National Cooperative Soil Survey Newsletter

November 2008
Issue 45

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Editor's Note

Issues of this newsletter are available on the World Wide Web (http://soils.usda.gov/). Under Quick Access, click on NCSS, then on Newsletters, and then on the desired issue number.

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The National Soil Survey Center: A Short History

By Robert J. Ahrens, Director, NRCS, National Soil Survey Center (NSSC), and Craig A. Ditzler, National Leader for Classification and Standards, NSSC, Lincoln, Nebraska.

As the National Soil Survey Center celebrates 20 years of technical expertise and dedicated service to the Soil Survey Program, it seems an appropriate time to reflect on the Center's short, but dynamic history.

The establishment of the National Soil Survey Center followed the recommendations of the Soil Survey Program Productivity Improvement Study (PIP report), which was approved by then Chief Wilson Scaling in 1987. Specifically, the report recommended, "A National Soil Survey Center of technical authoritative information on soils should be established. Previously, SCS expertise has been dispersed or segmented among National Headquarters (NHQ), four National Technical Centers (NTCs), and the National Soil Survey Laboratory (NSSL)." The idea was to have all the technical expertise at one location, rather than scattered among the NTCs, NSSL, and NHQ.

The PIP report recommended a structure with four staffs at the National Soil Survey Center, which included a Pedology Staff, a Soil Survey Investigations Staff, a Soil Classification and Mapping Quality Staff, and a Soil Survey Interpretations Staff. The Pedology Staff would have the responsibilities for soil taxonomy and soil geography. The duties of the other staffs are self-explanatory. When the Center began operations in fiscal year 1988, the staffs were aligned around interpretations, quality assurance, databases, investigations, and classification, not exactly the same staffs recommended in the PIP report. The Pedology Staff was never established, but most of the responsibilities mentioned in the PIP report were assumed by one staff or another. Before the inception of the NSSC, the Classification, Geography, and Interpretations Staffs, as they existed, were at National Headquarters, mapping quality was a function of the NTCs, and research and laboratory analyses were coordinated from the NSSL in Lincoln. Several editors working on the preparation of soil survey manuscripts for publication were housed separately at NHQ and the NTCs.

As an aside, the PIP report was an influential document, and several of the recommendations from the report are still being practiced today. For example, the PIP report noted considerable overlap between the duties of the State Office and the Soil Staffs at the NTCs. The technical review of soil survey manuscripts, Official Series Descriptions, and Soil Interpretation Records occurred in both places. Other activities also occurred in both places. The report recommended that quality control functions not occur at several levels. Quality control responsibilities became the State's responsibilities, rather than the duties of NHQ, the NTCs, or the new NSSC. The PIP report also emphasized progressive correlation to keep field soil scientists in some instances from covering the same ground over and

over. Based on the report's recommendations, the Quality Assurance Staff's areas of responsibility were assigned by MLRA, not by State or political boundaries. Does this all sound familiar?

Originally, the National Soil Survey Center was to be located in Fort Worth, Texas. Fort Worth is somewhat centrally located and has a major airline hub. The cost of moving the laboratory equipment and thousands of soil samples from Lincoln, Nebraska, however, was prohibitive, and it was later decided to locate the Center in Lincoln. Also, the potential job loss in Lincoln was a concern to some businesses and likely to some of the politicians.

The Quality Assurance Staff was the largest staff at the NSSC. It was a centralized correlation staff, which combined soil correlators from the National Technical Centers and additional soil scientists, who were recruited from State Office Staffs. The Quality Assurance Staff was divided among the West, Central, and East, and each staff member was responsible for the quality assurance of a few to several MLRAs. In addition, most of the editors working within the Soil Survey Program were brought together into one group as a part of the Quality Assurance Staff. The State Office Staffs were charged with quality control. The authority to sign correlation documents was transferred from the NTCs to the States, not to the NSSC. This arrangement meant that while the "correlators" at the NSSC could make recommendations regarding correlation decisions, the final authority belonged to the State Soil Scientists.

Quality assurance was a new concept to the Soil Survey Program and was not easily understood or implemented. For the most part, soil scientists were used to doing a thorough review of a soil survey manuscript, OSD, or other product. The new concept called for a less extensive review. For example, the Quality Assurance Staff was instructed to perform a 10 percent check of soil survey manuscripts and note any errors or deficiencies. The manuscript then went back to the State Office with the understanding that the State Staff would make the corrections and look for similar errors in the rest of the manuscript and correct those. In reality, the task of going back and checking for similar errors in the rest of the manuscript was time consuming, and it was seldom done.

One of the most effective activities for assuring quality is training employees to know our agency's standards and policies and to implement them effectively. Training courses, such as Basic Soil Survey and Soil Correlation, were moved from the NTCs and consolidated into the mission of the NSSC, in cooperation with the National Employee Development Center (NEDC). Training became an important function of the NSSC at its inception and remains so today. As a result of the cooperative efforts of the NSSC and NEDC, the Soil Survey Division's training opportunities are, we believe, the best in the agency today.

The Database Staff was charged with the responsibility for the structure and modifications of databases, the selection of hardware-software combinations, and the training of soil scientists to use the systems. This group conducted an in-depth study to document all of the process steps necessary to conduct soil survey and described in detail the multitude of features that a database for our field employees would need to have. This staff did much of the initial work in the development of NASIS, which is by far our agency's most complex and successful database today. In 1991, most of the functions and staff were moved to Ft. Collins and joined with the Information Technology Center. The NSSC retained the training responsibilities related to soil databases.

In the early 1990s, the Center experimented with different management philosophies, as did much of the rest of NRCS. Total Quality Management (TQM) was stressed at the NSSC, and all employees received training on the philosophy and concepts. TQM attempted to improve products and services by involving employees at all levels of the organization, installing pride of workmanship, and breaking down barriers among staffs. While TQM was somewhat of a fad, it has worthwhile goals and promotes good common sense and a philosophy that should be practiced by any business or unit of government.

At one point, the Center was directed by a Steering Team, and staffs were disbanded. People were supervised by a member of the Steering Team, which consisted of former National Leaders. The employees supervised by a member of the Steering Team may or may not have all worked on the same or similar projects, and the supervisor may or may not have had much experience with the types of projects. The idea was to eliminate staff boundaries and encourage individuals to work together more effectively. Of course, a big inefficiency was that the supervisor or Steering Team member could not possibly have broad enough experiences to focus and direct a more-or-less randomly assigned group of individuals with many different specialties and projects. As a result, it was challenging to focus the Center's activities during this period.

It is difficult to argue with the good intentions of these various management

philosophies and practices, but it is questionable how well these operate in a government bureaucracy, where a staff-and-line structure fits well within the standard operating procedures. Eventually, the NSSC abandoned the steering team concept and returned to a more traditional staff-oriented structure.

Efforts to reorganize those parts of the Agency related to technology transfer were underway in the mid-1990s. The NSSC was affected, but not to the same extent as the National Technical Centers, which were abolished and replaced by five Regional Offices and several "Institutes" dedicated to the development and transfer of new technology. MLRA Soil Survey Regional Offices also were established to assume the quality assurance responsibilities of the now disbanded Quality Assurance Staff at the NSSC. In addition, the authority for correlation was transferred from the State Soil Scientists to the MLRA Regional Office Leaders. Some of the Quality Assurance Staff personnel were no longer included in the staffing plan at the NSSC and were required to apply for positions as they were advertised. It was a time of uncertainty at the Center, and morale declined. The reasons for the shift of quality assurance from the NSSC to the newly formed MLRA Soil Survey Region Offices were never made clear to us at the Center. Most of us perceived the need for the shift as some sort of failure, although no one believed that it was the result of not having talented and capable staff. While it can be argued that this change moved the important function of quality assurance closer to the field, it also had the undesirable effect of greatly reducing the overall breadth and depth of soil survey experience housed at the NSSC. Some of the Quality Assurance Staff members were selected as MO Leaders and were very successful in those positions. Despite vigorous arguments by some at the time, the editorial staff was mostly reassigned to the various MLRA Regional Offices, thus forgoing the efficiencies that were gained by bringing them together into one staff nearly a decade previously.

After the reorganization, the Center retained the responsibilities associated with the laboratory, research, standards, and interpretations and took on the added responsibility of soil survey technical services, which was needed to support the main responsibility of the State Soil Scientists, who now needed to focus on the interpretations, use, and dissemination of soil survey information. Also, specialists were added in the disciplines of agronomy, forestry, range science, and geology to improve soil survey interpretations and integrate soil information with other disciplines. More recently, a significant change in the function and staffing of the NSSC took place when the position of National Leader for Technical Soil Services was moved to NHQ. This change was made primarily so that the leader would be able to interact more easily with individuals representing the various other programs in the agency and to ensure effective input from the soils discipline. This change has proved to be effective, but it is interesting to note that in a small way it reverses the original intention of the PIP report to move technical positions out of NHQ and into the NSSC.

Like most of the Agency, the Center has not been able to replace all the staff members who have retired in the past several years. When the Center began, it had a mixture of experienced, mid-career, and younger employees. Before the departure of the Database Staff, the Center had over 110 employees. Today, that number is in the low 60s, yet the Center still tries to perform most of the same functions and provide the same services that it did when it had a much larger staff. A continuing challenge for the Center is to try to pare down its activities and focus on the most essential ones.

We are somewhat biased, but we think it is fair to say that the Center has a very capable and talented staff. We have been able to recruit exceptional people to apply for vacancies at the Center, and we expect that trend to continue. Some are worried that in the future the Center and for that matter the Soil Survey Program will have positions filled by people without significant field experience. There are fewer opportunities for field experience now than there were at the time when some of the older soil scientists started their careers. In the future, we will likely have soil scientists with less field experience, but they will have other experiences and bring new skills to the profession. We are always gratified to witness the caliber of people we are hiring when we host the Basic Soil Survey Course. So, the message probably is that the Soil Survey Program and the Center will continue to evolve and change. It is difficult to predict the extent of change and evolution, but be assured that the Center and the Soil Survey Program have excellent, talented people to meet any challenges that may lie ahead. ■

Soil Rubbed on Baseballs

By Stanley P. Anderson, Editor, NRCS, National Soil Survey Center, Lincoln, Nebraska.

For a story about a "feldspar-rich clay" that is rubbed on baseballs used in the major leagues, see "The Dirt on Baseball" in the Culture section of the October 2008 issue of *National Geographic*. The soil is from a New Jersey swamp. ■

New Edition of the *Keys to Soil Taxonomy* Planned

By Stanley P. Anderson, Editor, NRCS, National Soil Survey Center, Lincoln, Nebraska.

The National Soil Survey Center plans to publish a new edition of the *Keys to Soil Taxonomy* in 2009. In preparation for this publication, Craig Ditzler and I asked John Kelley, Soil Quality Data Specialist, MO 14, Raleigh, North Carolina, to take pictures of soils with lamellae for use on the cover. John sent us a few, and we picked one. The next day, he sent me a more personal picture from the same site for consideration. I cropped and this new picture and otherwise slightly modified it, creating the impression of a human figure embedded in the soil (fig. 1).

Removing a little more of the anthropological detail creates a different impression (fig. 2), one in which the human figure appears to be behind the soil, as if he were on the other side of a hill. In figure 3, the figure is in front of the soil. ■

Figure 1.—Lamellae in an anthropogenic soil.

Figure 2.—Peering over the horizon.

Figure 3.—John Kelley.

Another Mode of Travel in Soil Survey

By Stanley P. Anderson, Editor, NRCS, National Soil Survey Center, Lincoln, Nebraska.

Joseph McCloskey, MLRA Office Leader, St. Paul, Minnesota, sent me a picture (shown below) of a soil scientist using an all-terrain vehicle while mapping the soils of St. Louis County. The manufacturer named the vehicle "ARGO," after the ship that the Greek legendary hero Jason and his Argonauts (sailors) used in a successful search for the Golden Fleece. This is a good name to remember if you want to complete crossword puzzles.

Note: The trade name in this news item is used solely to provide specific information. Mention of a trade name does not constitute a guarantee of the product by the U.S. Department of Agriculture, nor does it imply endorsement by the Department or the Natural Resources Conservation Service over comparable products that are not named. ■

Traveling through bogs using ARGO to access mineral soils in an area of St. Louis County, Minnesota.

New Tools Make Data Population More Efficient

By Paul R. Finnell, National Soils Database Manager, National Soil Survey Center, Lincoln Nebraska, and Henry J. Ferguson, Soil Scientist—Data Management Specialist, National Geospatial Development Center, Morgantown, West Virginia, USDA Natural Resources Conservation Service.

The National Soils Information System Draft Requirements Statement published in January 1991 identified 12 "Fundamental NASIS Concepts." The second of these stated:

> Item 4.2 Availability of detailed primary soil property data. One user requirement for NASIS is to have access to the most detailed information available. Although detailed information is collected in the form of pedon descriptions, transects and field notes, most of the detail is not available to users in the soil survey report. Historically, the soil survey report has been a primary mechanism for providing soils information to users. In the future NASIS will be a dynamic soils information system that will enable many different output formats and levels of detail. A conventional soil survey report

would be only one of these output formats. **It is an objective of NASIS to be able to provide as much detailed information as has been collected or recorded.** The level of information provided (either detailed or generalized) should be determined by the user's need, based on the availability of data and the detail appropriate for the intended use.

This document was created almost 18 years ago, and the foresight of the task force is coming to fruition. The soil scientist of today now has the tools that can achieve this fundamental concept in an efficient manner. Recently, new software tools written in Microsoft Access have become available—PedonPC and AnalysisPC. In addition, the Soil Resource Inventory Tool Box, or SRITB, has been released for use with ArcGIS. These tools are available on the Soils Web site (http://soils.usda.gov/technical/nasis/downloads/index.html). All of these tools now allow for all pedon descriptions to be captured and imported into NASIS. The National Soil Survey Laboratory (NSSL) has posted MLRA Regional Office (MO) ACCESS subsets of the National Characterization Laboratory Database characterization data to the NSSC sharepoint site for internal agency use (https://nrcs.sc.egov.usda.gov/ssra/nssc/ssl/Shared%20Documents/Forms/AllItems.aspx). External users can contact the appropriate State Soil Scientist to retrieve the data. The development and release of PedonPC, AnalysisPC, SRITB, and the NSSL data have provided field soil scientists with tools for efficiently populating and aggregating all appropriate pedon descriptions to support the development of a component and its horizon properties for the given map unit.

PedonPC was created to provide the soil scientist an efficient tool for populating soil descriptions and importing them into the NASIS database. This tool is most efficient when used on a tablet PC. The software is formatted in a way that allows the soil scientist to take full advantage of the tablet and quickly enter pedon data while in the field or in the office. Previous attempts to enter pedon descriptions into NASIS may have taken hours, whereas with PedonPC entering the descriptions now takes less than an hour. The gain in efficiency makes the capture of all appropriate pedon descriptions into NASIS a fulfillment of the original fundamental NASIS concept. Proper and complete population of data fields and the linking of sites to map units and pedons to components are essential for quality review and aggregation of data.

AnalysisPC allows rapid analysis of soil description properties. Horizon properties can be quickly reviewed, and data can be aggregated to build component horizon properties. The AnalysisPC application can be used to write queries that link across multiple ACCESS databases. This feature permits pedon descriptions to be linked to laboratory data, and both the descriptions and the data can be associated with map units. The GIS interface in AnalysisPC provides the ability to identify the geographical location of each pedon description. An intermediate ACCESS database is used to send point data from AnalysisPC to ArcGIS. In cases where the pedons in NASIS have been stored in multiple datum (NAD27, NAD83, WGS84, Old Hawaiian, etc.), a tool in the SRITB can be used to project all of the points to a common projection of NAD83 or WGS84, but the datum must be populated.

The SRITB has some tools that increase the efficiency of digitizing spatial data. The user interface consists of six rotating toolbars used to increase screen real estate. The toolbars display commonly used tools that are organized in a logical fashion. New tools assist the user in cutting polygons, creating island polygons, modifying edges, and reshaping edges. The tools lead the user through the processes through automatic selection of the appropriate ArcGIS tools in sequential order. Although the Soil Resource Inventory Toolbox installer is available to the general public (http://soils.usda.gov/technical/nasis/downloads/index.html#SRITB), NRCS soil scientists must obtain the extension from ITS. They will download and install it from the Team Services Web site.

The SRITB also has a GPS toolbar that acts as an interface between a tablet PC, a GPS unit, and Pedon PC described above. With a GPS connection established, the user's location is shown in ArcMap in real time and is updated as the user moves across the landscape. The pedon points layer and way points can be digitized immediately according to the current or clicked location, and the Autopopulation tool populates site information according to the spatial layers loaded, such as Latitude, Longtitude, Datum, UTM Easting, Northing, State, County, Soil Survey Area, and MLRA. Since many of the locations of older pedon descriptions in NASIS were located using the North American Datum of 1927, the SRITB Pedon Auto population toolbar has been developed to help reproject the locations to a common projection. The user has the choice of NAD83 or WGS84.

This new software provides soil scientists the ability to efficiently locate, describe, and capture all

descriptive point data in the NASIS database. It confirms the prediction in the National Soils Information System Draft Requirements Statement of 1991: "In the future NASIS will be a dynamic soils information system that will enable many different output formats and levels of detail."

Training materials are being developed for the upcoming MLRA Management Course to be held in March 2009. Job aids have been posted to the NCSS Training Web site (http://soils.usda.gov/technical/nasis/downloads/index.html) and (http://soils.usda.gov/education/training/descriptions.html#database_JA). ■

2008 Annual ASLA Conference Report

By Karl W. Hipple, National Leader for Soil Survey Interpretations, NRCS, National Soil Survey Center, Lincoln, Nebraska.

For the second consecutive year, the Web Soil Survey and other USDA and NRCS products were demonstrated and provided to attendees of the American Society of Landscape Architects (ASLA) Conference. More than 6,000 people attended the conference, which was held in Philadelphia, Pennsylvania. Many of the attendees indicated that they have used Web Soil Survey (WSS) and are extremely pleased with the product. Many indicated that they still use the older paper copies of soil surveys and were unaware that these copies include out-of-date information. Conference attendees were encouraged to use WSS to find the most complete and current information about soil and vegetation. Many attendees indicated that they regularly use the NRCS "PLANTS database" in the performance of their jobs.

This year, employees from New Jersey (Ron Taylor, Edwin Muniz, and Maria Collazo), Pennsylvania (John Chibirka), and Washington, D.C. (Bob Glennon) and a retiree from Washington, D.C. (Bob Escheman), helped Linda Greene and Karl Hipple (National Soil Survey Center, Lincoln, Nebraska) to provide WSS demonstrations to ASLA conference attendees (figs. 1 and 2). This year's preferred products were WSS, the

Figure 1.—Linda Greene and Ron Taylor provide information to ASLA conference attendees.

Figure 2.—Ed Muniz helps a conference attendee work with Web Soil Survey.

PLANTS database, LandCare bookmarks, *Urban Soil Primer* CDs, and the 12 Soil Orders poster.

The ASLA venue and the American Planning Association annual meeting have allowed NRCS to expand its outreach and service to nontraditional customers. The 2009 ASLA annual conference will be held in Chicago, Illinois. NRCS plans to offer a soils session in support of a new ASLA initiative called the Sustainable Sites Initiative, which was introduced at the 2008 meeting and will be refined and prepared for rollout sometime in 2009 or 2010. Soils and plants are the focal points of this initiative. ■

Roy W. Simonson Dies at the Age of 100

By Stanley P. Anderson, Editor, NRCS, National Soil Survey Center, Lincoln, Nebraska.

On November 3, 2008, Douglas Helms, Historian, USDA, Natural Resources Conservation Service, Washington, D.C., received the following message from Bruce M. Simonson, son of Roy W. Simonson:

> I'm sorry to tell you that Dad passed away over the weekend. I visited with him after dinner on Saturday and he was pretty much his usual self at that point. We had a nice conversation about the World Series, the election campaign etc., but just after midnight he slipped peacefully away. I happened to get an inquiry from an Ohio pedologist about the history of our state's soil survey that I discussed with Dad last week. He still remembered all the details, so in a sense he was active right up to the end - just the way he wanted it. We arranged a celebration of his 100th birthday at Kendal in September that he thoroughly enjoyed. We'll all miss him.
>
> Bruce

The Fall 2008 issue of *Soil Survey Horizons* includes an article that Bruce M. Simonson wrote on the occasion of his father's100th birthday ("Roy W. Simonson: A Century as a Soil Scientist"). ■

1899 Soil Surveys From Colorado and Utah

By Stanley P. Anderson, Editor, NRCS, National Soil Survey Center, Lincoln, Nebraska.

In the August 2008 NCSS Newsletter, I referred to two 1899 soil surveys, both by Thos. H. Means, that were published without maps. These are *A Reconnoissance in Sanpete, Cache, and Utah Counties, Utah* (1899), and *A Reconnoissance in the Cache a la Poudre Valley, Colorado* (1899). Both of these are posted on the NSSC Web site and can be accessed from the "List of Published Soil Surveys" (http://soils.usda.gov/survey/printed_surveys/). See the Colorado list (http://soils.usda.gov/survey/online_surveys/colorado/#cache1899) and the Utah list (http://soils.usda.gov/survey/online_surveys/utah/#sanpete1899).

See the next 12 pages for three 1899 items by Thomas Means, one written on May 4, one written on July 27, and one received at the Division of Soils on August 8. The closest thing that either of the two surveys has to a map is a diagram at the end of the July 27 item. Note that two of the three items are incomplete. Thanks to Michael Domeier, State Soil Scientist, Salt Lake City, Utah, for sending me all of the items. ■

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DIVISION OF SOILS,
WASHINGTON, D. C.

Brigup

Malaga N. Mex.
May 4, 1899

Prof. Milton Whitney
Chief of the Division of Soils
Washington D.C.

Dear Prof. Whitney:

We are now located at Malaga for a few days working up this part of the valley. We are only going to do detailed work a couple of miles below here at the canal ends about 2 miles South of Black River We have some country just north of the river to finish but think we can get the most of it done by the 15th. Then with a week working up some points we will be almost ready to go up to Roswell We are still in the gypsum lands

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and are working on the origin of the seepage waters. This afternoon we gauged a lateral at two points about 1/4 miles apart and found it loosing 17% of its water by seepage. This would be in this case 1.64 cu. ft per second enough water to saturate ~~fill~~ 164 acres of soil to a depth of 2 1/2 feet. in an irrigating season of 100 days. You can see something of the trouble this water would cause. We measured the main canal opposite Eddy yesterday and found it loosing about 1% per mile or 2 cu ft. per second. This water is coming up on one edge of town and it

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can be hit a question of a short time until the town will be in a worse condition than Billings and will find it necessary to drain the water around the town.

Our work is still progressing very nicely. I have the surface soils mapped for half the valley and the map shows up very well. I haven't attempted to calculate any soil determinations yet but will defer all of that until I get back to Wash. On the map as far constructed we have outlined the following type of soils.

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S — Sand Soils formed from wind blown material. Typ. develop. along river.

SSC 2 — Sandy Loams (Otis) Typically developed around Otis

SC 3 — Loams and gypsum soils. Likely to sub-irrigate

g — Gravelly and conglomerate soils

aK — Alkali flats.

Being stippled where subirriga and soils are accumulating

We have data to subdivide some of them and when the final maps are made I think we will do so. The Otis sandy loams occur along Black River but are of such a different type that we will map them differently. The green colo

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includes two kinds of gravelly soils the true conglomerate soil and the River gravel soil. These we will map separately. We may find it necessary to subdivide the sc soils into ordinary loams and gypsum loams. So far we have found very little loam outside the gypsum area. This scheme of classification is the same I used at Billings and on the whole seems to be the most easily handled in this kind of field work. I use the abbreviations entirely in the note book and find it takes much less time for taking of notes

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The scheme is as follows

s = sand soil
sfc = sandy loam
sc = loam
scl = heavy loam
c = clay
hc = heavy clay,
g = gravel.

I take enough samples of each type to determine the percentage of water of saturation when I get back to the laboratory, Any unusual properties of the must be described and come in full.

Please tell Mr Briggs that the Tables Prof Chilcott wants are no doubt the tables for calculating

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~~WASHINGTON, D. C.~~

Gunnison Utah
July 27. 1899

Prof. Milton Whitney: -
Chief of Division of Soils

Dear Prof. Whitney: -

I reached Gunnison Sunday afternoon as I wired you I would. Monday was Pioneer day and a legal holiday in Utah, so I had some difficultly in finding any one, yet I managed to meet the persons Mr. Fowler had referred me to and in the afternoon drove out in the country with one of them. We visited the upper part of the irrigation district and examined some deposits of salt and a few waters.

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On Tuesday I spent the whole day out with Mr. Short. We examined some of the farming lands in the lower part of the country near the Sevier river as well as some lands further back. Wednesday morning I drove down the Sevier river about 9 miles and saw the worst of the country. In the afternoon I spent the time working on a new Highland canal which is to be used next year the first time.

Today I leave for Salt Lake City where I spend the night and go on to Logan tomorrow.

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The country here is very interesting, the problems are different from any we have yet studied and the question of alkali is becoming a very serious one in this county. This is not the county seat so I have not been able to get maps yet I will sketch roughly the country around here. The sketch will illustrate the general lay of the country.

Manti is situated at the foot of a broad well cultivated valley of the San Pitch river. The valley closes in below Manti by low rounded hills and mountains. Among these hills the San Pitch is dammed and the water stored

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This water is all used in the Gunnison country. The water from the dam is run into the old creek bed and taken out lower down by the old canals, some of them 30 years old. Two new canals are being built which will take water out from near the dam. They are the "Highland" and the "Antelope". Both irrigate the higher benches. Neither of these canals are completed but the Highland on the East side of the river will carry water next year.

There are several canals at Gunnison taking water from both San Pitch and Sevier Rivers.

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These canals in fact all the canals here are owned and built by the farmers.

Later - on Train.

The soils are of two marked types - Sandy loam (SSC) and heavy silty clay (HC). These are very distinct and the boundary sharply marked. On the sand land little alkali is found except where washed in and sub-irrigated. Under the clay lands, the soil is generally bad, containing

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salt.

The following example illustrates

	Res.
-1	30
-2	19.5
-4	19.0
-6	17.0

another place.

	Res.
-1 —	31
-2 —	22
-3 —	20
-4 —	21
-6 —	34.

When this land is cultivated it seems to do pretty well

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except where subirrigated water from above. Crops seem to do pretty well on well drained land.

There is said to be gypsum even now and in the hills. All the days contain more or less salt and cause trouble in proportion to the amount I have visited the hills and find small quantities of salt invisibly present.

The two new canals run through a light soil carrying easily

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very little salt, but great damage can be done by these canals on the lower lands. The farmers are much worried to know what the result of the cultivation of the upper benches will be.

I think our chance to get in some good work here is very fine. We have new conditions new types of soil very marked and new lands just ripe for cultivation. The season gets worse as it goes down

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just as the Pecos does and ends at Fayette Ranch a distance of 62 Ohms at 72 degrees. It is used in two or three districts lower down to that at Desert where they are having much trouble. Considering the number of problems coming up I certainly hope you can be fit to have this district looked in detail next summer. Then the new

10

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Candy will be in operation and its effects noted. Two months would cover the whole country, including the San Pitch and Sevier country.

I will write you more in detail tonight!

Respectfully
Mears,

I found no back wheel

San Pete Co. Utah,

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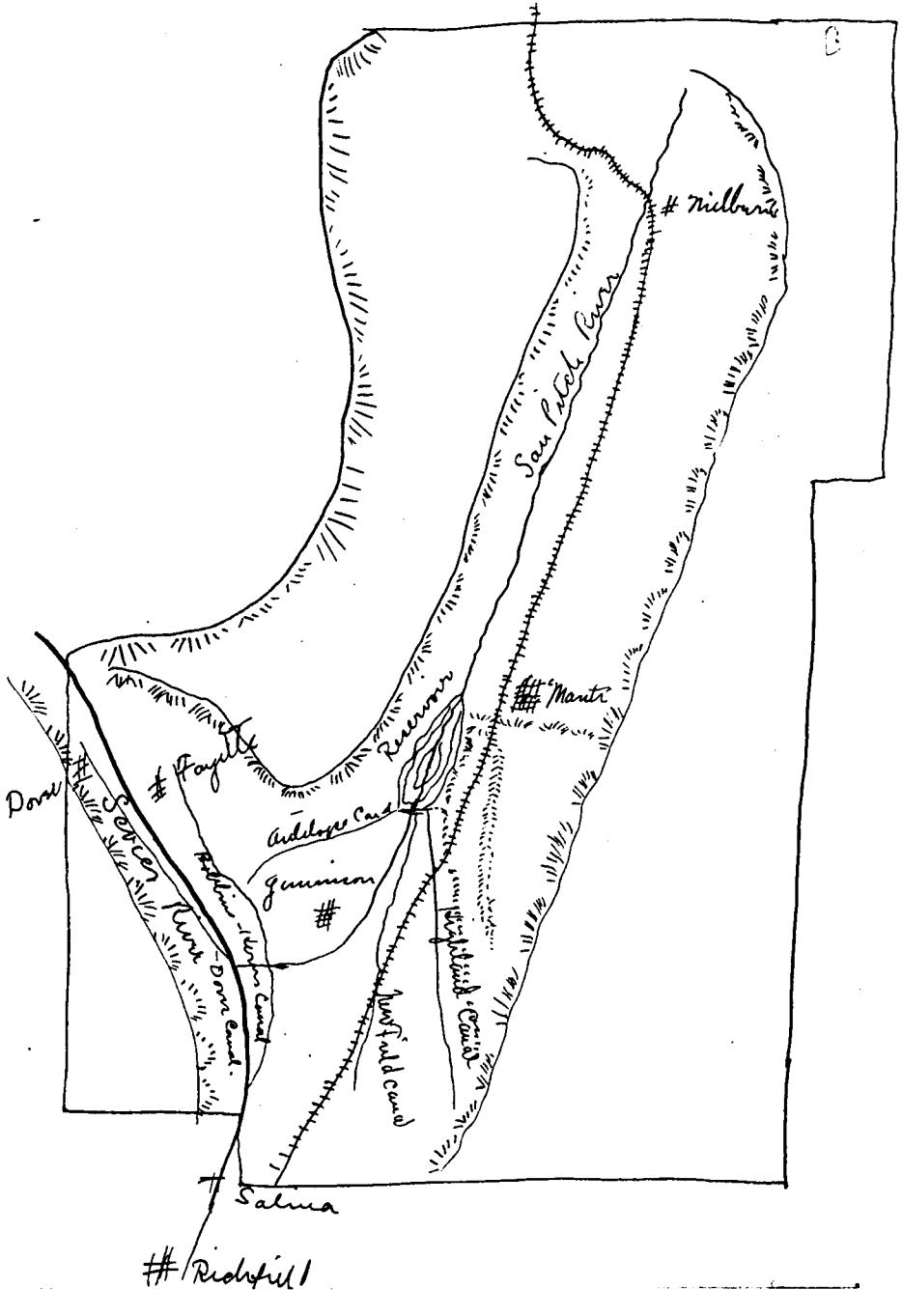
WASHINGTON, D. C.



A Reconnaissance in Utah County, Utah.

Thos. A. Means.

Utah County lies in the North Central part of the State of Utah. Its most prominent feature is Utah Lake a body of fresh water covering 188 square miles. Radiating out from this Lake are the irrigated lands of the County sloping gradually to the foot of the mountains which rise to a height of 5000 feet above the Lake and form a great catchment for snow and rain.

All of the important valley portions of the county lie under the shore lines of the ancient Lake Bonneville and the soils are the decomposed sediments from the ancient lake bed. The rocks of the mountains are varied but consist in a great measure of sandstone and limestone ridges with backbone of granite. This granite in its decomposition yields large amounts of sodium and potassium

carbonates and it is to this fact that we owe the black alkali or sodium carbonate which is found in the soils of the irrigated portions.

Soils. Considering the origin of the soils it will be readily seen that they would vary greatly. Such is found to be the case when the soils are studied in the field. The soils vary from the coarse gravelly and sandy soils of the old beaches and deltas to the lighter sediments carried further out in the lake. During the formation of the lake beds the water undoubtedly varied much in level for we find in boring, gravel beds, sand bars heavy clay strata and beds of organic matter which give the water a "sloughy" taste. Well records to a depth of 135 feet show these varying from one to the other all the way down. It will be found as a rule that the soils near the slopes of the mountains and old beaches is sandy in nature light and easily worked. Gravelly soils are

frequently and under the whole county gravel is easily found. Further away from the slopes and sources of swift moving water the soils become heavier in texture, gravel is seldom found and the dangers from alkali and seepage water much greater.

From the lake the lands gradually rise until the foot of the mountains is reached. The slope at first is very gentle almost imperceptible, perhaps 3 or 4 feet per mile but as the mountains are approached the slope increases until it reaches 15 or 20 feet per mile.

The mountains have very abrupt slopes and steep sides (30°-40°) with V canyons and gullies which further back open out into small valleys.

From these mountains which collect heavy coatings of snow during the winter months ~~the source~~ all the irrigation water of Utah county is obtained. The various streams, American Fork, Provo