Management and Techniques for Cold Entisols in Southwestern Wyoming.International Soil Committee on Aridisols. Salt Lake City, Utah.

Perry, E. F. 1978. Minesoil Properties That Influence Fish and Wildlife Habitats. In Samuel, D. E., J. R. Stauffer, C. H. Hocutt, and W. T. Mason (editors). Surface Mining and Fish/Wildlife Needs in Eastern United States. FWS/OBS-78/81. Biological Services Program, U. S. Dept. of Interior. p. 223-231.

Pettry, D.E., W.F. Miller, and J.W. Darden. 1980. Reclamation of the Knob Surface Mine, Alabama, Using Selected Overburden Material. Symposium on Mining Hydrology, Sedimentology and Reclamation. University of Kentucky. Lexington, KY. pp. 285-291.

Pfordresher, A. A., 1988. Evaluation of Vegetative Cover on Reclaimed Land By Color Infrared Videography Relative to Soil Properties. Texas A & M University. M.S. Thesis.

Plass, W.T. and W.G. Vogel. 1973. Chemical Properties and Particle-Size Distribution of 39 Surface-Mine spoils in southern West

Virginia. U.S. Forest Service Northeastern Exp. Station. Res. Paper NE-276. pp8.

Roberts, J.A., W.L. Daniels, J.C. Bell, and J.A. Burger. 1988. Early Stages of Mine Soil Genesis as Affected by Topsoiling and Organic Amendments. Soil. Sci. Soc. Am. J. Vo1.52. No.3.

Roberts, J.A., W.L. Daniels, J.C. Bell, and J.A. Burger. 1988. Early Stages of Mine Soils *Genesis* in a Southwest Virginia Spoil Lithoseguence Sequence. Soil Sci. Soc. Am. J. Vol 52. No. 3.

Rubel, N., P.C. Jenny, and M.K. Plunkett. 1981. Soil Survey of Belmont County, Ohio. USDA-SCS in coop. with Ohio DNR, Div. of Lands and Soil and Ohio Ag. Research and Development Center.

Schafer, W.M. 1979. Variability of Mine Soil6 and Natural Soils in Southeastern Montana. Soil Sci. Soc. Amer. J. 14:1207-1212.

Schneider, W. J. 1977. Analysis of the Densification of Reclaimed Surface Mined Land. Texas A & M University. H.S. Thesis.

Sencindiver, J.C., J.T. Ammons, and C.H. Delp. 1978. Minesoil Classification - A Proposed Suborder. 11th Int. Soil Sci. Cong. Abstr. Edmonton, Canada. p. 30.

Sencindiver, J.C., B.L. Wolf, and N.C. Thurman. 1985. Characterization and Classification of Minesoils in Southern West Virginia. Agron. Abstr. p. 197.

Sencindiver, J. C., J. T. Ammons, and R. M. Smith. 1979. Overburden and minesoil potentials for land use. Proc. W Acad. Sci. 51(3):138-146.

Sencindiver, J.C. 1977. Classification and genesis of minesoils. Ph.D. Diss. West Virginia Univ., Morgantown (Diss. Abstr. 38:1495B).

Severson, R.C. 1981. Evaluating Chemical Character of Soil Material for Suitability in Rehabilitating Mined Land in the San Juan Basin, New Mexico. Soil. Sci. Soc. Am. J. Vol. 45.

Singh, R. N., R. M. Smith, W. E. Grube, and E. M. Jencks. 1972. Soil Testing and Its Application to Minesoils. p. 4. In Proc. Acid Mine Drainage Workshop. Dept. of Geology, Ohio University. Athens, OH.

Smith, R.M., A.A. Sobek, T. Arkle, J.C. Sencindiver, and J.R. Freeman. 1976. Extensive Overburden Potentials for Soil and Water Quality. EPA-60012-76-184. USEPA. Cincinnati, OH.

Smith, R. M. 1976. Minesoil Properties and Classification study. Green Lands Quarterly. 6(1):11.

Smith, R. M. 1971. Properties of Coal Overburden That Influence Revegetation and Economic Use of Mine Soils. p. 5-6. In D. M. Bondurant (ed.) Proceedings of the Revegetation and Economic Use of Surface-Mined Land and Mine Refuse Symposium. West Virginia Univ. Morgantown, WV.

Smith, R. M., E. H. Tryon, and E. H. Tyner. 1971. Soil Development on Mine Spoil. West Virginia Agric. Exp. Stn. Bull. 604T.

Smith, R.M. and A.A. Sobek. 1978. Physical and Chemical Properties of Overburdens, Spoils, Wastes, and New Soils. p. 149-172. In F.W.Schaller and P. Sutton (eds.) Reclamation of drastically disturbed lands. ASA Madison, WI.

Smith, R. M., W. E. Grube, Jr., and J. T. Ammons. 1973. Toxic or Potentially Toxic Materials. Green Lands Quarterly. 3(3):7.

Smith, R.M., W.E. Grube, Jr., T. Arkle and A.A. Sobek. 1974. Mine Spoil Potentials for Soil and Water Quality. EPA-670-12-74-070. USEPA. Cincinnati, OH.

Smith, R. M. 1973. Choosing topsoil to fit the needs. Green Lands Quarterly. 3(2):30-31.

Smith, R. M., W. E. Grube, Jr., J. C. Sencindiver, R. N. Singh, and A. A. Sobek. 1974. Properties, Processes and Energetic6 of Minesoils. Transactions of the 10th International Congress of Soil Science (Moscow, U.S.S.R). IV:406-411.

Smith, R. M., W. E. Grube, Jr., and J. R. Freeman. 1975. Better Minesoils by Blending. Green Lands Quarterly. 5(1):16-18.

Sobek, A. A., W. A. Schuller, J. R. Freeman, and R. M. Smith. 1978. Field and Laboratory Methods Applicable to Overburdens and Minesoils. EPA-600/2-78-054. National Tech. Information Service. Springfield, VA.

Sobek, A. A. and R. M. Smith. 1971. Properties of Barren Minespoil. Proc. WV Acad. Sci. 43:161-169.

Sobek, A. A., R. M. Smith, and T. Arkle, Jr. 1976. Planning Criteria and Use of Highly Disturbed Soils. In Hillands, Proc. of an International Symposium. Morgantown, WV. p. 535-539.

Sweeney, R.L. 1979. Soil Genesis on Relatively Young Surface Mined Land in Southern West Virginia. M.S. Thesis. Virginia Polytechnic Institute and State University. Blacksburg, VA.

Thomas, J. R. 1987. Characterization and Classification of Minesoils in Central West Virginia. M.S. Thesis. West Virginia Univ. Morgantown, WV.

Thomas, D. and I. Jansen. 1985. Soil Development in Coal Mine Spoils. J. Soil and Water Cons. 40:439-442.

Thurman, N. C. and J. C. Sencindiver. 1986. Properties, Classification, and Interpretation of Minesoils at Two Sites in West Virginia. Soil Sci. Soc. Amer. J. 50(1):181-185.

Thurman, N. C., J. C. Sencindiver, J. T. Ammons, and D. C. Adamo. 1985. Physical Properties of Minesoils and Their Effects on Root Growth. p. 194-208. In C. A. Kolar (ed.), Proc. of the 7th Better Reclamation with Trees Conf. Southern Ill. Univ.

West Virginia University. 1971. Minespoil Potentials for Water Quality and Controlled Erosion. Water Pollution and Control Series. 14010. EJE. USEPA. Washington, DC.

Wright, E. L, C. H. Delp, K. Sponougle, C. Cole, J. T. Ammons, J. Gorman, and F. D. Childs. 1980. Soil Survey of Marion and Monongalia Counties, West Virginia. USDA -Soil Conservation Service in Cooperation with West Virginia University Agr. Exp. Sta. and Marion and Monongalia County Commissions.

National Soil Survey Laboratory
Activities Report
June 1990

Since our last conference, Dr. Ellis Knox became the Head of The National Soil Survey Laboratory and in that capacity is the SCS National Leader for Soil Survey Investigations. Dr. Carolyn Olson is the head of the new Field Investigations staff that was added a year and a half ago. New liaison assignments to states and other personnel changes those are reflected on our current staff listing. Those are available to those of you who want them.

We have received the OPM vacancy announcement for a GS-11 research soil scientist to work primarily with our datasystems. This will draw from all sources and hence will not be on the familiar SCS "green sheets". We will soon announce another research soil scientist vacancy, likely for emphasis in soil chemistry. So, if you know of qualified candidates, please have them contact Dr. Knox or one of the Laboratory Staff members.

Analytical Activities

The number of samples that we receive has increased each year for the last several years. Last year we received about 260 projects with about 8,600 samples on which nearly 190,000 analyses were completed.

A new Soil Survey Laboratory method6 is being written and is complete except for final in-house editing. We can provide it a6 a draft document to NCSS cooperators on request before the end of this calendar year. We plan for it to replace Soil Survey Investigations Report No. 1 after being subjected to a more formal editorial review.

To provide more software uniformity between our analytical instruments and our data storage units we are in the process of purchasing, a Laboratory Information Wanagement System (LIMS). We expect this system to automatically provide some analytical laboratory management tool6 that we Currently lack or have to maintain manually. We anticipate that this will further improve analytical efficiency.

Data Bases and Record6

As in the past, as soon as analyses are complete and stored in the mainframe computer, they are electronically available to you using the INTERACT program to access the National Soil Survey Laboratory Database.

Use of the NSSL database is limited by the lack of classification of many of the pedons. We are modifying the instructions for the soil-8 forms to separate the family classification of the pedon itself from the correlation procedure. The classification of the pedon based on the field description and laboratory data can be made as soon as the data are available. We know that the classification of the pedon is likely to differ from the classification of the series identified at final correlation, so there is no need to wait for completion of the survey or for final correlation to force a match with the family of the correlated series. We would like to have the classification of the pedon determined by the states, but if classification is separated from correlation issues, then any competent, informed soil scientist can classify.

The National Soil Characterization Data Base development is moving closer to reality with the location of Ellis Benham at the Soil Survey Laboratory. Ellis is an Auburn University Ph.D. candidate employed by Texas A&M University. This database will incorporate data from all NCCS contributing laboratories. The associated committee has experiment station representatives from each region in addition to the SCS members. Analytical data and descriptions with software for manipulation of the data will be distributed periodically on CD ROM to make it available to the SCS and other participants in the National Cooperative Soil Survey.

Training

A great deal of our staff time is spent training other soil scientists. Warren Lynn continues to serve as technical coordinator for lab data courses with three or four sessions taught in Lincoln and usually in one or two other locations each year. Most of the staff helps with these courses. Warren represented NSSL in the joint effort with the NSSQA staff to pilot two sessions of a new soil survey course this year. NSSL staff members also teach at the Soil Science Institute, the soil salinity course, and soil correlation courses.

For the third year, our staff had a well-received presentation at the National Science Teacher's Conference.

Research and Development

Since the list of research activities in which our staff is involved is quite long, permit me to highlight some representative ones.

Study	Leadership
N.C. Mountain Soils Study and Tour	
Int'l Soil Correlation Meetings	
Humic Substances Characterization	
Saline Seeps	
Drainmod parameters from S-5 data	
Particle size by transducer	
Soil	

booking Ahead

We believe that the use of the data ve have now and what we collect in the foreseeable future will be much more heavily concerned with soil survey interpretations. Those will include concerns on which we are already working such as water quality and some just coming onto the horizon such as global warming.

Priorities and protocols for getting additional data may change somewhat from our current ways of operating. Perhaps we will need to consider sampling representative soils in an MLRA instead of a county or group of counties. A proposed sampling protocol for MLRA updates is being Written and reviewed by our staff. Some have suggested that the benchmark soils concept may again be a viable way to approach sampling. We may also find that our staff liaison assignments may need to be made in a different way. If you have some thoughts about these topics, please tell me your ideas.

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See reverse side for liaison assignments and NSSL technical work groups 6/90

LIAISON ASSIGNMENTS 6/90

Area and States	Scientist
Pacific Northwest (WA, OR, ID)	Rebecca Burt/Fred M. Xaisak
Montana	Richard L. Pullman
Lake States, Alaska (MN, WI, MI, AK)	Ronald D. Yeck
New England (ME, NH, VT, MA, CT, RI)	Laurence E. Brown
Lower Northeast (NY, NJ, PA, MD, DE, DC, WV, VA) and Northern Plains (NE, ND, SD)	Robert B. Grossman
Hawaii	Leo C. Klameth
Southwest (CA, NV, AZ, NH)	Otto W. Baumer
Intermountain (UT, CO)	Thomas G. Reinsch
Central Corn Belt and Central Plains (IA, IL, IN, OH, MO, ES, WY)	W. Dennis Nettleton
South Central (OX, TX, LA, AR)	Benny R. Brasher
Southeast and Puerto Rico (M, TN, NC, SC, GA, MS, AL, FL, PR)	Warren C. Lynn

REGIONAL LIAISON

Midwest National Technical Center	W. Dennis Nettleton
Northeast National Technical Center	Robert B. Grossman
South National Technical Center	Warren C. Lynn
West National Technical Center	Otto W. Baumer

*** NSSL DATABASE ***

PEDON COUNTS

01/May/90

STATE	TOTAL	PRE1978	1978-UP	W/TAX	NO TAX	DESCRIPTION	CORRELATED
			<---------------- 1978 & UP				---------------->
NOT IDENTIFIED	35	2	33	0	33	0	0
ALASKA	344	80	264	29	235	207	28
ALABAMA	104	19	85	72	13	35	71
AMERICAN SAMOA	25	10	15	15	0	15	15
ARKANSAS	70	27	43	14	29	26	14
ARIZONA	581	295	266	38	248	198	38
CALIFORNIA	1193	529	664	116	548	341	74
COLORADO	482	212	270	8	262	143	8
CONNECTICUT	23	8	15	15	0.	11	15
DISTRICT OF COLUMBIA	3	3	0	0	0	0	0
DELAWARE	24	15	9	0	9	3	D
FLORIDA	155	94	61	4	57	13	4
FOREIGN NATION	894	3	891	566	325	652	560
GEORGIA	244	54	190	69	121	101	64
GUAM	20	0	20	19	1	16	19
HAWAII	42	7	35	17	18	21	17
IOWA	780	146	634	443	191	543	409
IDAHO	554	129	425	189	236	199	59
ILLINOIS	479	142	337	90	247	197	101
INDIANA	319	9	310	94	216	70	04
KANSAS	346	111	235	126	109	126	126
KENTUCKY	244	85	159	70	a9	100	71
LOUISIANA	230	124	106	71	35	32	37
MASSACHUSETTS	89	69	20	4	16	5	4
MARYLAND	150	17	133	0	133	96	0
MAINE	121	63	58	14	44	18	7
MICHIGAN	173	90	83	31	52	34	31
MINNESOTA	151	108	43	26	17	38	27
MISSOURI	327	82	245	100	145	93	99
MISSISSIPPI	163	123	40	SO	10	29	29
MONTANA	538	296	242	72	170	95	53
NORTH CAROLINA	268	59	209	51	158	86	51
NORTH DAKOTA	424	171	253	173	80	53	172
NEBRASKA	752	292	460	159	301	224	105
NEW HAMPSHIRE	107	70	37	2	35	30	2
NEW JERSEY	86	54	32	29	3	26	29
NATIONAL LABORATORY	79	0	79	0	79	0	0
NEW MEXICO	368	137	231	94	157	104	72
NEVADA	600	261	339	14	325	181	14
NEW YORK	279	75	204	46	158	84	19
OHIO	32	6	26	18	8	22	18
OKLAHOMA	163	68	95	10	85	69	8
OREGON	478	285	193	1	192	68	18
PENNSYLVANIA	57	40	17	2	15	0	2
PUERTO RICO	188	100	88	1	87	58	0
SOUTH CAROLINA	85	SO	55	14	41	21	11
SOUTH DAKOTA	412	198	214	·33	181	111	33
TENNESSEE	220	168	60	15	45	52	15
TRUST PACIFIC ISLAND	37	0	37	35	2	27	36
TEXAS	706	273	433	240	193	255	229
UTAH	458	265	193	4	189	122	1
VIRGINIA	76	13	63	0	63	19	0

*** NSSL DATABASE ***
PEDON COUNTS
01/May/90

			<---------------- 1978 B UP --------------->				
STATE	TOTAL	PRE1978	1978-UP	W/TAX	NO TAX	DESCRIPTION	CORRELATED
VIRGIN ISLANDS	12	8	4	0	4	4	0
VERMONT	175	73	102	39	63	67	39
WASHINGTON	504	162	342	25	317	151	25
WISCONSIN	515	178	337	139	198	134	59
WEST VIRGINIA	159	59	100	51	49	71	51
WYOMING	412	191	221	9	212	93	10
GRAND TOTALS ------>	16563	6188	10375	3546	6829	5589	3083

** SOUTHERN STATES **

			<---------------- 1978 8 "p --------------->				
STATE	TOTAL	PRE1978	1978-UP	W/TAX	NO TAX	DESCRIPTION	CORRELATED
ALABAMA	104	19	85	72	13	35	71
ARKANSAS	70	27	43	14	29	26	14
FLORIDA	155	94	61	4	57	13	4
GEORGIA	244	54	190	69	121	101	64
KENTUCKY	244	85	159	70	89	100	71
LOUISIANA	230	124	106	71	35	32	37
MISSISSIPPI	163	123	40	30	10	29	29
NORTH CAROLINA	268	59	209	51	158	86	51
OKLAHOMA	163	68	95	10	85	69	8
PUERTO RICO	188	100	88	1	87	58	0
SOUTH CAROLINA	85	30	55	14	41	21	11
TENNESSEE	228	168	60	15	45	52	15
TEXAS	706	275	433	240	193	255	229
VIRGIN ISLANDS	12	8	4	0	4	4	0
GRAND TOTALS ------>	2860	1232	1628	661	967	881	604

TOTAL......... All of the pedons in the NSSL Database.
PRE1978....... Pedons ● nblad prior to 1978 by the NSSL and it's predecessor laboratories.
1978-UP...... Pedons sampled by NSSL beginning in 1978.
W/TAX........ Pedons classified by states or TSC's on NSSL Soil-8 forms returned to NSSL.
NO TAX....... Pedons not classified by states or TSC's.
DESCRIPTION . . Profile descriptions currently stored in the NSSL Database.
CORRELATED ... Pedons with a correlated series name shown on NSSL Soil-8 form returned to NSSL.

Report of the Soil Taxonomy Committee of the Southern Regional Work Planning Conference of the National Cooperative Soil Survey.

May 11, 1989 - Amendment adding Alfic and Ustalfic Quartzipsamments was cleared by the South Taxonomy Committee and sent to John Witty.

October 12, 1989 - Proposed amendment to Soil Taxonomy to allow Ultisols in the Frigid family - No objections. Original cleared by the Northeast Taxonomy Committee.

October 20, 1989 - Proposed glossic great groups with the glossic horizon. Sent to John Witty and cleared by the South Taxonomy Committee.

January 12, 1990 - An opportunity to comment to John Witty on minor changes made January 12, 1990. The changes were agreed upon by Richard Mayhugh, soil correlator, and senior author of the proposal. No objections noted.

Joe D. Nichols

JOE D. NICHOLS
Chairman

Taxonomy **Committee** Members

Elected at the 1988 Southern Regional Work Planning Conference

Term Expires at the Work Planning Conf. or in June of Alternate Years	State Representatives	Federal Representatives
1991	Dr. Brian Carter	Paul G. Martin
1992 (Term began in 1989)	Dr. Randy Brown	Adam Hyde

Elected at the 1990 Southern Regional Work Planning Conference

Term Expires at the Work Planning Conf. or in June of Alternate Years	State Representatives	Federal Representatives
1993 (Term began in 1990)	Dr. Frederick Beinroth	Harry Davis
1994 (Term begins in 1991)	Dr. B. L. Allen	Benjamin Stuckey

JOE D. NICHOLS

SOUTH REGIONAL SOIL SURVEY WORK PLANNING CONFERENCE
San Juan Puerto Rico
Motions, June 20, 1990

For the 1992 South Region Work Planning Conference, discontinue the session in which committee reports are presented to the conference as a whole.

Warren Lynn
Larry Wilding, second
Motion Carried

For the 1992 South Region Work Planning Conference, request committee chairpersons to finalize committee recommendations in written form, so they can be collated and presented to members of the group for adoption.

Larry Wilding
Warren Lynn, second
Motion Carried

For the location of the South Regional Work Planning Conference in 1992. Horace Smith, State Soil Scientist, proposed North Carolina representing SCS and Dr. Stan Buol. No other invitations were received and the conference voted to go to North Carolina in 1992.

JOE D. NICHOLS

SOUTHERN REGIONAL TECHNICAL WORK PLANNING CONFERENCE
of the
NATIONAL COOPERATIVE SOIL SURVEY

SAN JUAN, PUERTO RICO
18 to 22 June 1990

PROGRAM

<u>Sunday, 17 June 1990</u>

Participants arrive in San Juan, transfer to TraveLodge Hotel.

1800 - 1900 Registration, TraveLodge Hotel

<u>Monday, 18 June 1990</u>

0730 - 0830 Registration, TraveLodge Hotel

OPENING SESSION
Chairman: Fred H. Beinroth

0830 - 0845 Welcome: Humberto Hernández
Director
USDA-Soil Conservation Service
Caribbean Area
San Juan, Puerto Rico

0845 - 0945 Opening Remarks:

Paul F. Larson, Director
South National Technical Center
USDA-Soil Conservation Service
Fort Worth, Texas

Miguel A. Lugo Lopez
Professor Emeritus
College of Agricultural Sciences
University of Puerto Rico
Mayaguez, Puerto Rico

William E. Roth, Soil Scientist
Soil Survey Division
USDA-Soil Conservation Service
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Everett Emino
Assistant Dean for Research
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Gainesville, Florida

0945 - 1015 Refreshments

KEYNOTE ADDRESSES
Chairman: Joe D. Nichols

1015 - 1100	The Role of Tropical Forest Ecosystems in a Time of Global Change Ariel E. Lugo Institute of Tropical Forestry USDA-Forest Service San Juan, Puerto Rico
1100 - 1145	The Soil Resource: Challenges and Perspectives for the 1990 's E.C.A. Runge Texas A&M University College Station, Texas
1145 - 1200	Announcements
1200 - 0130	Lunch
0130 - 0300	COMMITTEE MEETINGS
0300 - 0330	Refreshments
0330 - 0500	COMMITTEE MEETINGS
0500 - 0600	FIELD TRIP BACKGROUND

Tuesday, 19 June 1990

0730 - 1330	FIELD TRIP TO CARIBBEAN NATIONAL FOREST
1430 - 1700	COMMITTEE MEETINGS

Wednesdav. 20 June 1990

0800 - 0930	COMMITTEE MEETINGS
0930 - 1000	Refreshments
1000 - 1200	COMMITTEE MEETINGS
1200 - 1300	Lunch
1300 - 1500	COMMITTEE REPORTS
1500 - 1530	Refreshments
1530 - 1545	TAXONOMY REPORT - Joe D. Nichols
1545 - 1600	CLCSING REMARKS - Joe D. Nichols
1600 - 1730	MEETING OF FEDERAL AND STATE AGENCIES
1739	Conference adjourns

Thursday, 21 June 1990

0800 - 1730 FIELD TRIP
San Juan-Arecibo-Isbbela-Mayaguez-Lajas.
Travel along the island's north and west coasts with study sites in Oxisol and Ultisol areas and visit of a coffee plantation.
Night at Hotel Villa Parguera, Lajas.

Friday, 22 June 1990

0800 Participants depart for San Juan airport.
Travel along Puerto Rico's **ustic** south coast and across the **udic** Cordillera Central.

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