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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 Newsletter and then on the desired issue number.

You are invited to submit stories for this newsletter to Stanley Anderson, National Soil Survey Center, Lincoln, Nebraska. Phone—402-437-5357; FAX—402-437-5336; email—stan.anderson@nssc.nrcs.usda.gov.

Endangered Soils

By Craig Ditzler, National Leader, Soil Classification and Standards, NRCS, National Soil Survey Center, Lincoln, Nebraska.

We are all familiar with the concept of "threatened or endangered species" as it applies to plants and animals. After all, most everyone has heard of the snail darter and spotted owl. But have you ever considered if a *soil* might be endangered? If there are endangered soils, how many are there? Where are they located? Why are they endangered? Dr. Ronald Amundson and his coauthors explore these questions in their recent article "Soil Diversity and Land Use in the United States," published in the journal *Ecosystems* (Amundson, et al., October 2003, vol. 6, pages 470-482) and available on-line at http://www.springerlink.com/. To view the on-line version, use the search engine on the Springer Web site to locate the article.

In this study, the authors present the first quantitative analysis of the impact that humans have had on the diversity of soils in the United States. The article opens with a short discussion of the importance of soils as components of ecosystems and goes on to describe the nature of soils as a continuum on the earth's surface. The authors do a nice job of explaining how soil scientists use Soil Taxonomy to break the natural continuum of soil cover into discrete units based on major properties. They compare Soil Taxonomy's hierarchical levels of "order" through "series" to the biological classes of "kingdom" through "species." Since there are no currently accepted definitions for concepts of rare or endangered soils, the authors propose the following definitions as a first approximation:

Rare: Soils that make up <10,000 hectares.
Unique: Soils that occur in only one state.
Rare-unique: Soils that make up <10,000 hectares and occur in only one state.
Endangered: Rare or rare-unique soils that have had more than 50 percent of their area impacted by urban or agricultural development.

For the analysis, the NRCS State Soil Geographic Database (STATSGO) was combined in a GIS with National Land Cover Data (NLCD) interpreted from Landsat Thematic Mapper scenes. Combining the data layers allowed the authors to estimate the extent of various soil series in the United States and the degree to which the soils may have been impacted by human activities.

Based on their analysis, the authors identified 4,540 rare or rare-unique soils, or about 35 percent of the series included in STATSGO. Fifty-four percent of these series are located in just six Western states (CA, ID, NV, OR, UT, and WA). This distribution pattern is likely a function of the complexity of parent materials in the region and moisture and temperature regimes, resulting in more soil series per unit area compared to other regions. Hawaii and Puerto Rico also have relatively large numbers of rare or rare-unique soils (159 and 135, respectively), and, given their small

size, they were identified as the areas with by far the highest density of these soils, 10 and 15 percent, respectively, per 100,000 hectares. Washington State is next with about 3 percent.

When the extent of urban or agricultural disturbance is considered, six states were identified as having 50 percent or more of their rare or rare-unique soils "endangered." They are Indiana and Iowa (each with about 81 percent), followed by Illinois (66 percent), Nebraska (61 percent), Minnesota (53 percent), and Connecticut (50 percent). I think that most would agree that urban development, where it consists of excavation, filling, or paving over, may have an effect akin to "endangering" a rare or unique soil, but I suspect many will question whether agricultural use alone (plowing) should be considered in the same context, especially where adequate conservation measures are applied.

The authors acknowledge numerous weaknesses in the procedure they used. I will focus on a few of the more important ones.

STATSGO (1997 version) includes only about 60 percent of the total number of series currently recognized in the United States. Many of those not listed are likely to be of minor extent, but those are precisely the soils that this analysis is attempting to identify.

Some parts of the country, such as Alaska and some wilderness areas, are mapped at a low intensity, resulting in the recognition of fewer soil series per given area compared to more intensively mapped areas. Defining unique soils by the extent within the boundaries of a state (as opposed to a physiographic unit, such as an MLRA) can be questioned, although the authors remind us that many plant and animal lists are presented this way and there are some political advantages to this approach.

One concern that I have with this analysis is the comparison of soil series to species of plants or animals. Soil series are concepts we have devised to organize our knowledge of soils as they occur on the landscape and to transfer technology related to soil performance from one place to another. As such, soil series do not really exist in nature in the way plants and animals do. The extent of a series depends directly on the way we define it. Many soil series have become less extensive over time, not through human disturbance on the landscape, but simply by having their concept narrowed (consider the Miami and Cecil series). The conceptual nature of the soil series is also illustrated by considering the fact that it would change if different classification systems were used (for example World Reference Base vs. Soil Taxonomy vs. the Russian Taxonomy). The authors acknowledge this shortcoming by saying, "While soils (nonreplicating entities), and the soil classification system (practical, not scientific), differ from biological entities, this analogy is at least an organizing concept on which to begin this investigation."

The authors go on to present a case for why all this matters. They argue that land use changes have an impact on soil properties, which in turn affect function. (While they do not use the phrase, this is much like what the concept of Soil Quality is all about.) The authors state that "cultivated soils might be viewed as domesticated versions of their natural counterparts with widely differing properties and functions." While we know a lot about the value of soils for agricultural production, we know less about the value of soils in performing other environmental services, such as support of genetic diversity in micro-organisms that may prove valuable for medicinal and industrial purposes, ecosystem regulation, and waterflow, carbon cycling, and other forms of elemental cycling. We also know less about the linkage between rare soils and rare and endangered plants. For these and other reasons, the authors argue that soils and landscapes should be considered along with plants and animals in preservation efforts.

I found this article to be interesting and worth reading for two reasons. First, the idea of rare and endangered soils is a fascinating one that few of us have considered. This discussion tends to connect soil science and soil survey with aspects of conservation and preservation that we soil scientists have not usually identified closely with. I suspect most of us would feel uncomfortable with the development of a list of threatened and endangered soils that could be used in a regulatory sense to restrict growth and development.

Second, I found it very interesting to once again see how soil survey information can be used in ways not anticipated by those of us who originally made the maps. Amundson and his colleagues have used the soil survey to provide a unique analysis that brings additional attention to the subject of soil science, to the important role that soils play in regulating the environment, and to the possible consequence of human alteration. Their article is worth the read. ■

A Mark Twain Tale About a Landslide in Nevada

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

Mark Twain's story "The Facts in the Great Land-Slide Case," first published in the Buffalo *Express* on April 2, 1870, and reprinted in collections of Twain's works,

Slide Mountain in an area of Washoe County, Nevada. Major landslides occurred on this mountain in 1852, 1874, 1890, 1950, and 1983. William Dollarhide, State Soil Scientist in Nevada, says that there is soil evidence indicating that landslides have been occurring on the mountain for many thousands of years and geologic evidence that they have been occurring for millions of years. He also says that the Railcity series was set up on these landslides. He characterizes this series "not very extensive but certainly unique." The series consists of very deep soils that formed in colluvium derived from granitic rocks. Bill saw the results of the 1983 slide in a field where about 70 percent of the surface was "covered with debris, about 6 feet thick at the top of the field and 2 feet at the bottom."

including *Mark Twain: Collected Tales, Sketches, Speeches, & Essays, 1852–1890*, edited by Louis J. Budd (pages 345-349), begins with a description of how landslides occur in Nevada. Twain says that the landslides begin when "the warm surface-earth" on the very high, very steep mountains near Carson, Eagle, and Washoe Valleys becomes moist and soft after snow begins to melt rapidly in the spring. Whole mountainsides are removed and deposited in the valleys, and "a vast, treeless, unsightly scar" is left on the front of the mountains.

The "case" is a trumped-up one designed as a practical joke on General Buncombe, a newly arrived U.S. Attorney. The General is hired by Dick Sides (the supposed plaintiff), who owns a ranch on the edge of a valley in "Washoe District." The supposed defendant is Tom Morgan, who owns a ranch on the mountainside directly above Sides' ranch. When Sides hires General Buncombe, he claims that a landside has moved all of Morgan's ranch, including barns, cabins, fences, cattle, and soil ("solid clouds of dust") from the mountainside and deposited it right on top of Sides' ranch, the soil covering it to a depth of about 6 feet. According to Sides, Morgan claims that he still owns the repositioned ranch, even though it is now on top of Sides' ranch, and so he refuses to leave. Sides claims that Morgan is a trespasser.

The courts are out of session, so former Governor Roop, who is in on the joke, is appointed to referee the case. Though all of the testimony, including that of the witnesses called by Morgan's lawyer, favored plaintiff Sides, Roop argues that the repositioning of Morgan's ranch was an act of God that is not to be questioned in court, that God created the ranches and is free to rearrange them as he sees fit. Roop's verdict is that Sides "has been deprived of his ranch by the visitation of God! And from this decision there is no appeal."

That night, General Buncombe begs Roop to modify his verdict. Roop acts as though he is reconsidering the matter, pacing the floor for $2^1/_2$ hours as he does so, and then announces his modification. He says that Sides still has title to the ranch underlying Morgan's new ranch and has "a right to dig it out from under there." General Buncombe is stunned first by the original verdict and then by this modification. Two weeks pass before he realizes that he has been had.

A slightly revised version of this story is included as chapter XXXIV in *Roughing It* (1872). In this version, the name of the plaintiff is changed from Dick Sides to Dick Hyde and the description of how General Buncombe came to realize that he was the victim of a practical joke is expanded: "At the end of two months the fact that he had been played upon with a joke had managed to bore itself, like another Hoosac Tunnel, through the solid adamant of his understanding."

Also, the depth of the defendant's repositioned ranch over the plaintiff's property is changed from 6 feet to 38 feet. The tall tale got taller. ■

Who Were the First Soil Scientists in America?

Stephen Gourley, State Soil Scientist, NRCS, Colchester, Vermont.

The first soil scientists in America are almost always assumed to be those men who completed the first soil surveys in the late 1800s. Lewis and Clark are often given credit for conducting the first soil surveys in the West. Some early European settlers are often credited with making contributions that led to the development of soil science.

What is often forgotten is that many American Indian tribes relied in part on farming for food. In New England, farming was a way of life long before the Pilgrims set foot on Plymouth Rock.

American Indians of the Abenaki Tribe, which occupied a large portion of northern New England, have a number of words in their language that demonstrate a good understanding of the principals of soil science. (See Gordon M. Day, *Western Abenaki Dictionary, Volume 2: English-Abenaki*). Some examples include:

- aki—earth, land, ground, soil, world
- asakwamki—grey soil under moss, a podzol soil
- asakwamimskagw—a moss swamp
- azeskojagw—muddy soil
- begwi—sand
- bidhomkitan—silt
- senomkol—gravel
- mazalopskw–clay
- megoakw—a swamp
- mekwakaa—red earth
- mkazawiki—black soil

From the early accounts of European settlement in New England, it is clear that the local tribes were good farmers, in part because of their understanding of soil science. In the beginning, it was the American Indians who shared their harvest with European settlers who had little knowledge of farming. Undoubtedly, they also shared their knowledge of soils with the new settlers.

Other American Indian tribes who farmed the land must have also had a basic understanding of soil science. The evidence can be discovered if you care to look beyond the history books. ■

Soil Taxonomy Forum

By Robert Engel, Soil Scientist, NRCS, National Soil Survey Center, Lincoln, Nebraska.

The Soil Taxonomy forum is again functioning. The forum is for topics and issues concerning Soil Taxonomy and classification of soils using Soil Taxonomy. Anyone may post a question or join in the discussion. Bob Engel, Soil Scientist at the National Soil Survey Center, is the moderator for this forum. To respond to an item posted after February 2003, click on the link of interest. To respond to any items posted before February 2003, open the old message and incorporate it into a new posting at the following link:

http://clic.cses.vt.edu/soiltax/soilt.html

Many of the topics and issues on the forum have been related to why criteria were selected or changed in Soil Taxonomy. We may select and publish some of the questions and answers in a publication describing the rationale for the taxonomic concepts. This publication will be similar to *Guy Smith Interviews: Rationale for Concepts in Soil Taxonomy*. If you have any questions, please post them on the forum. The Classification and Standards Staff will try to answer them. ■

The Soaring Birds of Spain—A Metaphor on Survival in Bureaucracy

By Bob Grossman, Research Soil Scientist, NRCS, National Soil Survey Center, Lincoln, Nebraska.

Many years ago I read a piece in *The Atlantic* on the soaring birds of Andalusia, Spain. I have come to realize that these birds serve as a metaphor for how to survive in the soil survey, probably in NRCS as a whole, and perhaps in life generally.

There are three kinds of birds. The largest are the bone-crushers. They are large birds that soar to great heights, drop their prey on the rocks, alight, and tear out the bone marrow, which is high in fat and provides high energy per unit weight. The next size lands and tears away the flesh from the bones of the bone-crushers' prey or from other carrion. The third and smallest bird has a long, curved beak, with which it cleans the meat from between the bones of a wide range of carrion.

For your career choice, consider that the bone-crusher flies the highest but is dependent on the vagaries of upward air drafts for flight, being too large to fly with its wing power alone, and hence is extremely dependent on the environment. Then, too, the bone-crusher must be able to catch the prey and have the opportunity to crush it by dropping it on the rocks—a combination that may not be too common in a bureaucracy.

The intermediate size is so flexible that it is not dependent on catching prey. It eats only carrion and does not need the special conditions of strong updrafts with rocks beneath. Neither does it have the special adaptations of the smallest soaring bird. It can survive without a restricted diet and has access to flesh not available to the two larger

birds. The smallest can survive on the interstitial flesh through an extensive specialization. It depends on neither of the two larger soaring birds, but it does have to work harder than either of the others, and then what if that long beak were to break?

So, is there a moral? Perhaps there is: Do not attempt to soar to the height of important administration, because you must be adept at both catching prey and finding the conditions that will let you capitalize, and yet do not become so specialized that you become dependent on a very narrow range of work being available for application of a particular skill that you could lose.

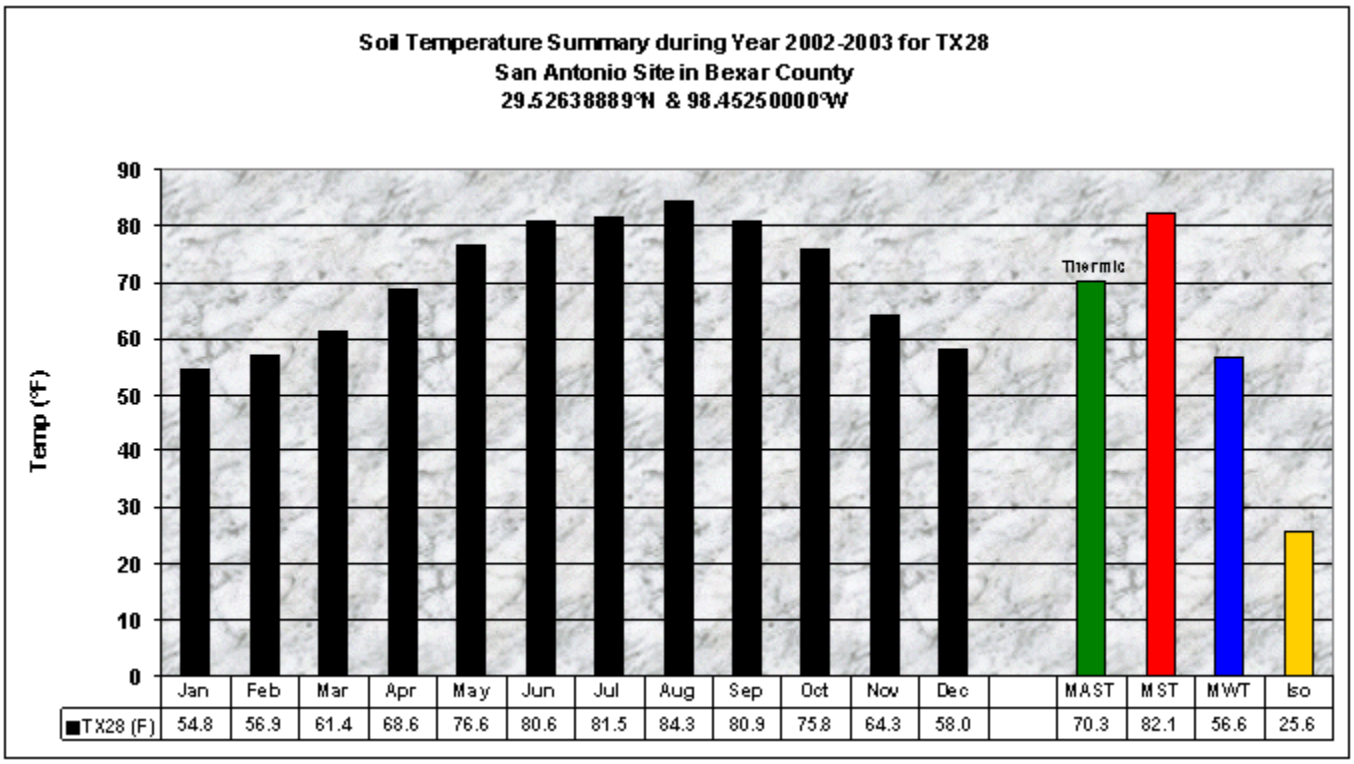
The ecology of the soaring birds of Andalusia shows that in a state soil survey program, the best place is in the middle, at the level of a field soil scientist. ■

Nationwide Investigation of the Boundary Between the Thermic and Hyperthermic Soil Temperature Regimes

By Henry Mount, Soil Scientist, NRCS, National Soil Survey Center, Lincoln, Nebraska.

A 4-year study investigating the soil temperature regime at 147 sites has been initiated in eight states representing six MLRA regions. A formal work plan for this initiative was prepared by the MLRA Office in Temple, Texas. This is the largest coordinated study of soil temperature in Soil Survey Division history. States participating in the study include California, New Mexico, Texas, Louisiana, Mississippi, Alabama, Florida, and Georgia. The majority of the funding for this study was provided by the MLRA Offices and States. Technical review, coordination of equipment acquisition, and software support to launch the data loggers in a uniform fashion were provided by the National Soil Survey Center.

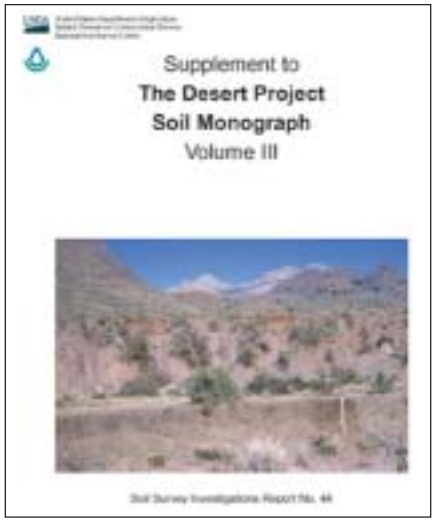
The purpose of this investigation is to identify the latitudinal boundary between the thermic and hyperthermic soil temperature regimes in the Southern States. Prior technology used to collect soil temperature data invariably required a soil scientist to travel to a site either each month or four times a year. These studies yielded inconclusive or mixed results. The early attempts at making a division between the thermic and hyperthermic temperature regimes were based mainly on estimates and, in some cases,



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		MAST	MST	MWT	Iso
TX28 (F)	54.8	56.9	61.4	68.6	76.6	80.6	81.5	84.3	80.9	75.8	64.3	58.0		70.3	82.1	56.6	25.6

Soil temperature summary for San Antonio, Texas.

convenience of correlation. Consequently, correlation conflicts involving Soil Taxonomy have occurred throughout the study area. The primary objective of this investigation is to gather soil temperature data in a comprehensive and uniform manner that will determine the division between the thermic and hyperthermic temperature regimes across the Southern United States. Air temperature data will also be gathered, so that the relationship between air temperature and the soil temperature at a depth of 50 cm can be ascertained. ■



Supplement to the Desert Project Soil Monograph, Volume III

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

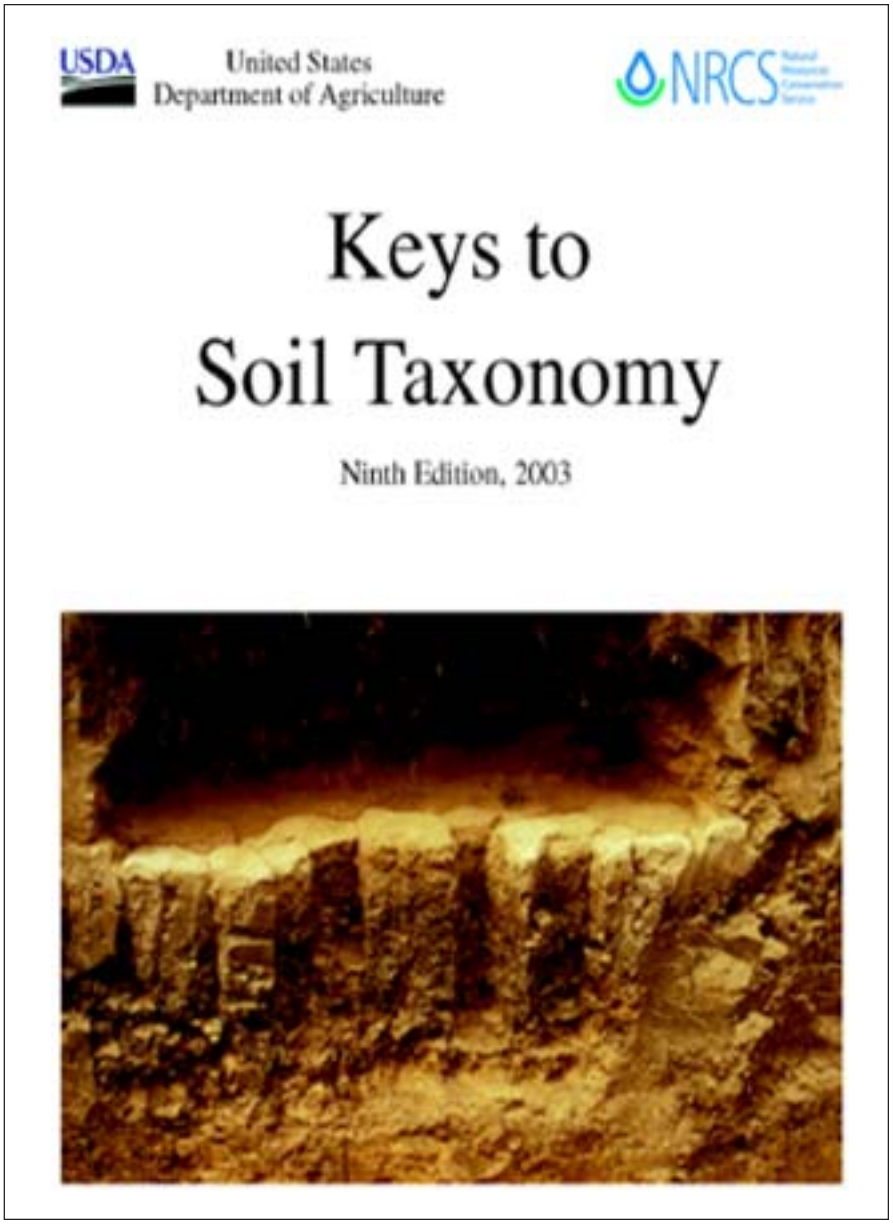
This book, by Leland Gile, Robert Grossman, and Robert Ahrens, is in press. It includes soil descriptions, a chapter on organic and carbonate carbon, about 150 illustrations, traditional detailed soil maps, and GIS maps. The printed copy will be accompanied by a CD that contains the text and the GIS maps. ■

Caption for figure 104 in *The Desert Project*: The Ustic Haplargid, Caralampi 60-9, is at left in this mine pit near Organ. Bob Grossman, at left, and Lee Gile are sampling the pedon. The Organ Mountains are on the skyline.

New Edition of the *Keys to Soil Taxonomy*

By Craig Ditzler, National Leader, Soil Classification and Standards, NRCS, National Soil Survey Center, Lincoln, Nebraska.

The NSSC Soil Classification and Standards Staff, along with the NCSS Regional Soil Taxonomy Committees, reviewed over 50 proposals for revising *Soil Taxonomy* that were submitted since 1998. Many of the proposals were approved, resulting in the addition of 4 new suborders, 11 great groups, and 87 subgroups. These changes have been included in the *Keys to Soil Taxonomy*, 9th edition. This edition is available on the Web (http://soils.usda.gov/technical/classification/tax_keys/) and will be printed next year. ■



Publication Backlog

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

There has been a soil survey publication backlog since I joined the Soil Survey Editorial Staff in Hyattsville, Maryland, in 1974. Even then, the backlog was not a new thing. A comment made by Charles E. Kellogg at the "National Technical Work-Planning Conference of the Cooperative Soil Survey" in 1963 identifies the reason for the backlog:

> The publication of soil surveys goes slowly. Only 36 surveys are scheduled to go to the Government Printer in 1963 and only 40 in 1964. We have the problem of getting the soil correlation, the map work, and the text of the soil survey for the same area at the same time. ■