TABLE OF CONTENTS

General Session

The National Cooperative Soil Survey-New Technology and Building for the Future, by Wayne M. Maresch, Acting Director for the Soil Survey Division, USDA, Natural Resources Conservation Service
Washington, D. C.

I want to thank Maury Mausbach, Deputy Chief for the Natural Resources Conservation Service (NRCS), Soil Science and Resource Assessment (SSRA) for his confidence and the opportunity to serve as the acting director for the Soil Survey Division, NRCS, until a new director is named. I feel very fortunate to return to the roots of my education and early career and I never expected this opportunity to come my way. It has also been my pleasure to act as the Chair for the National Cooperative Soil Survey Conference for this year. Most of my comments will be operational in nature and from the NRCS soil survey framework. I see soil survey more from a user perspective now and I will address a few areas of opportunity.

Although the United States is 95 percent complete with once over mapping of the country, the National Cooperative Soil Survey in NRCS continues to focus our efforts on mapping while the public is begging for soils information they can access and understand. We need to move beyond mapping soils to delivering soil survey technical services. To a large percent of the American public, soil survey information does not exist because it is not in a format they can readily use or easily understand. This needs to change, and the National Soil Information System (NASIS) and Digital Soil Survey Maps (SSURGO) can help us meet the public demand for better soils information. We are providing an additional $5 million per year thru 2006 to complete the SSURGO initiative, but the information is only as good as its accessibility and understandability. Paper copy Soil Surveys will not bring us into the 21st Century. Electronically accessible, Web based Soil Surveys are needed for GIS integration so city planners, zoning boards or 6th grade science students can discover soil properties and their relationship to the landscape and land use. More staff is needed for this effort but there is also a role for the private-sector soil scientists to add value and deliver an enhanced soil survey product.

We still need to complete once-over mapping and update older Soil Surveys but we need to work smarter. We need new technologies like 3-D mapper and we must take advantage of other emerging technologies. We need to fully embrace the MLRA concept and use technology to delivery soil survey products on political boundaries instead of maintaining a mapping structure based upon political boundaries. Technology can take us where we want to go and we can still meet the needs of the low end users with on-demand services. We just need to keep all levels of users in mind as we adopt and move forward with new technologies. There is a rapid response team addressing how we can get our soil survey publication process into the 21st Century and they are meeting here this week to develop a draft plan by a July 15th. A big part of this plan will be limiting the production of federally funded paper copy Soil Surveys and full conversion to electronic media. Discussing this with our national cooperators is an important part of the plan and why I mention it here today.

I have just a few more comments I would like to make:

- Governmental A-76 competitive sourcing studies for soil survey are underway and this is causing much concern among our NRCS field level soil scientists. I assure you we are working with the competitive sourcing team to ensure preservation of the integrity of the soil survey program and although I don't have many answers at this time, we will work hard to compete only what should be competed.
- The NRCS Soil Science discipline is not the same discipline I entered 26 years ago. The agency needs new soils scientists with new technical skills to address today's challenges.
- Finally, soil quality will play a major role as a new measure of environmental quality. As we look to the future "T" will remain an important the soil resource base measure but organic carbon or "C" will offer a better future measure of environmental quality.

It's been my pleasure to speak with you here today and I plan to be here for the entire week to participate and take part in the conference.

The Importance of Statistical Documentation – Keeping Soil Survey Information Relevant in the 21st Century, by Maurice J. Mausbach, Deputy Chief for Soil Survey and Resource Assessment, USDA, Natural Resources Conservation Service
Washington, D.C.

Thank you and it is a pleasure for me to attend the National Soil Survey Conference. It is always a relief to get out of Washington and be around Soil Scientists again. This is my third conference since becoming Deputy Chief. In reviewing my previous presentations I seem to have fallen into a pattern of talking about our successes, discussing some current or emerging issues, and finishing with some challenges. I may do that again, but with a different twist. We need to do more than just talk about challenges and visions for the future; we need to generate enthusiasm and energy to take us to the next level in soil survey – the statistical documentation of our product. And I guess the buck stops with me but I am fixing to move it.

We have much to be proud of in the 100 plus years of Soil Survey activities. The most important fact being that the U.S. National Cooperative Soil Survey is the only viable soil survey program among the developed countries. One of the key reasons for this success is that the survey is truly a cooperative venture among local, state and federal agencies and units of government, land grant universities, our private sector soil scientists, and other groups and organizations. Another reason for our success it that we also concentrated on making the product useful to a diverse set of customers, by addressing their needs in field data collection and servicing those needs through a strong interpretations program. In order for us to continue to succeed and to grow the soil survey to the next level of excellence, we must foster and enhance our collaborative effort and continue to meet customer needs of our product.

I have mentioned many times, that we have had a series of technological advances throughout our history including but not limited to the development of standard procedures for making soil through development of the soil survey manual, the adoption of the Munsel color chart, and the use of aerial photography. These tools brought as up to the 1950s or about half way through our history. However, leadership for the NCSS was not satisfied with the soil classification system and Dr. Kellogg challenged his staff to upgrade the classification system to address deficiencies. About 20 years later and a lot of hard work by all of us, especially the Land Grant Universities, Soil Taxonomy was developed. Among other things, it revolutionized the way we correlate soil surveys. Since Soil Taxonomy, we have brought soil survey into the digital, world by developing NASIS, SSURGO, and in utilizing digital tools in making soil surveys. We are now developing tools to digitally capture our soil landscape model used in mapping and to use that model to enhance our mapping activities and for later use in interpreting the soil maps to address needs of the user community.

Thirty years after Soil Taxonomy was published we are doing all of this good stuff – maintaining and tinkering with Soil Taxonomy, messing with NASIS, marketing our product, thinking about use dependent properties, promoting soil quality, and trying to fully utilize GIS technology. While all of this is good stuff, somehow I feel we are becoming somewhat complacent and are fixed on making good things better. Not only do we trap ourselves in the status quo – but we also burden the field with immense workloads each time we change Taxonomy or NASIS. I know I may be stepping on toes, but Soil Taxonomy has done all it can do for soil survey – we must move beyond Soil Taxonomy to a new level! Yes, we need to continue to maintain what we have BUT what should our next major technological accomplishment be? I think we have been talking about 2 possibilities for 20 years or more but haven't gone beyond the talking stage. One is moving from a soil survey of static soil properties to a soil survey that addresses both static and use (time) dependent properties. The other closely related topic is how to systematically address variability in space and quantify the random variability of the soil survey (if you will a standard error for our maps and attribute properties). I strongly believe our future lies in addressing variability in time and space – our customers in one way or another are asking for this information. However, to accomplish these goals, we will need to review the very core of soil survey, its underlying philosophy, concepts, and procedures. And as appropriate adjust the philosophy, concepts and procedures to address quantification of our product. This will not be easy and, I am sure, will cause consternation among many of us. However, it is beneficial and healthy that we engage in these fundamental discussions. My hope is that through these discussions, we will create a new energy and appreciation for our product.

Variability in Time – Human Time Scale (Use Dependent Properties).
We spent the first 100 years perfecting a system to capture information on static soil properties – in fact Soil Taxonomy is built on these so-called static properties. By static, I mean those properties that remain constant during our life spans or at least don't change much due to land use. Use dependent properties are those properties that do change with land use and management. Hopefully, it will not take 100 years to perfect a system for use dependent properties. Bob Grossman has been working on this issue for what seems like a career for most of us, but just half a career for him. We are capitalizing on all the good work that Bob and his group have done and are close to being able to implement what might be best called the "first approximation" for collecting this information. I have asked Karl Hipple, working closely with the Soil Quality Institute, to take leadership for the use dependent soil properties. You should expect to see draft policy, procedures, and protocols for implementing collection of information on use dependent properties soon.

Variability in space.
We have a solid paradigm for soil survey in the landscape model that guides soil mapping activities. This landscape model is the basis for describing and accounting for variability of soils in space. What remains to be developed are the underlying concepts for systematically quantifying (describing) the random variability associated with the model. Why you may ask do we want to venture into such a quagmire? There are a number of reasons, first and foremost many customers ask for a quantitative measure of random error in our product. However, what really tripped my trigger was a recent publication where the authors presented a map of the United States showing the distribution of a soil property, maybe it was cation exchange capacity, and presented an error term for the map. The map was based on about 1300 samples collected across the U.S. Could we do

better using our soil survey data? I think all of us would agree the answer is a resounding YES, but we would not be able to give a statistically valid error term for our product and the very fact that we call our attributes estimated properties does little to help our argument. There lies the dilemma, we know or at least strongly suspect that our product is better, but can not prove it statistically. Another reason for quantifying the random error is that I believe in developing the concepts to do this, we will also greatly help our struggle in developing the process and procedures for updating the soil survey. We simply can not do the same thing in our update process and expect something different and better to result.

How do we go about accomplishing this task? There is a plethora literature that addresses spatial variability and variability of our soil maps. However, if I can be so bold, many of these studies, mine included, are singularly focused and frankly miss the point. It is fairly simple to design a study to check the accuracy of a soil map unit (for example can we find the soil that we say is in the delineation?), but it is not so easy to design a study that tests the accuracy of the soil landscape model and addresses the attribute data too. Especially, since only a few people, maybe as few as one person actually knows the landscape model that was used to create the soil map. It is not a simple task – and that is why we are still talking about it. I have asked Craig Ditzler to take leadership on this issue. Craig is currently reviewing the literature and will develop an options paper for all of us to use in considering the direction and actions needed to develop the systems for quantifying our product. I expect we will have something early next year to discuss and make further decisions. Whatever we do, will require a research effort similar to the effort of Soil Taxonomy to solve.

Expectations:
I seem to become more urgent with each passing year. I fully expect that we will be able to initiate collection of use dependent property data within the next year on a limited number of soil properties perhaps 4 or less. We'll need to decide which four are the most important properties from both a soil science perspective and from a user community perspective.

The systematic approach for describing random variability will take a bit longer. We will need to fully vet basic concepts of the soil survey with respect to statistical procedures for describing the variability in conjunction with Geospatial tools that enable data collection and analysis. To this end, tools such as SoLIM will facilitate collection of the data. This represents a huge amount of work, but I think it will be extremely exciting and gratifying work.

Director of the Soil Survey Division:
Before I close, I want to say a little about the Director of the Soil Survey. I was truly sorry to see Berman leave as Director. He was one of best thinkers that we have in Soil Survey and had a wonderful vision for the soil survey program. I had hoped to be able to introduce the new director of the division at this meeting, but it will be a while, perhaps towards the end of summer before we will have a new director in place.

NEXT STEPS:
In order for us to move soil survey to the next level and address variability in time and space we need to move from an estimated property based delivery of data and information to use of real data. We need to consider the following

1. Our ability to do national and regional assessment of soil properties and characteristics,
2. Use of new technology (SoLIM) to capture more of the systematic variability,
3. Understand/characterize random variability and develop means to express this uncertainty to users, and
4. Understand relationships between taxonomic limits and natural variability on the landscape.

My challenge to all of us is to have the initial concepts (first or second approximations) developed and ready to be presented at the 2006 World Congress of Soil Science.

CLOSING REMARKS:
I am excited about the future of soil survey. Yes, we have a lot of work to do, but we have an excellent partnership, an extremely dedicated and capable staff of soil scientists, and a growing number of users (over a million hits a month on our web site). Thank you for your attention.

Challenges to the Soil Survey: Soil Information for a Changing World, by Craig Cox, Executive Director, Soil and Water Conservation Society

I am very pleased, proud, and honored to be asked to speak to you today. I'm also a bit anxious because the topic of this conference—the future of the soil survey and soil conservation—is so important to me and the Soil and Water Conservation Society.

For example, one of the first projects we undertook during my first year as Executive Director was to help celebrate the centennial of the soil survey. Our goal was to bring greater attention to the importance of soil conservation and the soil survey by creating this information packet that we distributed widely to media, policy makers, and opinion leaders. The packet included fact sheets and feature articles highlighting the importance of the soil survey to agriculture and the environment.

A few caveats before I begin my remarks.

First, the remarks I will make today are from the point of view of a conservationist and reflect my understanding of the importance of soils information in a conservation context. I understand that soils information is extremely important for many other purposes, but I want to limit my remarks to subjects I actually know something about.

Second, my remarks are also shaped by what I've seen during my career in conservation. They spring from my experience rather than from research or rigorous study.

Finally, my remarks are not those of an objective, disinterested observer. Instead they are the remarks of someone who cares deeply about soil, its management, and its conservation.

RESPONDING TO A CHANGING WORLD

The theme of this conference couldn't be more appropriate. We live in changing times and those changes are rapid, multidirectional, complex and very uncertain. I think the real challenge posed to the soil survey by such rapid and complex change is to develop a survey approach and information system that is explicitly designed to accommodate constant change, rapid obsolescence, and uncertainty about what information will be important to particular users at any particular point in time.

I think we need to recognize that our ability to predict the course of change is limited. Because our ability to predict is limited, we need a system that allows each user to construct their own survey tailored to their individual needs, capabilities, and objectives.

I'll come back to this point at the end of my remarks. I've already admitted I can't predict the future, but that doesn't mean I can't speculate. And speculation is sometimes a good way to think through what we need to be prepared for in a changing world. What I'd like to do is point out the changes that are impinging on the conservation movement and conservation professionals and speculate about the implications of those changes for the soil survey and soil information systems.

ADVENT OF ENVIRONMENTALISM

By far the most far-reaching change for conservationists has been the advent of environmentalism. Environmentalism became an important consideration for most economic sectors in the 1970s. Agriculture did not experience the advent of environmental concerns until the 1980s.

Swampbuster was the clearest indication in agricultural policy of the advent of environmentalism. Farm subsidies were denied in 1985 for doing what we had once used conservation programs to encourage. Five years later, in the 1990 farm bill, we would authorize a program to begin restoring wetlands.

The advent of the environmental agenda was also signaled by the way we changed the names of U.S. Department of Agriculture (USDA) conservation programs. The *Agricultural* Conservation Program had, for five decades, been the premier program delivering financial help to producers for conservation on their operations. In 1990, a new program—the *Water Quality* Incentives Program (WQIP)—was added to the mix. Six year later, the 1996 farm bill combined ACP, WQIP and two other programs to create the *Environmental Quality* Incentives Program (EQIP).

These name changes reflected a much more fundamental shift in the purposes those programs were to serve. The Soil Conservation and Domestic Allotment Act of 1935 set out the following purposes for USDA conservation programs:

- Preservation and improvement of soil fertility.
- Promotion of economic use and conservation of land.
- Diminution of exploitation and wasteful and unscientific use of national soil resources.
- Protection of navigability of rivers and harbors and flood prevention.
- Restoration of parity in purchasing power of net farm and nonfarm income.

In contrast, the Farm Security and Rural Investment Act of 2002 states that the primary purpose of EQIP is to “promote agricultural production and environmental quality as compatible goals, and to optimize environmental benefits.” EQIP is to achieve that purpose by:

- Assisting producers complying with local, State and national regulatory requirements.
- Avoiding the need for resource and regulatory programs by assisting producers in meeting environmental quality criteria established by Federal, State, tribal, and local agencies.
- Providing flexible assistance to producers to enhance soil, water, and related natural resources (including grazing land and wetland) and wildlife while sustaining production of food and fiber.

- Assisting producers to make beneficial, cost effective changes to cropping systems, grazing management, nutrient management associated with livestock, pest, or irrigation management.
- Consolidating and streamlining conservation planning and regulatory compliance processes to reduce administrative burdens on producers and the cost of achieving environmental goals.

In a little more than 15 years (1985 to 2002), we have fundamentally transformed the purposes of conservation activity within the USDA that had held sway for the previous 50 years. We have transformed conservation from an activity intended primarily to develop soil and water resources for use as inputs to agricultural production to an activity intended primarily to help agricultural producers improve their environmental performance.

The Farm Security and Rural Investment Act of 2002 reinforced this fundamental change in purpose with historic increases in funding for the new agenda. A decade's long decline in funding for ACP culminated in 1995 with the Administration's proposal to fund the program at only $50 million—$20 million less than the $70 million provided for the program in the previous year. One year later, the new EQIP was funded at $200 million a year—a 4-fold increase from the funding projected for ACP. This year, new farm bill more than triples EQIP funding to $700 million. Next year, will increase again to $1.0 billion and peak at $1.3 billion in 2007—over 25 times more funding than scheduled for ACP only six years ago.

Implications for the Soil Survey

The most direct implication of the advent of environmentalism will be the demand for new classes and interpretations based on environmentally important properties or functions of soil. The current delineation of hydric soils and highly erodible land are good examples. Can we build on these examples to delineate hydrologically sensitive areas, estimate the vulnerability of map units or soil landscapes to loss of nutrients, pesticides, salts, or other potential pollutants, or combine soils and climate data to delineate areas at high risk for wind erosion induced air pollution? In a way, such new interpretations are not so different in form from traditional interpretations of crop potential or land capability classes.

A second implication I think will be the demand for soils information specifically designed for use at watershed or other landscape scales. Environmental quality is largely an aggregate phenomenon. Planning for environmental quality requires aggregation and generalization of soils and management information to landscape or watershed scales. Could we produce a soil survey specifically designed to provide the information needed for modeling and planning at landscape scales. In other words, at scales somewhere between SSURGO and STATSGO.

Third, soil surveys designed to meet the needs of environmental managers will also need to display the linkages between soils and other key features such as landscape position, pattern, and shape; hydrologic processes; and other features that together help determine the cumulative, aggregate effect of use and management of soils.

Finally, the environmental agenda is bringing a very diverse and sophisticated group of users to the soil survey. Those users require soil survey information in digital form and related information in file structures that are amenable to use in GIS and model applications.

SOIL FUNCTION VERSUS SOIL TYPE

The other major change I have seen is the growing awareness of the important role soil plays in the ecosystem and the environment. Science is deepening our understanding of how soils function in agricultural landscapes and ecosystems. That deeper understanding has led to concepts such as soil quality, soil health, and soil functional assessment.

The 1993 National Research Council report, *Soil and Water Quality an Agenda for Agriculture* defined soil quality as "the ability of a soil to perform its three primary functions: to function as a primary input to crop production, to partition and regulate water flow, and to act as an environmental filter." The Soil Science Society of America defines soil quality as "The capacity of a soil to function within ecosystem boundaries to sustain biological productivity, maintain environmental quality, and promote plant and animal health."

Both definitions emphasize soil functions—what soils do for us.

Implications for the Soil Survey

Can we find a way to map soils based on comparable functional capabilities in addition to taxonomic classes? In many applications, mapping and analysis of individual soil properties or clusters of related soil properties closely tied to key soil functions may be more useful than mapping of soil types or phases. Such maps of properties could become highly valuable inputs to a new generation of integrated environmental planning and assessment tools at field, farm, and ranch scale.

DYNAMIC VERSUS STATIC PROPERTIES

The emphasis on soil function—what soils do for us—has also focused attention on the effect of human use and management on soil function—what we do to soils. We now understand that human use and management can profoundly affect soil function even if it doesn't affect soil taxonomy. That means, I think, that soil surveys will increasingly need to account for the effects of good conservation or mismanagement of soils. Two current and particularly important examples of the effect of human use and management on soil function are tile drainage and phosphorus build-up.

Implications for Soil Survey

Could we and should we find ways to incorporate changes being wrought on soils and soil landscapes by our use and management of those soils and landscapes? An example is the new USDA Natural Resources Conservation Service (NRCS) Soil Condition Index. That tool can generate new maps and functional interpretations based on projected effects of past, ongoing, or proposed management of soils and soil landscapes. Can we use such tools to generate new maps and interpretations of soils based on how they have been managed or mismanaged in the past? Or better yet, can we use such tools to quantify the benefits of soil conservation and soils information for guiding the use and management of soils?

The next obvious step would be to use our scientific knowledge of soil function to set thresholds levels for soil function and connect those thresholds to management practices and systems. In other words, can we augment T with new standards that reflect the effect of soil use and management on other critical soil functions—particularly those functions tied closely to the environmental performance of farming systems?

If we could create such a knowledge base and system it would be a powerful tool for conservation planning, policymaking, program management, priority setting, and accountability.

INFORMATION TECHNOLOGY

Advances in information technology are having profound effects on conservation in all its aspects. In fact, advances in information technology are changing our very definition of information.

I won't spend much time on this issue because you know it better than I do and a great deal has been written about, talked about, and implemented already to take advantage of information technology in soil survey and dissemination of soil information to users.

Let me just say the information technology is both a benefit and a curse. Its benefits are tremendous and varied. Its curse is it can be costly and very demanding to get existing information into the forms required for use in GIS or other technologies and it can be a tremendous effort to keep up with advances in information technology.

There are real trade-offs between generating new information and getting old information in a form that can be used by new technology.

PLAN FOR CHANGE

Finally, as I said at the beginning of this talk, I think the real implication of the kind of change we are experiencing is the increasing difficulty in planning for the future with any real confidence. This is especially true if the future is more than ten-years out.

I think this means we simply cannot produce a single product that anticipates what users will need, how creative users will be, or what tools those users may have to use soil information in the future.

Implications for Soil Survey

Given that uncertainty, the ideal solution is to build a soil survey and information system that allows each individual user to create his or her own soil survey—a “survey” tailored to their abilities, creativity, and objectives. Such an ideal system requires a very flexible data structure and very accessible information.

It also calls into question the notion that there is one correct soil survey for any county or landscape. There are instead, as many soil surveys as there are potential uses and concerns.

That last remark worries me because it implies we know how to enable people to build their own surveys using high quality information *in the right way*. I think we need to develop strategies and making resources available to build the capacity of users to use such a soils information and assessment system both creatively and appropriately. Users will need a dense technical support network and ongoing opportunities and training. Building the capabilities and creativity of users will be as important as the quality and consistency of the information we provide them with.

CONCLUSION

I assure you, I fully understand that everything I’ve speculated about here costs money to do. I also understand that we aren’t investing enough in the soil survey now to finish the job we started a few decades ago while new demands and opportunities are mounting daily.

Will we see substantial new federal dollars flowing to the soil survey in the next few years? Probably not.

So what do we do?

The only solution is see is technology and brainpower—with brainpower the most important. The numbers of people I run across who are using soils information in innovative ways amaze me. They are very creatively finding ways to make old information work for new problems. They are finding ways to generate new information from existing information.

Are these the best solutions? No. The best solution would be to have enough money and skilled people to update all our surveys, get them all digitized, and build the information system that empowers people to use that information. And get that all done in the next few years.

That is not likely to happen, so I think we need stimulate and support the development of as many next best solutions as possible. One of those next best solutions is to spin off intermediate products as we make steady progress toward SSURGO certified surveys. One of those intermediate products could be surveys designed to work at watershed or landscape scales. Others may be products designed to assist in soil functional assessments. I think it is a strategic mistake to rely on producing only one primary product—SSURGO certified surveys. It would be much better to produce a series of useful products along the way to achieving our ultimate goal.

The second important next best solution is to invest in building the capacity of users. Building that capacity both adds value to existing information and creates demand for soil surveys of the future.

Finally, I started out this speech saying I had given up trying to predict the future.

But one thing I'm sure of about the future—there will be a soil survey and it will be more important and used by more people in more creative ways than it is today.

That's a prediction I'll stand by. Thank you for your time and attention.

National Cooperative Soil Survey Conferences—Definition and Bylaws

602.00 Definition.

The National Cooperative Soil Survey (NCSS) coordinates technically and operationally at National, regional, and State levels. Its activities relate to the technology for the collection, management, and presentation of information about the properties, patterns, and responses of soils and to other joint concerns, such as training and coordinated research and operations. Workshops, meetings, and conferences are held at each level to discuss and resolve concerns, proposals, and recommendations for the cooperative soil survey.

(a) The National Cooperative Soil Survey Conference.

The national conference primarily discusses subjects of national concern to the NCSS. It is called in odd-numbered years by the Director Soil Survey Division, Natural Resources Conservation Service (NRCS), after consulting with the conference steering committee. The conference is attended by national representatives of cooperating agencies and institutions. Other interested foreign and domestic groups and individuals and particularly principal users of soil surveys are invited to participate. The proceedings of the conference are published and distributed to the cooperators in the NCSS. The objectives, membership, and committee responsibilities are specified in the conference bylaws. Refer to Exhibit 602-1 for the Bylaws of the National Cooperative Soil Survey Conference.

(b) The NCSS Regional Conferences.

The NCSS regional conferences primarily discuss subjects of regional concern. A soil survey conference is convened in each region in even-numbered years. The four regions correspond to the Agricultural Experiment Station regions and are the North Central, Northeastern, Southern, and Western. The conference is attended by state and regional soil survey leaders, some national leaders, and other invited persons. The conference proceedings are published and distributed to regional NCSS cooperators and others. The objectives, membership, and committee responsibilities are specified in the conference bylaws.

(c) NCSS State Conferences.

The NCSS state conferences primarily discuss subjects of state concern. A state conference is convened annually by the NRCS state soil scientist. It is attended by cooperators and others who contribute to NCSS activities at the state level and by principal users of soil survey information. Working agreements govern activities of the NCSS within the state.

(d) Joint Regional or State Conferences.

Joint regional or state conferences between two or more regions or states can be held with the agreement of the participants involved.

Exhibit 602-1 Bylaws of the National Cooperative Soil Survey Conference.

Article I. Name

Section 1.0 The name of the Conference shall be the National Cooperative Soil Survey (NCSS) Conference.

Article II. Objectives

Section 1.0 The objective of the Conference is to contribute to the general human welfare by promoting the use of soil resource information and by developing recommendations for courses of action, including national policies and procedures, related to soil surveys and soil resource information.

Article III. Membership and Participants

Section 1.0 Permanent chair of the Conference is Director Soil Survey Division, NRCS.

Section 2.0 Permanent membership of the Conference shall consist of:

Section 2.1.1 Members of the steering committee,

Section 2.1.2 Two State members appointed by each of the four regional conferences and six NRCS lead soil scientists as members representing each of the six NRCS Regions,

Section 2.1.3 Individuals designated by the Federal agencies listed in Appendix A.

Section 2.1.4 Soil scientists from each of the six NRCS regional offices are included as members.

Section 3.0 Participants of the Conference shall consist of:

Section 3.1.1 Permanent members,

Section 3.1.2 Individuals invited by the Steering Committee.

Article IV. Regional Conferences

Section 1.0 Regional Conferences are organized in the northeast, north-central, southern, and western regions of the United States.

Section 2.0 Regional Conferences determine their own membership requirements, officers, and number and kind of meetings.

Section 3.0 Each Regional Conference adopts its own purpose, policies, and procedures, provided these are consistent with the bylaws and objectives of the NCSS Conference.

Section 4.0 Each Regional Conference shall publish proceedings of regional meetings.

Article V. Executive Services

Section 1.0 The National Headquarters Soils staff of the Natural Resources Conservation Service (NRCS) shall provide the Conference with executive services.

Section 1.1 The Soils staff, NRCS, shall:

Section 1.1.1 Carry out administrative duties assigned by the Steering Committee.

Section 1.1.2 Distribute draft committee reports to participants.

Section 1.1.3 Issue announcements and invitations.

Section 1.1.4 Prepare and distribute the program.

Section 1.1.5 Make arrangements for lodging, food, meeting rooms, and, local transportation for official functions.

Section 1.1.6 Provide a recorder.

Section 1.1.7 Assemble and distribute the proceedings.

Section 1.1.8 Provide publicity.

Section 1.1.9 Maintain the Conference mailing list.

Section 1.1.10 Maintain a record of all Conference proceedings; proceedings of Regional Conference meetings; and a copy of each Regional Conference's purpose, policies, and procedures.

Article VI. Steering Committee

Section 1.0 The Conference shall have a Steering Committee.

Section 1.1 The steering committee shall consist of:

Section 1.1.1 The Director Soil Survey Division, NRCS, is permanent chair and is responsible for all work of the Steering Committee.

Section 1.1.2 The U.S. Forest Service Soil Survey Leader.

Section 1.1.3 The Bureau of Land Management Senior Soil Scientist.

Section 1.1.4 Four Agriculture Experiment Station Soil Survey Leaders, one from each respective Regional Conference. This normally is the State representative that will be chair or vice chair of the next Regional Conference.

Section 1.1.5 Six NRCS soil survey staff leaders, to include representatives of the National Headquarters, National Soil Survey Center, and Regional soil staffs as determined by the Director Soil Survey Division, NRCS.

Section 1.1.6 The President-elect of the National Society of Consulting Soil Scientists, Inc., representing the private sector.

Section 1.1.7 A representative of the 1890 College from the vicinity of the next conference recommended by the Conference Chair.

Section 1.1.8 A representative of the Tribal College from the vicinity of the next conference recommended by the Conference Chair.

Section 2.0 The Steering Committee shall select a vice chair for a 2-year term. The vice chair acts for the chair in the chair's absence or disability or as assigned.

Section 3.0 The Steering Committee shall formulate policy and procedure for the Conference.

Section 4.0 The Steering Committee shall:

Section 4.1.1 Determine subjects to be discussed.

Section 4.1.2 Determine committees to be formed.

Section 4.1.3 Select committee chair and obtain their approval and that of their agency for participation.

Section 4.1.4 Assign charges to the committee chairs.

Section 4.1.5 Recommend committee members to committee chairs.

Section 4.1.6 Determine individuals from the United States or other countries with soil science or related professional interest to be invited to participate.

Section 4.1.7 Determine the place and date of the Conference.

Section 4.1.8 Organize the program and select the presiding chairs for the sessions.

Section 4.1.9 Assemble in joint session at least once during each Conference to conduct business of the Conference.

Section 5.0 Steering Committee work will normally be done by correspondence and telephone communication.

Section 6.0 Fifty percent of the Steering Committee shall constitute a quorum for the transaction of business. Items shall be passed by a majority of members present or corresponding. The chair does not vote except in the case of a tie vote.

Article VII. Meetings.

Section 1.0 A meeting of the Conference normally shall be held every 2 years in odd-numbered years for the presentation and discussion of committee reports; exchange of ideas; and transaction of business. It shall consist of committee sessions and general sessions. Opportunity shall be provided for discussion of items members may wish to have brought before the Conference.

Section 2.0 The time and place of meetings shall be determined by the Steering Committee.

Section 3.0 The Steering Committee is responsible for planning, organizing, and managing the conference.

Section 4.0 The Steering Committee shall meet immediately after the conference to summarize recommendations and propose actions to be taken.

Section 5.0 Meetings of the Steering Committee, other than at the conference, may be called with the approval of the Steering Committee.

Article VIII. Committees

Section 1.0 The committees of the Conference shall be determined by the Steering Committee. Permanent or standing committees, ad hoc committees, and task force groups are considered to be committees of the Conference. The Steering Committee shall select committee chairs.

Section 2.0 Committee members shall be selected by the committee chairs. Committee members shall be selected after considering Steering Committee recommendations, Regional Conference recommendations, individual interests, technical proficiency, and continuity of the work. They are not limited to members of the National Cooperative Soil Survey.

Section 3.0 Each committee commonly conducts its work by correspondence among committee members. Committee chairs shall provide their committee members with the charges as assigned by the Steering Committee and procedure for committee operation.

Section 4.0 Each committee chair shall send copies of a draft committee report to the Steering Committee prior to the Conference.

Section 5.0 Each committee shall report at the Conference.

Article IX. Amendments

Section 1.0 The bylaws may be amended by ballot with a majority vote of the permanent members. An amendment shall, unless otherwise provided therein, be effective immediately upon adoption and shall remain in effect until changed.

APPENDIX A
MEMORANDUM OF UNDERSTANDINGS WITH THE NATURAL RESOURCES CONSERVATION SERVICE IN THE NATIONAL COOPERATIVE SOIL SURVEY CONFERENCE:

--Bureau of Indian Affairs, U.S. Department of the Interior
--Bureau of Land Management, U.S. Department of the Interior
--Bureau of Reclamation, U.S. Department of the Interior

--Cooperative State Research, Education, and Extension Service, U.S. Department of Agriculture
--Defense Mapping Agency, U.S. Department of Defense
--Economics and Statistics Service, U.S. Department of Agriculture
--Environmental Protection Agency
--Farm Services Agency, U.S. Department of Agriculture
--Forest Service, U.S. Department of Agriculture
--National Agricultural Statistics Service, U.S. Department of Agriculture
--National Institute of Standards and Technology, U.S. Department of Commerce
--National Oceanic and Atmospheric Administration, U.S. Department of Commerce
--National Park Service, U.S. Department of the Interior
--National Society of Consulting Soil Scientists, Inc.
--Office of Territorial Affairs, U.S. Department of the Interior
--Tennessee Valley Authority (quasi Federal)
--U.S. Army Corps of Engineers, U.S. Department of Defense
--U.S. Fish and Wildlife Service, U.S. Department of the Interior
--U.S. Food and Drug Administration, U.S. Department of Health and Human Services
--U.S. Geological Survey, U.S. Department of the Interior

2002 Regional NCSS Conferences

South Regional Cooperative Soil Survey Conference, 2002--Highlights

Action Items

1. Inventory of tools for electronic compilation and digital map finishing

2. Distribute Workload Analysis and Time Management presentation and tools to states

3. Develop overall strategy and discuss at regional level backlog

4. Review state compilation process and status

5. States review digitizing schedules and processes and coordinate with Digitizing Units

6. Joint Board of Directors Meeting in Little Rock, Arkansas

7. Provide process to complete digital map finishing

8. Visit with State Conservationists on individual basis for implementation of MLRA Project Offices

West Regional CSS Conference Highlights and Recommendations

William Ypsilantis, Bureau of Land Management, Denver, CO

Overview

The Western Regional Cooperative Soil Survey Conference was held at the Wydham Peaks Resort in Telluride, Colorado from July 6-12, 2002. The theme of the conference was "*Exploring New Frontiers in Ecological Resources; Integration, Delivery and Partnerships*." A pre-conference geomorphic and alpine restoration jeep tour was taken up rugged Tom Boy road to the top of 13,000 foot Imogene Pass. Agency and cooperator reports were followed by presentations that could be grouped into the general categories of soil quality/biological soil crusts, advanced technology applications in soil survey/soil information delivery, ecological site descriptions/inventory, rangeland restoration, and relevance of soil survey. Marilyn Colyer, Mesa Verde National Park was a luncheon guest speaker on fire ecology. A midweek tour looked at wetland mitigation, ski resort revegetation, mine site remediation, and aspen regeneration study sites in San Miguel River basin. Committee report recommendations are summarized below. Two special reports were presented; one from the Soil Crust Taskforce and one on the Tephra Workshop. A tour to Mesa Verde National Park wrapped up the conference. The next

WRCSS Conference will be co-hosted by Natural Resources Conservation Service and US Forest Service in Jackson, Wyoming.

New Technology Committee Recommendations

The New Technology Committee report contained the following recommendations:

1. ***Develop interest-oriented work groups charged with identifying new technologies that can be used to facilitate soil resource inventory, interpretation, information delivery, and agency implementation strategies (Potential for 4 work groups)***

2. ***Each interest-oriented work group will also be tasked with identifying specific needs in soil resource inventory, interpretation, information delivery, and agency implementation strategies.***

3. Compile, regularly update, and communicate to committee members a list of conferences, training sessions, workshops, etc. on development and implementation of emerging new technology.

4. Develop and implement methods for interagency technology transfer in NCSS and report to the National Standing New Technologies Committee.

5. Charge all task forces/work groups in recruiting members, specifying objectives, and developing realistic time lines for meeting objectives

6. Evaluate progress of work groups and redefine charges as needed, at minimum of every two years at WRCSS conferences.

7. Committee Chair will recruit/appoint/solicit members from NCSS to participate in appropriate work groups as needed.

8. Committee Chair will develop a comprehensive report and provide a presentation at each Western Regional Cooperative Soil Survey Conference

Research Needs Committee Recommendations

What are the research needs of NCSS cooperators ?

- Research that will increase our understanding of the soil system & increase the utility of Soil Surveys
- Promote the "research continuum" understanding that Basic as well as Applied research is needed.

Try to highlight the interdisciplinary nature of Pedology

Major Issues

- Soil Survey and Environmental Needs.
- Carbon Sequestration
- Terrain Analysis and Soil Mapping

•Sub-aqueous Soils

•Deep Regolith

•Dynamic Soil Properties

•Model Development

Soil Survey and Environmental Needs (examples)

•Determine additional characterization needs.

•Retro-fit Soil Surveys (augmentation)

•Include remediation information

•Needs to be included in updates

Carbon Sequestration

1) Management Systems/Soil Types
2) Spatial extrapolation of C data
3) Develop C based conservation programs
4) Inorganic C inventory (updates)
5) define the limitations of current data and utility under "current regime".

Terrain Analysis and Soil Mapping

•Don't let this slip away

•Assist in Developing Protocols for mapping

•Utilize cooperators

•Push for new soil surveys and updates

•Essential for updates

•Attribute maps

Sub-aqueous Soils

1) need to develop protocols
2) standards for characterization
3) environmental importance

Deep Regolith

1) how to investigate
2) need to develop standard methods for characterization and sampling
3) Retro- old soil surveys

Dynamic Soil Properties

1) test state transition model
2) ID key properties that reflect "ecosystem status" (e.g. Crust, aggregate stability)
3) 3)Investigate Microbial Populations (e.g. PLFA)
4) Fire influences
5) Develop "common vocabulary" (function is vague)

Model Development

1) develop models for characterization lab to assist in screening soils data
2) Physically based models to assist in mapping and interpretations

Recommendations

- NCSS needs to set priorities and commit to supporting Soil survey related research.
- Develop projects that allow NCSS to train future employees
- Make WRCC-93 permanent research committee by changing by-laws.
- Need to develop real funding opportunities

Soil Standards Committee Recommendations

1. What roles and function should this committee have in the West Region?

a) The West Regional Standards Committee serves as a technical advisory committee to the National Leader for Standards. Committee tasks are assigned by the Conference Steering Committee for the West Region.
b) The Committee represents West Region interests on proposed changes to standards.
c) The Committee reviews proposals on changes to NCSS standards including Soil Taxonomy, National Soil Survey Handbook, Soil Survey Manual and makes a recommendation on approval.
d) The Committee serves as a forum for new issues and recommends action to address these issues.
e) Two members of the Committee represent the West Region on a National Standards Committee.

The committee recognizes the need for review of proposed changes to NCSS standards, but also acknowledges the challenge to members of finding time to read and evaluate proposals. By accepting an appointment to this committee, members have accepted responsibility to review proposals. Because this is an additional workload, the effort needed to adequately address proposed changes should be kept to a minimum.

To facilitate review by committee members, it is recommended that staff at the NSSC conduct the following tasks for change management of NCSS standards:

1) Assist in drafting proposals, to ensure they are technically correct, within principles and guidelines for NCSS standards and consistent across all published standards (e.g. SSM and NSSH);
2) Write a narrative that discusses rationale, identifies potential concerns (e.g. departure from principles, inconsistency in terminology) and lists impacts of the proposed change (e.g. number of series, regions impacted, interpretations, NASIS data dictionary, guide for describing soils);
3) Post proposals to a web page and distribute a memorandum to cooperators that lists proposed changes, web address and reply due date;
4) Compile and review comments on the proposals and writes a reconciliation statement that addresses the comments on each proposal;
5) Distribute compiled comments and reconciliation statements to Standards Committees in all four Regions for review and recommendation for approval

6) Facilitate communication among Standards Committees in the four regions, and resolution of recommendation for approval or disapproval of proposed standards
7) Coordinate implementation of the final version into all appropriate documents, databases, etc.

2. Does the West Region Conference Bylaws specifically address this committee and its membership?

Not specifically! The Bylaws say that the Conference Steering Committee determines the standing committees and appoints a Chairperson. The Chair in-turn selects committee members. It is probably not necessary for the Bylaws to specifically address this committee and its membership.

This Standards Committee recommends that:
1. membership on the committee be for a period of six years and rotate with two or three new members added each year and a like number retired from the committee.
2. Standards committee members be assigned to one of two subcommittees: (1) a Soil Taxonomy subcommittee, and (2) subcommittee to review proposed changes NSSH and SSM.
3. proposals for changes to standards will be received for review in April and November of each year; and about three months be allowed for each review process.

The following text documents how the Bylaws of the Western Region address standing committees:

Bylaws, revised in 2000, with reference to establishment of permanent standing committees to bylaws of the National Conference:

> *Permanent standing committees are established by the By-laws of the National Cooperative Soil Survey Conference as contained in the NSSH Part 602.00 and Exhibit 602-1.*

Bylaws of the National Conference do not establish specific standing committees; it directs how they are established and how committees conduct business.

Article VIII. Committees

> *Section 1.0 -- The committees of the Conference shall be determined by the Steering Committee. Permanent or standing committees, ad hoc committees, and task force groups are considered to be committees of the Conference. The Steering Committee shall select committee chairs.*

Opportunities/Cooperative Agreements Committee Recommendations

Charge: Compile success stories concerning new opportunities for funding and cooperative agreements within the NCSS.

Discussion centered around the following issues:

- Are there new and better ways of doing business?
- Soil Survey Production (inventory activities, data collection, correlation)
- Expanding use of technology tools.

We made an attempt to identify barriers that currently exist or are perceived:

- Related to meeting NCSS Standards
  - Database requirements such as data populated in NASIS
    - The National Soil Survey Handbook is being revised to indicate that NASIS is the official NCSS database for soils.
  - Private lands – there are mandatory needs for USDA programs, CST
  - Public lands - may need some flexibility in interpreting correlation requirements
    - What is enough data to correlate and interpret.

    (Some MO's have now prepared minimum documentation requirements in NASIS related to correlation of surveys, private and public.)

- There are parallel efforts going on with database development
  - NASIS and TERRA
  - We need to continue to find ways to work together at the field level to meet the needs of agencies working with in the NCSS.

The definition of a "standard soil survey" was agreed to as meeting NCSS standards and being correlated to those standards.

- Issue: there is some inconsistency in applying the standards

For proceedings: Capture success stories from balance of conference members:

Identify what accomplished
What process
Examples of product
Contracts, Agreements
Budgets
What to avoid

Committee Recommendations:

- Keep partnering as a committee.
- Continue to have presentations on Partner successes.
- Identify Barriers and come up with strategies to Address them.
- Advertise to line officers our cooperative successes.
  - Direct information to RO/STC/STD/Dept. Head
- Expand the partners:
  - Extend invites to Nature conservancy, ARS, Military, Tribes, City, County, SCD, etc.
- Work to fill holes in database with:

  - Reimbursable's, Private Sector,
- Develop or design a listing of Interagency Govt service contractors that are approved by the agencies.
- Develop a Certification Process for Mapping Soil Scientists:
  - Consider NSCSS as a certifying body.
- Shared Correlator Position's between Forest Service/NRCS and others.
- Treat this session as a beginning.
- Continue committee efforts as a means of information transfer.
- Tools out there, People are there, now lets use them.

Northeast Cooperative Soil Survey Conference—Highlights and Recommendations
By David Kingsbury, NRCS, WV

Regional conference was held in Alexandria Bay, New York, June 24-28, 2002.

The 2004 NECSS Conference will be hosted by West Virginia, June 20-24, 2004. The conference location will be at Canaan Valley Resort near Davis, West Virginia. This area was chosen for a number of reasons including reasonable cost, proximity to active soil survey update areas (for the field tour), and traditional Appalachian activities for spouses and families (hiking, camping, site seeing, etc.). Stephen Carpenter, SSS/MO-13 Leader, NRCS, WV, is the Steering Team Chair.

An additional item of interest is the future Soil Survey Exhibit at the Smithsonian Institute. Partial funding is being provided for this exhibit from NRCS-NHQ through NRCS-WV. The centerpiece of the exhibit will be the monolith display (similar to the 1999 Soil Survey Centennial exhibit at the Mall). More information is available through the Soil Science Society of America. Additional funding will be needed to keep the exhibit at the Smithsonian since it is very expensive to maintain exhibits there. Work on the display/exhibit will continue through 2004, and states will have the opportunity to acquire new monoliths for the display if needed.

Seven committees convened and reported their activities. Highlights and recommendations of these committees were summarized from the individual committee reports.

Committee 1 – Research Needs

Co-chaired by Joyce Scheyer, NRCS, and John Sencindiver, West Virginia University

<u>Committee Goals</u>: The major goal of the committee is to improve communication of soil survey research needs and activities in the NE NCSS area at all levels.

<u>2002 Charges</u>:

1. Identify, document and prioritize critical research for the Soil Survey in the Northeast.

2. Identify sources of funding for critical research and ties to the current national NCSS funding initiatives.
3. Identify and establish channels of communication for technology transfer and feedback between the field and researchers.
4. Develop protocols to measure performance on research agenda milestones and progress.
5. Identify cooperative interstate opportunities for research.

2002 Accomplishments:

1. Increased the visibility of research to support soil survey priorities.
2. Developed nine research proposals to address regional and field-based problems.
3. Facilitated networking of researchers across Northeast and beyond, especially to reactivate NEC-50.

Summary of 2002 Research Proposals:

- Assessing P sorption capacity in the Northeast
- Baseline heavy metals in the Northeast Region
- Benchmark water table study
- Carbon sequestration in coastal wetlands
- Determining hydric soil indicators in problem soils
- Soil carbon accounting for Humods in the Northeast – distribution, extend and properties
- Soil surveys for long-term forest productivity in the Northeast
- Subaqueous soils
- Sulfide-bearing rock distribution in the northeast region

Committee 2 – Soil Taxonomy

Co-chaired by Peter Veneman, University of Massachusetts, and Craig Ditzler, NRCS

Committee Goal: To evaluate the merits of proposals to change Soil Taxonomy.

Eighteen proposals were forwarded by Craig Ditzler, National Soil Taxonomy Leader, to committee members for review. Only twelve were considered as relevant to the Northeast. A listing of the twelve proposals and actions taken is as follows:

Proposal #1—Add subaqueous subgroups to great groups—The proposal was made following changes in the definition of “soil” in the latest version of Soil Taxonomy. The proposal was agreed to due to the obvious implications of the definition change.

Proposal #2—Rename Humic subgroups to Umbric (same definition as before, keeping same keying order) and add new Humic subgroup (and new definition) in certain great groups of Inceptisols. The intent of the proposal is to mimic the old Umbrepts suborders (proposed Umbric subgroup) and introduce a new subgroup (proposed Humic subgroup) to identify thicker, dark-colored ochric epipedons that were formerly identified in Soil Taxonomy. It was agreed to in principle, but the committee postponed final action since the proposal was being resubmitted with some changes.

Proposal #3—Excluding dense calcareous tills from fragipan designations—This proposal may have some impact in New York, Massachusetts and Vermont. Recommended.

Proposal #6B—Spodic subgroups—proposal recognizes Spodic subgroup using the color of the horizon directly underlying the Albic horizon. Committee recommends the change be limited only to Udipsamments.

Proposal #6C—Rearranging keying sequence of Hapludolls—Recommended.

Proposal #6D—Adding Fluvaquentic subgroups to Endoaquents—Committee rejected the proposal and felt it more appropriate to propose that Aeric Fluventic Endoaquents be inserted into the keys after the current Fluvaquentic Endoaquents subgroup. The latter subgroup could be changed to Fluventic.

Proposal #6E—Introduction of Lamellic Oxyaquic Haplorthods subgroup—Recommended by the committee.

Proposal #7A—Introduction of Lamellic Haplorthods subgroup—Recommended with the notation that there is a conflict in the code assignments for proposal 6E and 7A (CDEI versus CDEJ).

Proposal #13—Introduction of Sulfaquerts great group—The committee supports the proposal, in principle, but more pedon and potential distribution data needs to be collected to justify the proposal. It is not recommended at this time until adequate support is provided.

Proposal #15—Clarification of "resistant" and "weatherable" minerals—Recommended by the committee.

Proposal #16—Changes to mineralogy keys—Recommended by the committee.

Proposal #18—Restore mollic/umbric criteria—Recommended by the committee.

Additional recommendations:

1. Continue this committee as a standing committee of the NECSSC.
2. Recommend approval of the proposed changes to Soil Taxonomy as indicated above.

Committee 3 – SSURGO/Map Finishing

Chaired by Darlene Monds, NRCS

Committee Charges:

1. Clarify the current process for SSURGO re-archiving/recertification.
2. Clarify join requirements—what constitutes a join, personnel responsible, materials submitted, etc.
3. Clarify how SSURGO will be maintained—when does a survey need to be recertified?
4. Explore possible ways to speed up the soil survey publication process, including map finishing.
5. Determine if there are standards in place or planned to assure that electronic soil surveys are consistent form survey to survey, much like a traditional published soil survey.
6. Make recommendations regarding the direction this committee should go in future conferences.

Recommendations:

1. Although NHQ is currently encouraging innovation with regards to electronic soil survey, some basic minimum standard is needed to assure that soil surveys look similar from one survey to another.

2. The group recommends that some regional NRCS contact, possibly via the Interdisciplinary Resource Team (IRT), be established to monitor technology that could potentially be used in soil survey. Further, this person could forward information links to state soil scientists, MLRA team leaders, and university NECSS cooperators.

Committee 4 – Site Specific Soil Mapping

Chaired by Steve Hundley, NRCS

Committee Goal: Facilitate communication and technology transfer on Order 1 mapping standards and site-specific investigations throughout the Northeast and serve as liaison with other regions of the country.

2002 Committee Charges:

1. Formalize guidelines for the Northeast. How do these guidelines compare with those of the National Society of Consulting Soil Scientists?
2. Is there a boundary between Order 1 soil surveys and Site-Specific investigations?
3. What needs do consulting soil scientists and university soil scientists have with respect to interpretations of site-specific/high intensity soil mapping?
4. What are the Technical Soil Services needs associated with Order1/Site Specific mapping?

5. Identify the value of, and the resources needed to provide Order 1/Site-Specific mapping standards and map products to both external and internal customers.

Summary of Recommendations:

Encourage efforts by State Soil Scientists in the development of Order 1/Site-Specific soil mapping standards.

Recognize both Order 1 and Site-Specific mapping as separate and distinct mapping protocols.

Encourage states to increase cooperative efforts with the private sector in providing workshops, training and other educational opportunities.

Assess the latest technology in field tools to help develop Order 1 and/or Site-Specific soil surveys; develop a listing of who has these tools and to what extent they can be shared.

Support efforts to strengthen the validity and use of Order 1/Site-Specific mapping to support Farm Bill programs.

Technical Committee #4 on Site-Specific Soil Survey should be terminated and combined with Technical Soil Services.

Committee 5 – Hydric Soils

Co-chaired by Wayne Hoar and Lenore Vasilas, NRCS

During the first day of the NECSSC, the Hydric Soils Committee had a field tour to highlight some of the possible problems encountered when National Technical Committee on Hydric Soils (NTCHS) field indicators are used in the Northeast. Problem areas associated with some of the indicators occur in both the New England and Mid-Atlantic regions. It was recommended that a joint project be undertaken between the New England and Mid-Atlantic Hydric Soil Committees to determine if one of the indicators (S1-Sandy Mucky Mineral) needs to be eliminated from Land Resource Region R. Data may need to be collected to determine this.

Dissemination of information from the NTCHS to the regional committees and to the public was also identified as a need. Some collaborative research topics identified at the meeting included additional sites for the red parent material study, development of maps of the Northeast identifying areas of potential problem soils (high elevation organic soils, red parent material soils, etc.), compiling water table data collected for soil survey projects throughout the Northeast, hydric conditions in disturbed soils, and identification of drained hydric soils.

Committee 6 – Subaqueous Soils

2002 Committee Charges:

1. Develop and describe a general strategy or protocol for conducting a subaqueous soil survey that addresses the difficulties and problems unique to these areas and that

could serve as an introduction and guide to those considering or beginning subaqueous soil survey work.

2. Develop a list of resources available for addressing the unique situations and problems associated with conducting subaqueous soil survey.
3. Compile a list of preferred terms and definitions to be used in describing subaqueous soil landscapes and special subaqueous soil features.
4. Consider possible proposed changes to Soil Taxonomy regarding inclusion of or accommodating subaqueous soils.
5. Compile a list of possible soil interpretations to be developed for subaqueous soils.

Recommendations:

1. Continue this committee as a standing committee of the NECSSC, and continue work to complete the charges of the committee including:
   a. Development of a document outlining protocols for subaqueous soil surveys.
   b. Development of a glossary for subaqueous soils.
   c. Identification of subaqueous soil interpretation needs.
2. Conduct a one-day symposium in the winter of 2003 for the purposes of improving communication and collaboration with other interested agencies and parties.
3. Conduct a one-week workshop during the summer of 2003 for the purpose of training soil scientists in the processes, techniques and approaches of conducting subaqueous soil surveys.
4. Propose that committee on subaqueous soils be established at the National Cooperative Soil Survey Conference.

Committee 7 – Technical Soil Services

2002 Committee Charge:

Establish effective communication among technical soil service providers and others to maintain consistency, reduce duplication, and improve technical soil services in the Northeast Region.

Items discussed at the NECSSC:

- Promote consistency and suitability of soils criteria in standards and specifications
- Develop a means of communicating
- Regional meeting of technical soil service providers
- Bring technical soil services to the level of the agency’s other services
- Address research and data collection needed for technical soil service delivery
- Pull people together to work on problems

- Address training needs
- Address non-standard interpretations (urban soil interpretations, etc.)
- Soil information in field offices
- Address problem national interpretations
- Develop a self-service information capability for public on easy and/or common questions
- On-site investigations ("technical soil services" versus "limited revisions of a soil survey")
- Prime farmland and other important farmland determinations

North Central Cooperative Soil Survey Conference – Highlights and Recommendations
By Travis Neely, NRCS, Indiana

Regional Conference was held in Madison, Wisconsin, June 24-27, 2002.

The Future North Central Regional (NCR)Conference is planned for Indianapolis, Indiana, July 11-15, 2004. Travis Neely, State Soil Scientist/MO Leader is steering team chair, and co-host is Gary Steinhardt, Purdue University.

There were four Standing Committees in the NCR in 2002: Taxonomy and Research Needs, Data Acquisition for Problem Solving, New Technology, and Interpretation.

Recommendations for Indiana to consider in 2004:

* NCR3 came to this meeting but we should try to keep them involved more.

* Need to have the right Keynote speaker when the Leadership Team is present on the first day.

* Get private industry involved. This is supposed to be a partnership meeting.

* Integrate field trip around the conference theme.

* Include opportunity for posters, in particular on what unique things are going on in region.

Additional recommendations:

* Submit partnership state reports ahead of conference.

* Focus on dissemination of soils information, not on production issues at conferences.

Committees

Standing Committees—General Descriptions

Research Agenda Standing Committee

Co-Chairs: Nancy Cavallaro, CSREES, NRI, Washington, DC
(nancy.cavallaro@usda.gov**)**
Peter Veneman, University of Massachusetts, Amherst, MA
(veneman@pssci.umass.edu)

Charges:

1. To establish a formal mechanism within the NCSS to:
2. Identify, document, prioritize, and address the critical research and development issues within the NCSS.
3. Identify opportunities for partnering on priority research needs.
4. Identify opportunities for funding priority research needs.
5. Organize a **Task Force: Monitoring Long-term Soil Property Changes**. The purpose of the Task Force will be to formulate a plan to evaluate long-term changes in soil properties and conditions through NCSS partnerships. The NCSS Research Agenda Standing Committee will report the Task Force's recommendations at the NCSS.
6. Identify an Outstanding Research Project within the NCSS partnership to present at the National NCSS Conference.
7. The NCSS Research Agenda Standing Committee will be required to report its activities at each National Conference.

Suggested Members:
2 Representatives chosen from each Regional Conference Research Committee
Representative from the BLM
Representative from the USFS
PMT Coordinator- Sheryl Kunickus, NRCS
Carolyn Olson, National Leader Investigations, NRCS, NSSC
Lee Norfleet, SQI, NRCS (Task Force)
Rebecca Burt, NSSC, NRCS

Task Force: Monitoring Long-Term Soil Property Changes

A team would formulate a plan to evaluate long-term changes in soil properties and conditions through National Cooperative Soil Survey partnerships.

Soil properties relevant to assessment of the ***State of the Nation's Ecosystems*** and ***National Resource Inventory*** should be considered.
Infrastructure and goals of LTER Long Term Ecological Research Program should be considered.
The task force should consider the purpose and strategy of sampling soil properties nationally.

NCSS Standards Standing Committee

Co-Chairs: **Craig Ditzler, NRCS (craig.ditzler@usda.gov)**
Tim Sullivan, BLM (Tim_Sullivan@blm.gov)
Duane Lammers, USFS (dlammers@fs.fed.us)

Charges:

1. Report on Regional Conference standards-related activities from last year.
2. West – Biological Crust Task Force
3. Northeast – Subaqueous soils committee
4. Review, test, and comment on proposals in ICOMANTH circular letter #4 involving horizon nomenclature and technical terms for human-modified soils.

Members:

Biological Crust Report
Tom Reedy, NRCS, NSSC
Pete Biggam, Soil Scientist, NPS, Denver, CO
Janis Boettinger, Assistant Professor - Pedology, USU, Logan UT
Arlene Tugel, Soil Scientist, SQI, NRCS, Las Cruces, NM
Bill Ypsilantis, Soil Scientist, BLM, Denver, CO
Jayne Belnap, Research Ecologist, USGS, Moab, UT

Subaqueous Soil Mapping Report
Marty Rabenhorst, University of Maryland, College Park, MD
Peter Veneman, University of Massachusetts, Amherst, MA
Steve Park, NRCS, Lakewood, CO
Wade Hurt, NRCS, Gainesville, FL

ICOMANTH Circular Letter Testing
Craig Ditzler, NRCS, NSSC, Lincoln, NE
Duane Lammers, USFS, Corvallis, OR
Tim Sullivan, BLM, Washington, DC
Bob Ahrens, Director, NRCS, NSSC, Lincoln, NE
Bob Engel, NRCS, NSSC, Lincoln, NE
Richard Shaw, NRCS, NY
Luis Hernandez, NRCS, Lincoln, NE
Sam Brown, NRCS, Temple, TX
Roy Vick, NRCS, Raleigh, NC

New Technology Standing Committee

Co-Chairs: **Pete Biggam, NPS (*pbiggam@nps.gov*)**
William Effland, New Technology/Landscape Analyst, NRCS (bill.effland@usda.gov)

Charges:
1. To develop and document procedures, processes, and standards that will be used to integrate GIS, remote sensing, landscape modeling, and other similar technologies into the mainstream of the soil mapping and landscape inventory program.
2. Review and document progress on recommendations from 2001 report.
3. Review and document progress on recommendations from 1999 Task Force on Soil Survey Products of the Future.
4. Review recommendations from 2002 Regional Conference reports.
5. Develop a methodology for distribution of standards and make recommendations back to the Steering Committee on the disposition of issues raised.
6. The NCSS New Technology Standing Committee will be required to report its activities at each National Conference
7. Identify an Outstanding New Technology Transfer Project within the NCSS partnership to present at the National NCSS Conference

Suggested Members:
A Representative chosen from each Regional Conference New Technology committee (if a committee exists)
Representative from the Agricultural Experiment Stations
Representative from the BLM
Representative from the USFS
Dan Rooney
Wes Tuttle
Jim Doolittle
Jim Turenne
Darlene Monds

IN-Conference 2003 Committees—General Descriptions

Committee 1: Selling Soil Science to Society—Promoting Partnerships

This committee should consider issues concerning soil survey product identification, product delivery, marketing strategies, public access to expertise, product timeliness and education on product use with an emphasis on promoting partnerships.

Charges:

1. Outline the structure of the soil survey delivery with consideration to the current situation, needs, new challenges of 508 and Web services, needs for compatible formats for viewing and printing, recommendations, and capability.
   Specifically answer the question:
   Are published, printed soil surveys still needed in the world of EFOTG, NASIS, data marts, and SMARTECH delivery tools?
   If so, in what style and format should they be for combined CD and Web delivery?
   If not, what provisions are there to provide the historical and land use description; interpretative map unit descriptions; general soil map descriptions; specialists sections on agronomy, range, etc; images; block diagrams; glossary; climate data; classification tables; typical descriptions? Or are they needed?
2. Presentation of Action Plan to streamline the publication process for the National Cooperative Soil Survey.

QIT Rapid Response Team Charges:

1. **Strategize a streamlining of the publication process to incorporate the options of electronic media products.**
2. **Develop issue papers that clarify the pros and cons of eliminating printed media of soil survey publications.**
3. **Evaluate and make recommendations on print on-demand maps and publication documents.**
4. **Evaluate the standardization of digital soil survey format for CDs, DVDs and Web-based products.**
5. **Evaluate and develop implementation strategies to transition from hard copy NCSS soil survey publications to electronic publications.**

Utilize the contents of the 1998-99 Town Hall meetings as reported in the 2001 Summary Report, Environmental Justice Report, the 2001 CD Summit, 2001 National Soil Survey Conference, Soil Data Delivery and Distribution (Outline Physical Design) 2001, and other documents available.

<u>Co-Chairs:</u>
Gary Muckel, NRCS, NSSC (gary.muckel@usda.gov)
Gary Steinhardt, Purdue University

Nathan McCaleb, NCGC; Ken Lubich, NSSC, NRCS QIT Co-Chairs

Potential Committee Members:
Steve Howes, USFS, Portland OR 503-808-2937
Mike Golden, NRCS, TX
Bob Neilsen, NRCS, NSSC
Julie Best
Randy Brown
Dave Lightle
Bill Taylor, NRCS, MA
Ann Lewandoski, SQI, NRCS
Nat. Env. Health Assoc
National Building Assn

Committee 2: Ecological Interpretations & Principles

This Committee should review classical references and University curricula for ecological principles and associations with soil and natural resource inventories. The Committee should investigate new interpretations and management recommendations associated with state and transition models; ecological frameworks; ecological site inventories and ecological land use inventories and discuss how they may be incorporated into soil survey.

Charges:
1. Clarify terminology of emerging ecological theories for use in soil survey inventories.
2. How will new inventory techniques of soil survey help to interpret natural and altered landscapes to better represent emerging ecological models?
3. How will NCSS apply ecological interpretations and principles to soil survey inventory protocols and standards?
4. Review standard University curricula for soil scientists and evaluate how ecological principles are represented in relation to soil science and soil survey.

Co-Chairs:
Curtis Talbot, NRCS, NSSC (curtis.talbot@usda.gov)
Randy Davis, USFS, Washington, DC (rdavis03@fs.fed.us)

Potential Committee Members:
Joel Brown, NRCS
Curtis Monger, NMSU
Dennis Thompson, NRCS
Randy Davis, USFS, Washington, DC
Susan Andrews, SQI, NRCS
Sharon Waltman, NRCS, NSSC
Tom Reedy, NRCS, NSSC
Carol Franks, NRCS, NSSC
John Kick, NRCS, MA

George Peacock, RLHI, NRCS
Patrick Shaver, RLHI, NRCS
Leonard Jolley, Range Management Society
Dave Cleland, USFS, Rhinelander,WI
Greg Nowacki, USFS, Milwaukee, WI
Wayne Robbie, USFS, Albuquerque, NM
John Kick, NRCS, MA
Forester position, NRCS, NSSC

Committee 3: New Inventory Techniques and Delivery Systems in Production Soil Survey

This committee is to concern itself with development and training of soil scientists and geographers in new inventory techniques, data collection, use and application of interpretations, and information technology issues concerning the delivery of soil data and applications to the public and private sectors.

Charges (Address the following issues):

1. What is the national strategy for data collection and data interpretation with the public at large? How will this be applied towards encouraging national and regional interpretations?
2. What new inventory techniques have emerged recently and what are the strengths and weaknesses of these new techniques?
3. How will database strategies change with new inventory techniques and the desire for more complex analysis of soil inventory information?
4. What is the potential with new inventory techniques to better describe landscapes for site-specific inventories and management?

.

Co-Chairs:
Henry Mount, NRCS, NSSC (henry.mount@usda.gov)
Axing Zhu, University WI (axing@geography.wisc.edu)

Potential Committee Members:
A Representative chosen from each Regional Conference Training committee (if a committee exists)
Representatives from the Agricultural Experiment Stations
Representative from the BLM
Alan Busacca, Washington State University
Gene Kelly, CSU
Shawn Finn, NRCS, MA
Fred Young, NRCS, MO
Sam Indorante, NRCS, IL
Toby Rodgers, NRCS, WA
Suzann Kieanst, NRCS, UT
David Howell, NRCS, CA
Wayne Robbie, USFS

Janice Boettinger, Utah State U., Logan UT
Joey Shaw (AU)
Tommy Coleman (AL A&M)
Terry Cooper (MN)
Susan Casby-Horton, NRCS, Temple TX
Doug Miller, PSU
Brian Needleman, UMD
Patrick Drohan, Sheppard College, WV
Lyle Steffen, NRCS, NSSC

Committee 4: Recruitment and Retention of Soil Scientists in Soil Survey

This committee is to concern itself with recruitment and retention of Soil Scientists in soil survey and soil resource management.

Charges (Address the following issues):
1. Investigate what incentives and programs are available to the NCSS to recruit soil scientists with Office of Personnel Management for the federal government.
2. What are the reasons that students do not apply for federal jobs when they are made available?
3. What are impedes applicants from registering with OPM for positions such as soil scientist or soil conservationist?
4. What scholarships are available nationwide that support students in soil science?
5. Gather recommendations from past national and regional committee reports for retention of soil scientists in agencies and report on progress.
6. Explore options for electronic or internet clearinghouse that improves information flow on positions, student applicants, scholarships, grants, and contacts within NCSS.
7. Promote internships and career intern program in federal government to provide more opportunities for high school and college age students to consider soil science as a career.

Co-Chairs:
Jon Gerken, SSS (jon.gerken@oh.usda.gov)
Jason Parman, OPM (jparman@opm.gov)

Potential Committee Members:
A Representative chosen from each Regional Conference committee on recruitment or retention of soil scientists (if a committee exists)
Representatives from the Agricultural Experiment Stations
    Douglas Malo, South Dakota State University, Brookings SD
    Kevin McSweeney, University of Wisconsin, Madison WI
Representative from 1890's Colleges
Representative from Tribal Colleges
Representative from the BLM
Representative from the USFS
Joe Moore, NRCS, SSS, AK

Joyce Scheyer, NSSC, NRCS
Dwayne Mays, NSSC, NRCS
Ginger McGill, NRCS, Ft. Worth TX (817)509-3504
Kathy Mokrzecky, NRCS, HR, MA
Denise Decker, NRCS, Personnel

Committee 5: Water Movement and Water Table Monitoring in Soil Survey

This committee will explore and discuss how soil survey should address water movement and water tables for regional updates of the soil survey and database representation.

1. This committee will review water table studies nationally to formulate regional guidance of measurement techniques, database documentation and interpretations for taxonomy and practical user applications in soil survey.
2. What are the lessons learned from the Wet Soil Monitoring Project, 1990-2001 that could be applied for future studies?
3. How might studies of regional or local hydrology apply to updating and refining soil survey information?
4. How might the concepts of hydro-pedology apply to soil survey?
5. How may Sub-Aqueous Soil Mapping be incorporated in soil survey?

Co-Chairs:
Henry Lin, PSU (henrylin@psu.edu)
Cathy Seybold, NRCS (cathy.seybold@usda.gov)

Potential committee members:
Doug Wysocki, NRCS, NSSC
Phil Schoenburger, NRCS, NSSC
Warren Lynn, NRCS, NSSC
Bob Grossman, NRCS, NSSC
Marty Rabenhorst, UMD
Mark Stoltz, URI
Laurie Osher, University of Maine, Orono, ME
Moye Rutledge, UAR
Steve Carlilse, NRCS, NY
Al Averill, NRCS, MA
Steve Hundley, NRCS, NH
Karen Dudley, NRCS, NH
Ron Paetzold, NRCS, NSSC
Larry West, UGA
Joey Shaw, AU
Lyle Steffen, NRCS, NSSC
Jim Richardson, NRCS, NSSC

Committee 6: National Hydric Soil Committee

Leadership from the National Hydric Soil Committee will discuss 2002 meeting reports and any further debate on the indicators or test indicators for Hydric Soils. This will also be an opportunity for the NE Hydric Soils Committee and the Mid-Atlantic Hydric Soils Committee to meet with the National Committee leadership for discussion of future testing for proposed indicators.

CoChairs:
Karl Hipple, NSSC, NRCS (karl.hipple@usda.gov)

Standing Committee Reports

NCSS Research Agenda Standing Committee

Charge 1: Identify, document, prioritize, and address the critical research issues within NCSS

Each region sent a report with a listing of current projects considered priority. The committee agreed that the three highest priority areas at the national level were:

- **Dynamic soil properties**
- **New technologies, new inventory techniques**
- **Whole landscape hydropedology studies**

Other more specific issues were put forward by the regional committees and will be listed for each region as part of this report. Several related to water tables, water movement and hydric or subaqueous soils. Others related to chemical properties and indices as for carbon pools & accounting, phosphorus, heavy metals. Carbon sequestration is particularly of interest for use by the national global change research program and is a high priority for that program.

The committee also made the following process recommendations to by-laws of the National Cooperative Soil Survey with regard to this committee and research funding:

- Formalize the make up of the Research Agenda Standing Committee: 2 members from each region, one Co-chair will be permanent and should be the national leader for soil survey investigations; the second Co-chair should rotate among representatives from partners: ARS, FS, CSREES, BLM, Park Service
- This committee should meet each year at one of the region meetings or other national meeting
- Inject competition into process of funding from from the National Office. Formalize a peer review and reporting process:
    - The research agenda committee would act as review panel, adhoc review would be solicited. Proposal format established. Establish reporting process.
- Establish criteria for prioritizing—longevity, is it fundable, addresses NCSS mission, fits into USDA & NRCS strategic plan
- National Soil Survey Center research staff should pay significant attention to the National Research Priorities established by this Committee in their annual business plan.
- The request for proposals from State Soil Scientists should state that only proposals supporting the national NCSS research priorities will be considered.
- The committee requests that the National Conference steering committee accept these proposed changes and additions and implement them at the end of the meeting.

Charge 2: Identify opportunities for funding priority research needs

The committee suggests that the Co-Chairs submit a report each year of recommended research priorities to relevant program officers at the funding agencies that have relevant programs. This will assure formal input into their processes of establishing issue areas to be solicited in RFA's for the following fiscal year. The following agencies have programs that could accept grant proposals in NCSS priority areas:

- CSREES (NRI, Integrated Research Programs)
- NSF
- DOE
- NASA
- NOAA
- EPA

The rfa's for these programs generally solicit comments and recommendations regarding their rfa's. Generally these should be addressed to the Program Director for the particular program.

There is a trend in funding agencies towards larger, multi-institutional and multidisciplinary projects. A possible way to develop this kind of coordinated projects around priority research needs is to apply for funding for conferences and workshops. The NRI and NSF and USGCRP can fund this type of conference or workshop.

Monitoring Long Term Soil Property Changes--Task Force Report

M.A. Wilson, Research Soil Scientist, USDA-Natural Resources Conservation Service, National Soil Survey Center, Lincoln, NE

Executive Summary

The objectives of the report are to document current and recent past long-term soil, water, or ecology monitoring activities; discuss advantages and disadvantages of these types of studies, relevant properties, need of future activities; and to formulate a plan for future monitoring activities. Eight examples of monitoring activities are documented from various government agencies. A program developed by the NCSS for the future should create a dataset that is standardized, multi-faceted, and will meet current and future needs of the NCSS and others. It must withstand budget cuts, reallocations, and administrative changes, and integrate both research and education. It would best be viewed as a component of routine activities of the NCSS and must help sustain the NCSS and soil survey into the future. The necessary program should foster interdisciplinary cooperation and research, attempt to obtain funding from other agencies for research activities, and foster partnerships between government agencies and universities within the NCSS and potential customers such as private industry. A program is proposed in this report that would initially summarize the geographic extent of major soils in the U.S., then systematically select site and pedon locations that represent mapping units of all major soil series not characterized to date. Locations would be chosen cooperatively by NCSS partners of specific MLRA regions. Data generated for each site would be typical site and morphological data and descriptions (including past and recent land use) and laboratory characterize data. Completed data would be added to the existing, accessible databases of the NCSS (currently NASIS and the NRCS Soil Survey Laboratory Characterization Database). When completed this program would have a product that represents the most complete field and laboratory characterization dataset of soils in the world and be a premier product of the NCSS. Selected sites would be used for more intensive research studies conducted by university cooperators and other NCSS scientists, funded by an active, accountable granting process. These intensive studies could be short-term (2-3 years) and focus on issues such as pedogenic processes in watersheds or landscape components, or long-term to evaluate soil property changes over time or with land use for issues such as C sequestration, soil geochemistry, temporal properties, or hydrology.

Acknowledgements

This report represents contributions of many individuals. The proposed program has been in the formative process for many years. The author expresses his appreciation for the ideas and suggestions of the many persons within the NCSS who contributed to the report or provided suggestions during the review process.

Assigned Objectives of the Task Force

Document current and recent past monitoring activities in this topic area (monitoring long-term soil property changes).

Discuss the advantages and disadvantages of undertaking these types of studies

Examine the need and importance of future activities.

What properties are relevant to the assessment of the State of the Nation's Ecosystems and NRI? These properties should be considered.
Formulate a plan to evaluate long term changes in soil properties and conditions through NCSS partnerships. Consider purpose and strategy of sampling soils nationally.
Make recommendations to the NCSS.

Specific On-Going Long-Term Activities

National Resources Inventory (USDA-NRCS)
http://www.nrcs.usda.gov/technical/NRI/
The NRI program has its origins in the National Erosion Reconnaissance Survey of 1934, a survey that resulted in the establishment of the Soil Conservation Service. This initial survey evolved through the Conservation Needs Inventory (CNI) in the 1940-1960 era to the present day NRI.
The NRI current data collection is from 800,000 sample sites from all 50 states, Puerto Rico, U.S. Virgin Islands, and some Pacific Basin locations. This is non-federal land, about 75% of the total land area of the U.S. Sites are 160 acres with three sampling points randomly located in each site polygon. It is statistically based to assess conditions and trends of soil, water, and related resources. Surveys have been conducted in 1982, 1987, 1992, and 1997. Data collected for the 1997 survey were predominantly based on remote sensing and other imagery, field office records, historical records and data, other materials, and limited on site visits. There are soil maps associated with each site, obtained initially from STATSGO and later updated with more detailed soil maps. Soils data were obtained from the NRCS Soil Interpretation Record database. Soils property data related to soil erosion and soil-dependent interpretations (e.g., prime farmland) were linked to the NRI database.
The future of NRI is a concept to create a continuous, interagency, natural resource oriented monitoring and assessment program. There has been an effort to streamline the data collection process and assure quality control of the data. The continuous inventory process organizes sampling on an annual and infrequent basis (e.g., sampling is divided into core and rotational sample PSU's (primary sample units). Core samples have data collected annually, and rotational samples have data collected every few years. For example, Illinois has 1264 core samples and 995 rotational sample PSU's, sites last observed in 1997). Data to be collected include:
1. Crop planted (corn, soybeans, wheat, etc.)
2. Land cover use if not cropped (pasture, woods, urban, etc.)
3. Conservation practices if any (terraces, waterway, filter strips, etc.)
4. Tillage type used (minimum till, no till, conventional, etc.)
Land ownership if not private (county, state, federal).
Irrigation, for those counties with irrigated cropland or pastureland, please indicate the type of irrigation system

Data can be collected from photo interpretation, local knowledge, conservation planning records, and FSA records and slides.

Site locations, as they currently exist, are generally inexact and represent a area within a chosen polygon. They were established by a randomized, "statistically-defensible" process. Sites are not selected to be representative of a particular soil series within a mapping unit. There are no laboratory generated for each point location to date.

Forest Inventory and Analysis Program (US Forest Service)
http://www.fia.fs.fed.us/
The Forest Inventory and Analysis Program (FIA) is a continuous survey of the status and trends of the U.S. forests and origins of the program began in the 1930's. Data is used by both government agencies and private industry for sound forest policy and business planning.

Within this program, a suite of forest health indicators are measured (one forest health plot for each 16 standard FIA plots). These indicators are:
Crown Condition
Ozone Injury
Tree Damage
Tree Mortality
Lichen Communities
Down Wood Debris
Vegetation Diversity and Structure
Soil Condition

Each FIA plot is circular containing three FIA subplots to measure the health indicators. Soil condition indicators are used to establish data regarding status of forest lands regarding erosion (evaluating use of WEPP data to for erosion prediction for different forest ages and disturbances), compaction (status and change of compaction, and observable ruts, trails, etc.), and important physical and chemical soil properties. Soil samples collected are the litter layer, O horizon, and underlying mineral soil in two equal increments of 4 inches.

Phase 3 forest floor (organic) samples are analyzed in the laboratory for bulk density, water content, total carbon, and total nitrogen.

Phase 3 mineral soil samples are analyzed for:
Bulk density, water content, and coarse fragment (>2-mm) content.
pH in water and in 0.01 M $CaCl_2$.
Total carbon.
Total organic carbon.
Total inorganic carbon (carbonates) (pH>7.5 soils only).
Total nitrogen.
Exchangeable cations (Na, K, Mg, Ca, Al, Mn).
Extractable sulfur and trace metals.
Extractable phosphorus (Bray 1 method for pH < 6 soils, Olsen method for pH > 6 soils).

The QA program for the soil indicators address both field and laboratory measurements. Field crews are trained to make field measurements as well as take soil samples. After training, all field crew members are tested and certified for soil indicator measurements. Each trained crew member must demonstrate the ability to conduct soil measurements within established MQOs.

Long Term Ecological Research Program (LTER) (National Science Foundation)
http://lternet.edu/
The LTER program, funded by the National Science Foundation, is a collaborative, interdisciplinary research program that strives to evaluate and synthesize a wide range of data to answer important ecological questions. It consists of 24 sites in a wide range of climatic environments. The objectives of the program is to encourage interdisciplinary research among investigators, design of experimental studies across a range of spatial and temporal scales, develop a variety of models to guide research and allow comparison of research results in other systems, and comparative approaches for parallel studies in different ecosystems.

There is a strong emphasis on standardization of approaches and methods between LTER's in order to maximize data comparisons (e.g., Michener, W.K., J.H. Porter, and S.G. Stafford. 1998. Data and information management in the ecological sciences: a resource guide. LTER Network Office, University of New Mexico, Albuquerque, NM.). Note the LTER Climate database (http://www.fsl.orst.edu/climhy/climdb/index.htm) and the manual produced to help standardize methods (G. Philip Robertson, W. K., David C. Coleman, Caroline S. Bledsoe, and Phillip Sollins, eds. 1999. Standard Soil Methods for Long-Term Ecological Research. Oxford University Press, NY)

Wet Soils Monitoring (National Cooperative Soil Survey; Contact Warren Lynn, NSSC) The Wet Soil Monitoring Project was designed to collect factual data on the wet properties of soil several climatic regions. The data was to be collected for a minimum number of years to encompass the variation of the modern climate. The intent was to conduct research on monitoring methods, types of sensors and means of installation. Data were collected manually at appropriate intervals initially. Shifts to electronic collection occurred in varying degrees as opportunities developed. One facet was testing and commenting on hydric soil indicators and noting wetland vegetation. This time frame was to be for a minimum of five years to a maximum of 10 years or more. Funding was provided under the NRCS Global Climate Change Initiative (with additional funding provided by the U.S. Army Corp of Engineers) to the NCSS cooperator (Land Grant Universities). Project funding was from 1990-2000.

Study areas typically encompassed a catena of landscape positions exhibiting a range of wetness. Soil morphology and laboratory data is produced for each soil type in the study area. Field data related to wetness was collected by the following methods:

Piezometers (water table head)
wells (shallow water table depth)
tensiometers (matric potential)
platinum electrodes (redox potential)
thermocouples (soil temperature)
a, a-dipyridyl (presence of ferrous iron)

Projects were in Alaska, Oregon, Utah, North Dakota, Minnesota, Texas, Louisiana, Indiana, New Hampshire, Kansas, and Kentucky. They were typically administered by university professors and their graduate students. Projects generated many scientific presentations and publications, and have resulted in a database (in progress) at the NSSC in Lincoln, NE.

Soil Climate Analysis Network (SCAN) (NRCS Water and Climate Center and National Soil Survey Center; Contact: Ron Marlow, Conservation Engineering Division or Ron Paetzold, NSSC)
http://www.wcc.nrcs.usda.gov/scan/
SCAN was established in 1990 as a 10-year pilot project to test the feasibility of establishing a national soil-climate network. The effort was initially sponsored by Resource Inventory Division and the Soil Survey Division of NRCS. Currently, it is managed by NRCS, but program funding is from various federal, state, and private entities. This comprehensive soil moisture and climate monitoring information is

required for drought risk assessment and mitigation, for wetland determinations, and support of farm bill activities.

The project has established 175 monitoring stations in 39 states, Puerto Rico, Virgin Islands, Antarctica, China, and Mongolia. There are also 17 separate long-term projects, and short-term soil temperature activities in 25 states. The system, upon completion, will include 2,000 stations.

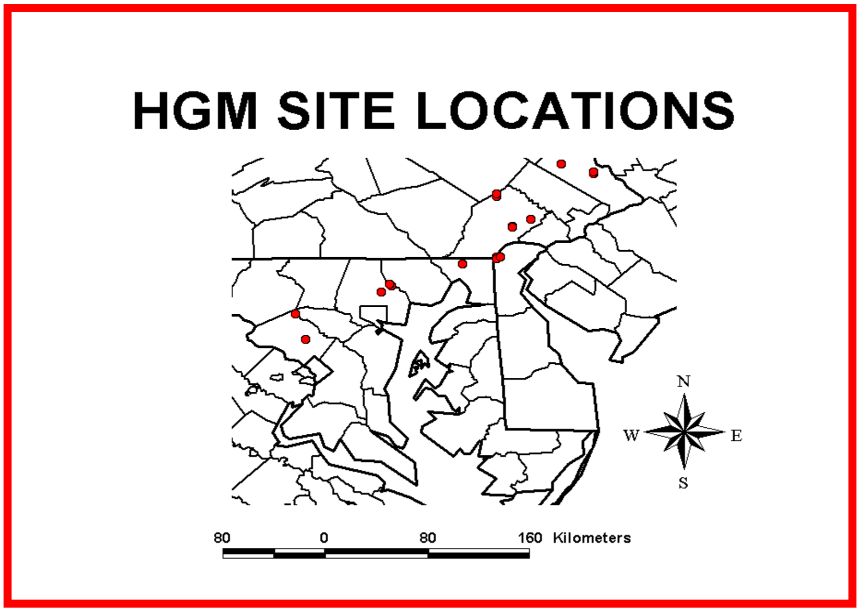
The project examined network communications, sensors, data collection electronics, station maintenance, data management, system interfaces, and the management of a large national resource monitoring program as a whole. It utilizes meteor burst communication for data collection from remote stations in near real-time. Properties monitored include soil temperature, soil moisture, soil water level, soil redox potential, soil heat flux, air temperature, relative humidity, wind speed and direction, precipitation, snow, solar radiation, albedo, net radiation, infrared radiation, barometric pressure

DATA USE EXAMPLES
Soil Survey
Ecology Studies
Engineering Uses
Biological Studies
School Science Projects
Global Climate Change Models
Continental Scale Climate Models
Other Models: Wind Erosion Model, Crop Yield, etc

National resource management issues for which long term soil-climate information is needed include:
Monitoring drought development and triggering plans and policies for mitigation.
Monitoring and predicting changes in crop, range, and woodland productivity in relation to soil moisture-temperature changes.
Predicting regional shifts in irrigation water requirements that may affect reservoir construction and ground water levels.
Developing new soil moisture accounting and risk assessments.
Predicting changes in runoff that affect flooding and flood control structures.
Assessing long-term sustainability of cropping systems and watershed health.
Predicting shifts in wetlands.

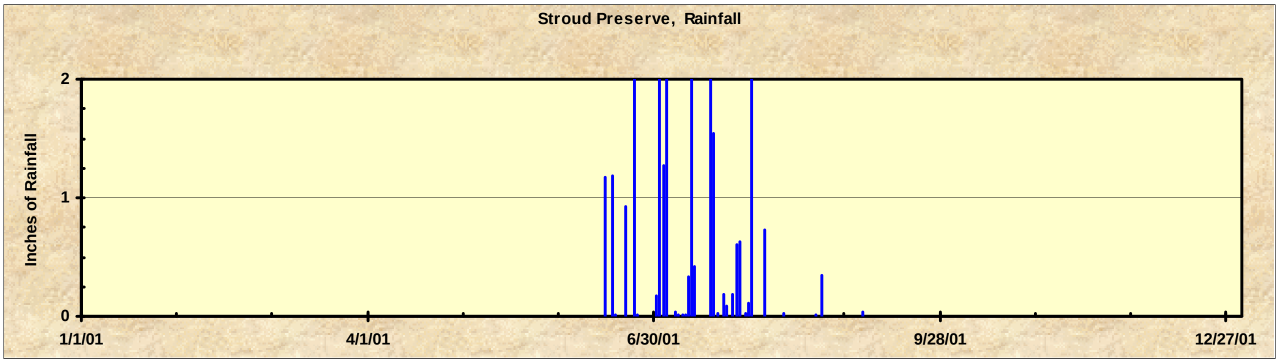
<u>Hydrogeomorphic (HGM) monitoring Project</u> (Contact: Lenore Vasilas, NRCS, Baltimore, MD)

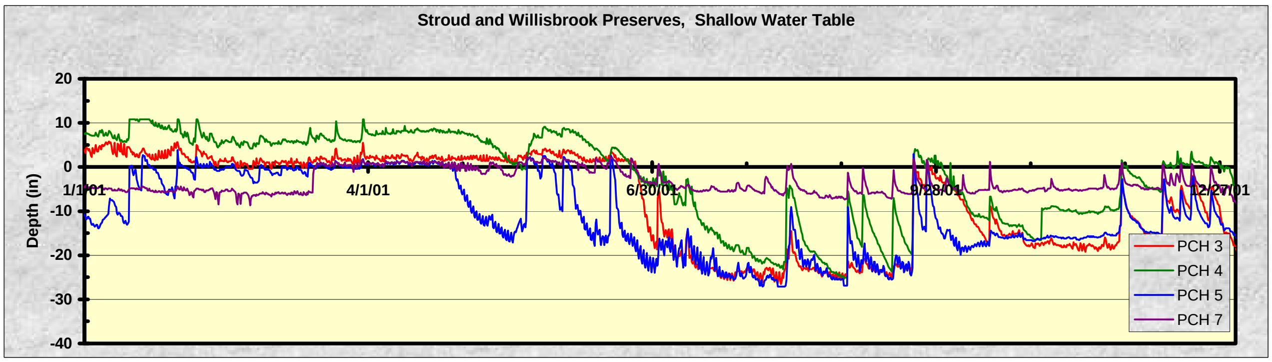
A plan was established in 1999 to initiate data collection for a hydrogeomorphic project through the cooperation of NRCS and U.S. Army Corp. of Engineers. The project was designed to characterize site characteristics (plants and soils), monitor climatic conditions, and quarterly measure soil and groundwater properties at wetland reference sites. These sites are slope and riverine wetlands in the Mid Atlantic US (Maryland, Delaware, Pennsylvania, and Virginia) of MLRA S148 (the Northern Piedmont physiographic province; LRR North Atlantic Slope Diversified Farming Region). The objectives of the project are to collect baseline data on these sites to develop a hydrogeomorphic model.



The project has been continuing since August, 1999 and currently has 35 sites. The following data has been collected:

Rainfall
Water table
Redox Potential (Quarterly)
Air and soil temperature
Representative pedon morphology
Laboratory pedon characterization
Quarterly Water Analysis:
Electrical conductivity,
Cations (Al, Fe, Mn, Ca, Mg, K, Na)
Anions (CO3, HCO3, PO4, F, NO3, NO2, Cl)
Quarterly Soil Analysis:
pH
Carbon, N, S
H2O-soluble Al, Fe, Mn, Si, P
Bray-extractable P
Citrate-dithionite Fe, Al, Mn
Acid Oxalate Fe, Al, Si, Mn, P





<u>Environmental Monitoring and Assessment Program</u> (EMAP) (Environmental Protection Agency)
http://www.epa.gov/emap
The Environmental Monitoring and Assessment Program (EMAP) is designed to develop tools for monitoring and assessing national ecological resources. Their goal is to use monitoring data collected at multiple scales to assess current ecological condition and forecasts of future risks for natural resources. They emphasize regional projects with multi-agency involvement. One example of their assessment work is the document "An Ecological Assessment of the United States: Mid-Atlantic Region (EPA, 1997), available at their web site. In that document, specific landscape indicators related to soils and agriculture are:

UINDEX Human use index (proportion of watershed area with agriculture or urban land cover)
NO3DEP Average annual wet deposition of nitrate
SO4DEP Average annual wet deposition of sulfate
RIPAG Proportion of total streamlength with adjacent agriculture land cover
CROPSL Proportion of watershed with crop land cover on slopes that are greater than three percent

AGSL Proportion of watershed with agriculture land cover on slopes that are greater than three percent
STNL Potential nitrogen loadings to streams
STPL Potential phosphorus loadings to streams
PSOIL Proportion of watershed with potential soil loss greater than one ton per acre per year
FOR% Percent of watershed area that has forest land cover

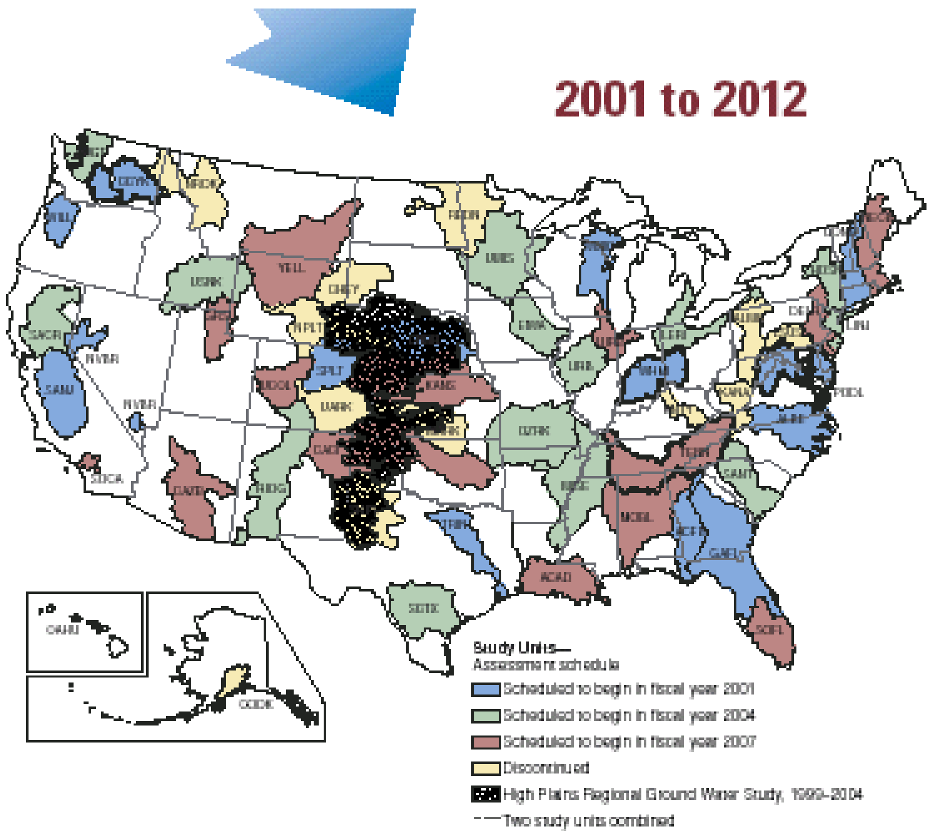
National Water Quality Assessment Program (NAWQA) (USGS)
http://water.usgs.gov/nawqa/index.html
The National Water Quality Assessment Program (NAWQA) is a United States Geological Survey program that was initiated in 1991. It collects and analyzes data on more than 50 major river basins and aquifers across the nation. The goal is to create a consistent and comparable (regionally or nationally) long term dataset that can be used for management and policy decisions. The NAWQA program is designed to answer questions such as the condition of the Nation's streams and groundwater, how these conditions change over time, and the natural or human influence (contaminant source or land and chemical use) on these conditions. The program is a multi-disciplinary approach including USGS scientists in hydrology, geology, geophysics, biology, geography, and statistics. The program is entering a second cycle, having began a second assessment of 14 major river basins or aquifers (the program's study unit) in 2001 based on the initial data collection cycle. They will begin two other assessments (of 14 river basins or aquifers each) in 2004 and 2007. USGS is focused on the total resource to evaluate the systems health.

Each study units conforms to the national design, sampling, and analytical standards. The program encourages participation of government, industry, research, and interest group partners to ensure that the program meets the needs at local, regional, and national levels.

From: USGS Fact Sheet 071-01 (The National Water Quality Assessment Program—Entering a New Decade of Investigations):
http://water.usgs.gov/pubs/FS/fs-071-01/pdf/fs07101.pdf

A focus on streams and ground water
NAWQA studies focus on streams and ground water. Lakes, reservoirs, estuaries, and coastal areas are
monitored in only a few selected areas for specialized studies. Because many of the assessed streams
and rivers contribute to lakes, reservoirs, and estuaries, an on-going goal is to collaborate with other
USGS programs, such as the National Stream Quality Accounting Network; with National Oceanic
and Atmospheric Administration, U.S. Environmental Protection Agency, and other Federal agencies;

and with States in the assessment of major receiving waters, such as the Great Lakes, Chesapeake Bay,
Long Island Sound, San Francisco Bay and Delta, and the Gulf of Mexico. In these collaborations, NAWQA provides quantitative information on (1) amounts (loads) and long-term trends in concentrations of
nutrients, pesticides, and sediment that enter receiving waters from major tributaries; (2) regional source areas of contaminants; and (3) effects of population growth and land use
on the concentrations and amounts of contaminants. This information is critical for developing strategies aimed
at reducing contaminants in individual river basins and their contributions to receiving waters.



There are 5 priority topics that are being studied by the program in this new cycle (1) Effects of nutrient enrichment on streams, (2) Sources, transport, and fate of agricultural, chemicals, (3) Transport of contaminants to water supply wells, (4) Effects of urbanization on stream ecosystems, (5) Bioaccumulation of mercury in aquatic organisms.

PROGRAM PROPOSAL FOR NATIONAL COOPERATIVE SOIL SURVEY

CONCEPTS OF A PROGRAM FOR MONITORING SOIL PROPERTIES

Emphasis of data produced by NCSS needs to be built on the concept of creating and then expanding a dataset that is standardize, multi-faceted for many types of users, and that will meet future needs of the NCSS and others.
The program should help foster the immediate needs of NCSS cooperators, e.g., providing funding for soil investigations and graduate research, with results be contributing to the collective good of the dataset.
The program should be viewed as long term and designed to withstand budget cuts and reallocation.
It should integrate both research and education. The data collection/analysis should expand our knowledge of certain research topics/areas, but also foster development of scientists and students. We need to be concerned about creating jobs, funding research, and providing training. The future of the NCSS depends on universities maintaining programs and training students in soil science and pedology, and government agencies maintaining the soil survey program and partnerships.
The program should foster research projects that bolster cooperation between government and university scientists.
It should strive to cross disciplines. This goal broadens the impact of data, and educates others of the values and approaches of soil investigation/characterization.
The NSSC should attempt to obtain funding from other agencies for the support of the activities of research, monitoring, and data collection.
The direction of the program should be built on the foundations of pedology and soil survey already created (e.g., look to add to NRI dataset, add to the existing characterization database of the NSSC, merge data from NRI with FIA). Avoid reinventing the wheel.
Consider adding soils information to existing long-term projects (e.g., collecting soils information (pedons) on LTER sites across the U.S.

COMMENTS

Monitoring long-term “changes” in soil properties on a national basis may appear sound conceptually. But it is (or will be) an elusive goal to actually monitor long-term soil property changes on a national basis due to variations in land use or anthropogenic additions. Most changes in properties are very slight over time and generally masked by soil variability. It may be successful to approach “state of the land” projects by avoiding actual soil measurements and collecting other types of ancillary data such as done in the NRI project. Studies that provide soil data reflecting land-use change are most successful on a limited geographic extent, such as a watershed or farm field. Land use changes can be more rigorously documented and a more intensive dataset of soil information can be collected. This approach has proven successful in monitoring use-dependent or temporal properties. One approach to study cropland management effects is through the use of university operated sites, may that have 80-100 years worth of data. The soil types, properties, and management of the sites are detailed in: Reeves, D.W. 1997. The role

of organic matter in maintaining soil quality in continuous cropping systems. Soil and Tillage Research. 43:131-167.

Most long term, large-scale monitoring projects that provide useful data have objectives to better understand variability or range of property flux over time. This is the concept of the wet soil monitoring or climate studies described above. Projects such as these have provided valuable data and funding should be continued on such projects.

The National Cooperative Soil Survey involvement in monitoring activities should fulfill the concepts listed above. Government and university philosophies and budgets of today will not likely support a nationally-based, long-term project that does not have an immediate impact and generate products. We need to consider soils data and information generated by the NCSS in the past and how we can improve it, rather that starting a new monitoring project. What is needed to improve our foundation of soil survey and pedology for the U.S.? What have we instituted in the past, but have yet to complete?

THE SUGGESTED APPROACH FOR FUTURE DATA COLLECTION

An approach, building on our past, would be to institute an aggressive, funded program to characterize pedons for all important soils of the U.S. Additional data reflecting spatial or temporal variability (related to land-use) may be added once these sites are established and an initial data-set collected.

The Soil Survey Laboratory database contains about 28,000 pedons sampled over the past 60+ years. About one half of that group have pedon descriptions, with all horizons sampled and characterized. The analytical suite defining "laboratory characterization" varies between pedons, as analyses performed over time vary by need and technology. This database of pedons is unique in the world and represents one of the premier products of the U.S. Cooperative Soil Survey Program. There are many users of these data for a wide range of applications.

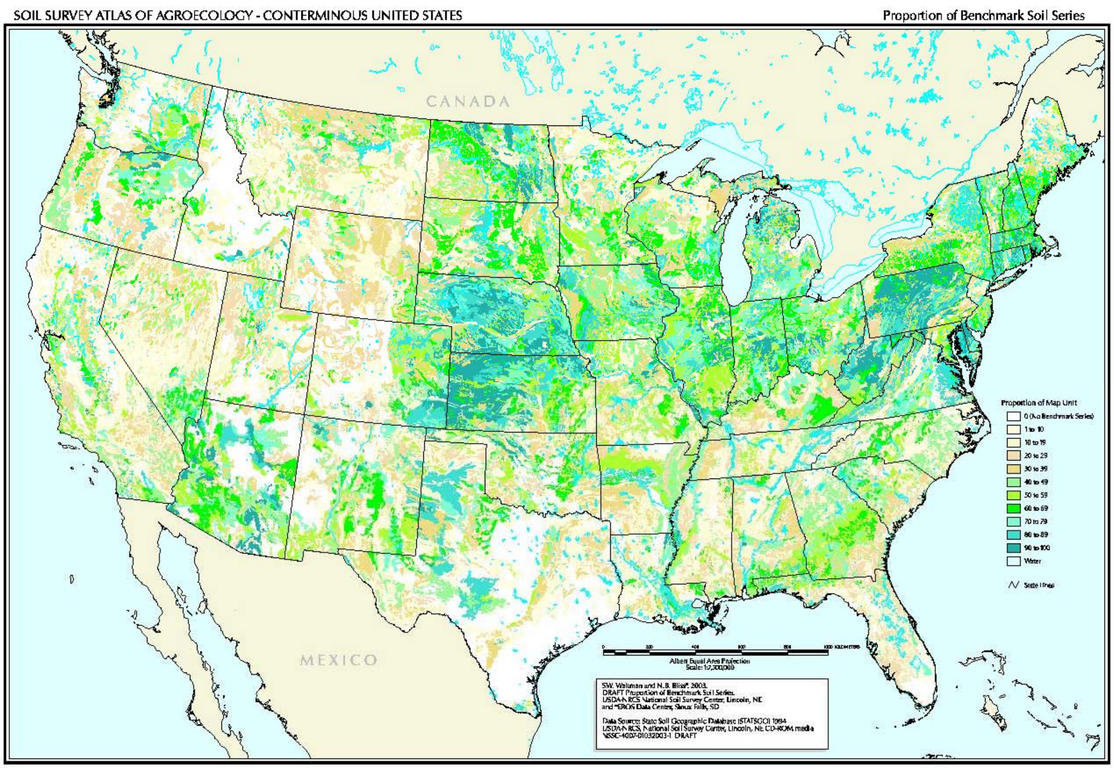
There has been much discussion for the past 20 years to formulate and execute a plan to build a comprehensive dataset that represents the major soil series mapped in the U.S. The extent of the dataset would include pedons that represent benchmark soils, have significant acreage, and represent a range of soil properties across the U.S. Currently, many areas of the U.S. have completed soil surveys or are being updated and digitized. Now is an opportune time to begin evaluating the current dataset for completeness and selecting additional soil series/pedons to be a part of a final, comprehensive dataset. Creation and completion of this dataset should be viewed as the long-term goal of the NCSS.

Members of the dataset needs to be critically evaluated and defined by MLRA regions.

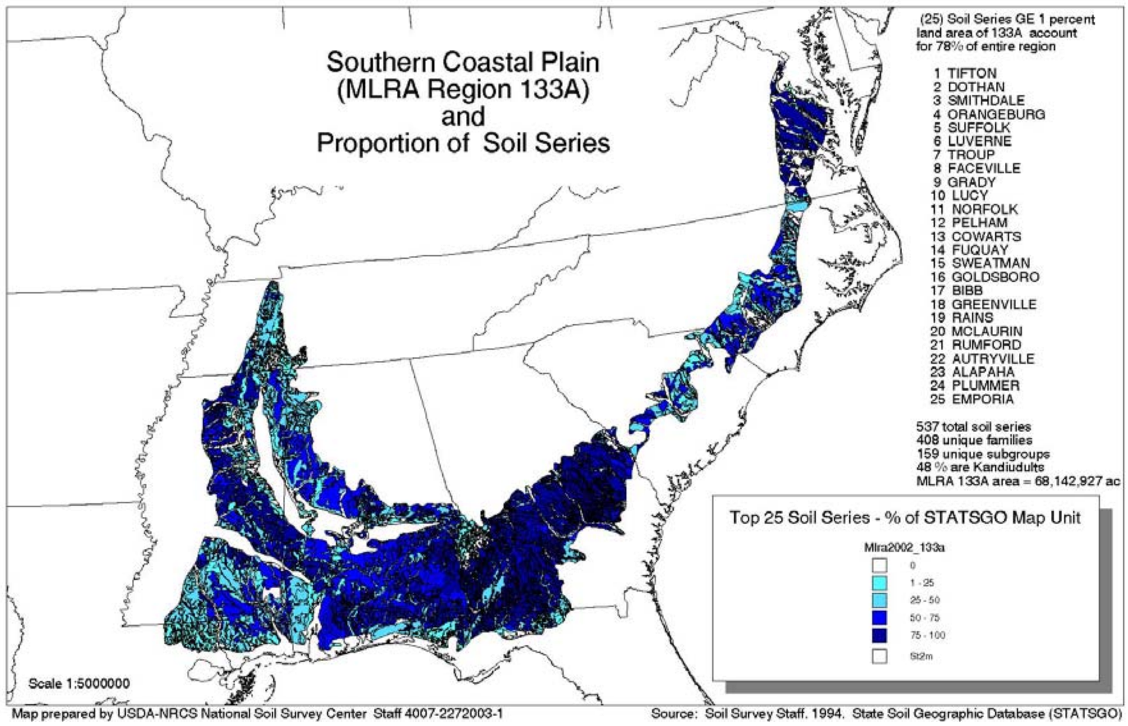
1. Benchmark soils are defined as those soils of large extent, holding a key taxonomic position, having large amounts of collected data, or special significance to use and management (Soil Survey Staff, 2001). The state soil scientist and MLRA office propose

and maintain a list of benchmark soils in their region. The list currently has 1200 pedons. The likely weakness of the list is the subjectivity of the selection process and how different regions view the importance of the list.

The figure below, based on STATSGO data, illustrates the proportion of mapping units that are accounted for by benchmark series in the U.S. and illustrates that the aerial extent represented by benchmark soils varies widely by region.



A second, more comprehensive approach to pedon selection is to evaluate acreage extent of important soils in each region. This approach performs well in areas that have nearly completed and/or digitized surveys. It was tested for MLRA Region 133A (Southern Coastal Plain) in the southeast US:



This map illustrates that 25 series (of 537 total series mapped) account for 78% of the STATSGO mapping units in this MLRA. Only 11 of 25 series are currently designated as benchmark series. This approach illustrates that for regions that have complete mapping, the important series can be determined for an area and that only a fraction of the series constitute the majority of the land in that area.

3. The laboratory database currently contains 1264 pedons representing benchmark soil series, with many of the series sampled multiple times. Of these pedons, mapped acres according to NASIS ranges from 0 to over 1 million. There are 247 additional pedons in the database that have greater than 50,000 acres mapped according to NASIS, but are not designated as benchmark series. These pedons are “nearly complete” but additional data could be added.

ADDITIONAL POINTS

Each MLRA region must be evaluated as to important series that represent soils of the area. It can then be determined which of these series have been previously sampled. Previously sampled pedons need to be evaluated as representative of the series concept and for completeness of field (morphological and site descriptions) and laboratory data. Pedons must have georeference information.
If samples from these pedons are available in the Soil Survey Laboratory archives, additional analyses should be requested to complete the dataset.
The standard laboratory analyses for a dataset must be established. This dataset will likely vary between region, but should constitute basic physical, chemical, and

mineralogical properties in all genetic horizons. Elemental analysis (major and trace) should be conducted on all major and other selected horizons. Additionally, properties important to specific interest groups or topically areas need to be included, i.e., the data collected for each pedon should encompass the needs of diverse groups: temporal properties, geochemistry, soil biology, soil quality.

For series designated as important but not sampled, the location of "typifying pedons" should be established. This pedon may be the site representative of the "Official Series Description".

A systematic plan to sample pedons should be organized, facilitated, and implemented on a national basis.

Sites or pedons should documented as to land use history.

Soils must be to be evaluated or classified regarding to their response to management. For example, soils at many sites will be altered via human use (e.g., agricultural management) and a "taxonomic" system (based on characteristics of surficial horizons) needs to be created that group soils based on their behavior or response to land use or disturbance.

The current program for distributing NRCS funds for research projects related to the NCSS should be evaluated. Funding currently distributed through states should be held at the national level and proposals submitted to obtain project funding. Annually or biennially, topically areas should be outlined and a request for proposals issued to cooperating universities and government scientists. The NSSC Research Committee should be the group that evaluates proposals and make selections. Funding could range for 2-4 years to support Masters or Doctoral students. A program to fund graduate student research through cooperative universities should be established to allow research studies to be conducted related to these pedons. The research could incorporate sampling of designated "important" pedons and additional related-pedons as needed for a particular study.

CONCLUSIONS

Any program for instituting long-term soil property changes needs to conform to the current realities of the National Cooperative Soil Survey. Long-term studies are best viewed as monitoring variability of properties over time rather than changes in specific directions. There is continued need to fund projects with designs that encompass a limited areal basis for on-going monitoring (e.g., soil climate project) or to define or document changes in soil properties based on land use.

Pedon characterization has been the focus of soil survey for many years. This dataset is important, widely-used, but incomplete. Future activities for monitoring by the NSSC should be related to evaluating members of this dataset and striving to make a complete, factual, uniform database of soil information for use by individual researchers, government agencies, and private industry.

Outstanding Research Project: Seasonal Saturation and Morphology Relationships

Larry T. West
Department of Crop & Soil Sciences
University of Georgia, Athens

Cooperators:

Donnie Bradshaw – International Paper
L.K. Kirkman and E.R. Blood – Jones Ecological Research Center
Peter Jacobs – Valdosta State University
Georgia Department of Human Resources
GA Soil Scientists

Soil Features and Seasonal Saturation
Taxonomic considerations

Aquic conditions

- Saturation
- Reduction (Fe)
- Redoximorphic features
- Duration of saturation not specified
    - 14-21 days of saturation for Fe reduction?

Oxyaquic subgroups
Saturated 20 consecutive days or 30 cumulative days w/in 100 cm

Soil Features and Seasonal Saturation

Interpretations for soil use

- On-site wastewater management
- Storm water infiltration
- Hydric soils
- Agriculture and silvaculture
- Others

Height of seasonal saturation interpreted as depth of redox depletions with chroma ≤2
Redox concentrations also form in response to seasonal saturation

"If we had water table data we could answer that question"
Statement from mid 1970's

Objective

Relate morphology to depth and duration of seasonal saturation

Methods

Transects of wells or piezometers

- Weekly (±) measurement of water table height
- 2-5 year monitoring period
- Rainfall measured on site
- No measurements of redox potential
    - Fe reduction assumed to require 21 days of saturation

Soil morphology

Soils:
Coastal Plain
Kandiudults (Paleudults) – Palequults
Atlantic Coast Flatwoods
Alorthods; Alaquods; Paleaquults; Paleudults
Piedmont
Kanhapludults (Hapludults)
Ridge and Valley
Paleudults; Hapludults

Saturation Time for Redox Features

Soils
Borderline Alaquods/Alorthods
Oxyaquic Alorthods
Arenic and Ultic Alaquods
Very low Fe content
Limited redox feature formation
Prediction of depth of seasonal saturation
Landscape position
Depth of spodic horizon
Color of albic horizon
Color of horizons underlying spodic horizon
Guess

Saturation Time for Spodosol Horizons

Summary

1. Redoximorphic features are valid indicators of seasonal saturation
2. Duration of saturation associated with various features can be determined with some success
3. Relict features exist

Questions

1. Should redox concentrations be included as indicators?
2. How far can the data be extended? County? MLRA? Region?
3. What are conditions that limit use? ---Decision must be based on consequences of malfunction and desires of public

NCSS Standards Standing Committee

Report to the NCSS Conference

Plymouth, Massachusetts
June, 2003
Report by Craig Ditzler, National Leader for Soil Classification and Standards.

Committee Charges:

1) Report on Regional Conference standards-related activities from last year.
   - West – Biological Crust Task Force
   - Northeast – Subaqueous Soils Committee
2) Review, test, and comment on proposals in ICOMANTH circular letter #4 involving horizon nomenclature and technical terms for human-modified soils.

Committee Members:

Co-Chairs: Craig Ditzler (NRCS), Tim Sullivan (BLM), and Duane Lammers (USFS).

Biological Crust subcommittee: Tom Reedy (NRCS), Pete Biggam (NPS), Janis Boettinger (USU), Arlene Tugel (NRCS), Bill Ypsilantis (BLM), Jayne Belnap (USGS).

Subaqueous Soil subcommittee: Marty Rabenhorst (UMD), Peter Veneman (UMass), Steve Park (NRCS), Wade Hurt (NRCS), Susan Casby-Horton (NRCS).

ICOMANTH circular letter testing subcommittee: Craig Ditzler (NRCS), Tim Sullivan (BLM), Bob Ahrens (NRCS), Bob Engel (NRCS), Richard Shaw (NRCS), Luis Hernandez (NRCS), Sam Brown (NRCS), Roy Vick (NRCS).

Committee Activity:

Biological Crusts Subcommittee. Biological crusts are a soil feature predominantly common in arid and semiarid environments. They are important to carrying out several ecological functions and are recognized as an indicator of rangeland health. The NCSS does not have protocols for describing biological soil crusts. A task force was established for the 2002 west region NCSS conference. They were charged to identify the needs of various agencies for this kind of information and to develop and test protocols for describing soil crusts in the field. Their report is recorded in the 2002 conference proceedings. The group has remained active. A report, presented by Tom Reedy, is included with these conference proceedings.

Subaqueous Soils Subcommittee. Research has documented genetic processes occurring in permanently submerged soils. Inventory of these soils as part of special projects in the northeast region has proven valuable to estuarine resource managers. However, there are many challenges involved in conducting this kind of work. A subcommittee was established for the 2002 northeast region NCSS conference. Their charges included developing a strategy for conducting field work, inventorying available resources to assist in this work, developing a glossary of terms, proposing changes to Soil Taxonomy, and compiling a list of needed interpretations. Their report is recorded in the 2002 conference proceedings. A report, summarizing these activities from the northeast region and presented by Marty Rabenhorst, is included with these conference proceedings. In addition, results from a poll of the State Soil Scientists to gauge their level of awareness about the concept of subaqueous soils and to see how much interest there is around the country in conducting these kind of inventories are presented.

<u>ICOMANTH Circular Letter Testing Subcommittee</u>. John Galbraith (VPI) is the new Chair for ICOMANTH (International Committee on Anthropogenic Soils). Circular letter #4 contains proposals for defining "Human Transported Material" (HTM), including criteria for identifying three varieties of HTM, "spolic", "dredgic", and "garbic" materials. Also included are proposals for two new master horizon symbols ("H" and "M"), as well as new textural modifiers ("puric", "urbic", and "garbic"). The subcommittee selected 28 official series descriptions representing an array of human-influenced soils including landfills, fill material (with and without human artifacts), land leveling, deep plowing, mine spoil, and dredged material. The circular letter proposals were tested on these descriptions and a report was presented to John Galbraith to aid in furthering the proposals. A copy of the subcommittee report is included with these proceedings.

Biological Soil Crust Subcommittee
Status Report
National Soil Survey Conference
Plymouth, Massachusetts
June 17, 2003
Submitted by Tom Reedy, Soil Scientist, National Soil Survey Center, NRCS, Lincoln, NE

The subcommittee on Biological Soil Crusts initially formed as a task force in response to a proposal from the West Regional Cooperative Soil Survey Conference, Coeur d'Alene, ID, 1998 and the rangeland health/soil quality indicator needs on rangelands:

> "Soil scientists need to include information about biological soil crusts (microbiotic soil crusts) when describing pedons on rangeland. The percent cover of biological soil crusts and relative amount of lichens, mosses and cyanobacteria need to be recorded for each pedon description. It would take a squirt bottle and five minutes to train employees and to have them perform this task in field, according to Jayne Belnap (Research Ecologist, USGS, Moab, UT). In turn, this pedon description information should be accessible to researchers so they can incorporate it into their studies. Include information about soil biological crusts in range site descriptions." –Bill Ypsilantis, BLM. Excerpted from West Regional Cooperative Soil Survey Conference Proceedings.

The task force, under the coordination of Arlene Tugel, currently comprises representatives from NPS, USGS, BLM, USFS, Utah State University, NRCS SQI and GLTI, the Phoenix and Denver MOs, and NRCS Utah and Colorado field soil scientists. The force met for the first time in May, 2002, in Moab, Utah, considered by experts to be biological soil crust Mecca. The purpose for the get together was to 1) receive training from Dr. Jayne Belnap, renowned research ecologist on biological soil crusts, USGS, 2) test methods for recording the composition of biological soil crusts and other surface features, 3) record the needs of each of the partners in attendance, and 4) present a report of recommendations to the Standards Committee at the 2002 West Regional Cooperative Soil Survey Conference, held in Telluride.

For your convenience, the CD version of these proceedings contains the Task Force Report to the West Regional Cooperative Soil Survey Conference. The CD contains a first draft of material intended for incorporation into the Soil Survey Manual, guidelines for recording soil surface features, a review of methods used to describe surface roughness, and examples of how a soil pedon with a biological soil crust could be described. We introduce the idea of recording soil surface features at two scales, that is at the pedon scale and at the component scale, and we present the notion of a hierarchical framework that differentiates features <u>at</u> the surface from the actual <u>shape</u> of the surface. So I encourage you to pour over the CD version of these proceedings to get an in-depth appreciation for the work this subcommittee has accomplished.

What are biological soil crusts and what are they good for?

I want to take a few minutes to introduce biological soil crusts, their ecosystem function, explain why they are important to our NCSS partners, and what this subcommittee has accomplished. Then I'll give Bill Ypsilantis and Pete Biggam an opportunity to chat about steps they are taking to get biological soil crusts integrated into their soil surveys.

Biological soil crusts are also known as cryptogams or microbiotic crusts. They formed by non-vascular living organisms and their by-products, creating a crust of soil particles bound together by organic material. They occur in all climates, but are a prominent feature in arid and semi-arid regions such as the Columbia Basin, Great Basin, Colorado Plateau, and Sonoran Desert. Prevalent in the surface few centimeters of soil, biological soil crusts are comprised of cyanobacteria, mosses, lichens, and microfungi. They function within ecosystems to 1) stabilize soil and protect it from erosion, 2) fix carbon and nitrogen for plant growth, and 3) provide sites for seed entrapment. The effect of biological crusts on infiltration varies with soil texture. Biological crusts are indicators of rangeland health and soil quality. Their presence and spatial distribution relative to higher plants are management-dependent, and can be used to infer disturbance effects on soil stability and erosion resistance. Presently, the National Cooperative Soil Survey (NCSS) does not record this soil-biotic component in soil surveys nor does it provide interpretations related to its functions. Thus, resource managers are unable to use soil surveys to spatially extend information about the likely occurrence and dynamic nature of biological crusts.

Needs identified by NCSS regarding biological soil crusts:

1. All public lands agencies must address biological soil crusts in National Environmental Policy Act (NEPA).
2. BLM needs a simplified field guide of factors related to biological crusts that should be included in NEPA documentation.
3. Where are biological soil crusts a management consideration and where not?
4. NPS must shift from managing visitors to managing resources. Need to identify biological soil crusts in the soil survey program.
5. NPS would use biological crusts in information and education programs on ecological significance of crusts across landscapes.
6. NPS would use crust information in biological inventory, possibly as vital signs or indicators for ecosystem processes.
7. USGS needs a database that links biological crust information to soil properties, site characteristics, and location.
8. USGS needs multi-agency support (money) for training and mapping. Because of limited resources and knowledgeable personnel, need to "train the trainers."
9. USFS Region 3 is currently making ocular estimates to document biological soil crusts composition in their Terrestrial Ecological Unit Inventories, and therefore recognize a need for a protocol to describe and record crusts in soil survey.
10. NRCS - Which regions or soils are crusts an important part of the system in terms of overall function? Do they function differently in different ecosystems?
11. NRCS - Must add biological soil crust information to site descriptions.
12. NRCS - What role do crusts play in each "state" (State and Transition Model).

13. NRCS - Consider biological crust as a possible threshold indicator: Where and when does it work?
14. NRCS - Biological crusts are used in Ecological Site Descriptions and the National Resources Inventory (NRI).

Findings of the West Regional Cooperative Soil Survey Standards Committee:
As to whether collecting information on biological soil crusts was a soil survey function, there was not unanimous agreement among the West Regional Standards Committee. The committee did make the following recommendations:

1. A standard protocol for identification and description of biological crusts should be proposed as a change to the Soil Survey Manual.
2. For the sake of efficiency in collecting data for compositional and functional analysis, those kinds of surface features commonly recorded during routine soil survey activities should be recorded at the same time. This common-sense idea evolved during the testing phase of various methods for transecting biological soil crusts and other surface cover features.
   In general, the NCSS appears to be collecting limited data related to soil properties at the soil–air interface. Except for percentage of various shapes and sizes of rock fragments, NASIS doesn't provide much in the way of options for recording other features at the soil surface, e.g. nothing for bare mineral soil material, organic soil material, plant litter, bedrock, pararock fragments, woody debris, fractions > 2mm, such as 2-5mm, 5-20. The biological soil crust subcommittee has developed a fairly complete table of kinds of surface features. After some additional refinements, we plan to distribute the surface feature table for a broader technical review.
3. The Soil Biological Crust Task Force should work closely with Soil Survey Classification and Standards staff to clarify terms and to incorporate soil crust methodology in the SSM.

Work in progress for 2003
The subcommittee is working on two high priority items in 2003 that were identified during the 2002 Moab meeting, that is
1) explore ways to describe surface roughness and
2) develop a protocol for describing biological soil crusts in pedon descriptions.

Surface roughness
The Soil Survey Manual offers little in the way of guidelines for determining surface roughness. This subcommittee conducted a literature review of some of the current methods. The cost and time constraints associated with high-end methods, such as laser microrelief and acoustical technology, preclude their application in standard soil surveys.

There is promise in exploring fractals to describe surface roughness. The Task Force has not pursued this. There is potential also in applying modern photogrammetric digital techniques to spatially analyze the shape of the surface at close-range. The subcommittee strongly recommends that the NCSS take the lead in developing these technologies.

The subcommittee was impressed with a method developed by Saleh. The theory is that a chain of given length (L1) will traverse a shorter horizontal length (L2) when it follows a rough surface compared to a smooth surface. The difference between L1 and L2 is related to the degree of roughness:

$Cr = (1 - L2/L1) \bullet 100$, where Cr is roughness in any direction.

The drawback to Saleh's method is that the ratio does not necessarily interpret variations in height (e.g. did the chain fall across one large bolder or two stones and a cobble?). Perhaps if Saleh's ratio is combined with a narrative description of surface morphology, then we will come a little closer to describing surface roughness.

An expedient technique for rapid field assessment and relative class placement of roughness would be to photograph areas of selected roughness conditions. A standardized set of photographs could be used to illustrate class limits of roughness; placement in the appropriate class (e.g. none, slight, moderate, and high) may be made directly from the photographs. Until better techniques become available, photos of the soil surface (both plan view and cross-section, with scale) could be archived.

Pedon descriptions

Biological soil crusts are in fact soil horizons, albeit in many cases less than 1 cm in thickness, the result of soil forming factors and processes acting upon and within the soil surface (figure 1). The following example separates the percent composition of features at the surface, such as biological soil crusts, rock fragments and surface roughness, from the A horizon description.

Pedon-scale surface features: Soil surface morphology is about 60 percent

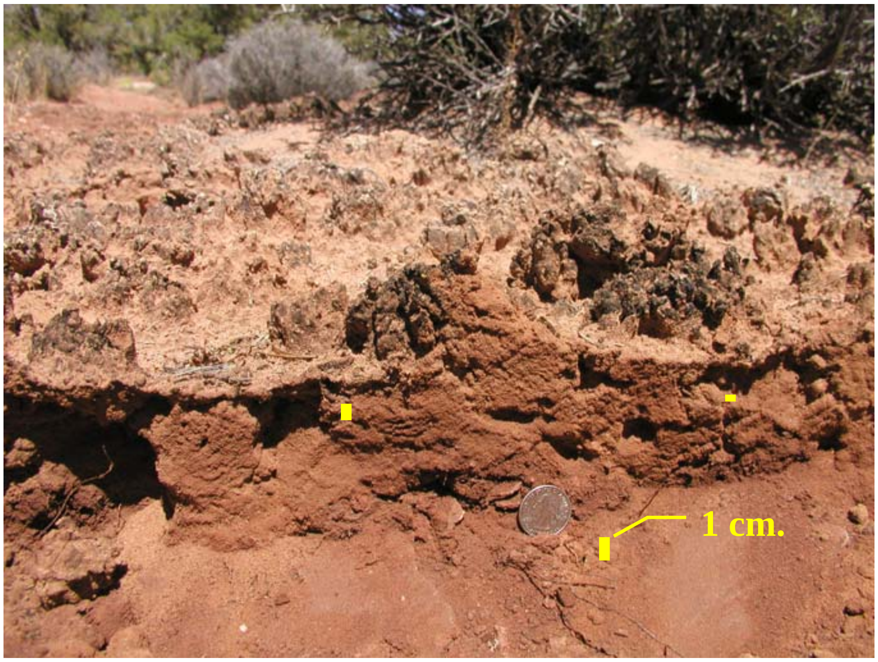


Figure 1 - Thickness of this biological soil crust horizon is about .3 to .8 cm. (Colorado Plateau, Moab, UT. May, 2002)

pinnacles, each pinnacle approximately 2 to 4 cm wide, 6 to 9 cm long, and 1 to 5 cm in height, spaced about 4 to 12 cm apart. Surface roughness index is 35 (1 - ratio of ground chain length to actual chain length). Surface features are 30 percent bare mineral soil (5YR 6/6 dry), 30 percent light cyanobacteria (5YR 6/6 dry), 10 percent dark cyanobacteria (color optional), 10 percent lichen (color optional), 5 percent moss (color optional), 10 percent plant bases, and 5 percent pebbles.

A--0 to .8 cm; light red (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak medium platy structure parting to single grain; soft, very friable; very fine roots and root-like structures; many medium interstitial pores; strongly effervescent; carbonates are disseminated; moderately alkaline (pH 8.2); very abrupt broken boundary (70 percent continuous) . (.3 to .8 cm thick).

Activities planned for 2004

The Task Force will continue to evaluate and refine the methods, procedures and examples discussed in this status report. Of primary interest is the applicability of methods in areas of the Sonoran, Mohave, and Chihuahuan Deserts. A field tour is being planned for the fall, 2003.

The surface features table will be further developed, tested, and distributed for review in 2004.

And now if Bill and Pete will share some of their thoughts of how they see biological crust being "institutionalized" with their program areas, I'll gladly step down and let them have the floor.

Current Developments among NCSS Cooperators

Pete Biggam, National Park Service: We are using the protocols initiated by the NCSS Biological Soil Crust taskforce on our ongoing soil resource inventory at Big Bend NP, and will continue to evaluate these on any future inventories.

There is a potential for their evaluation on our soil resource inventory which is currently in progress out at Channel Islands National Park, off the California coast.

Numerous units within the Colorado Plateau are currently "managing for crusts" as part of their "Visitor Experience, Resource Protection" (VERP) program. Arches NP has a well established program.

Here are a few Websites for your review;
http://data2.itc.nps.gov/nature/subnaturalfeatures.cfm?alphacode=arch&topic=11&loc=4
Zion NP General Management Plan addresses microbiotic soil;
http://www.nps.gov/zion/pr/zion_gmp.pdf
Site from Bryce Canyon NP;
http://www.nps.gov/brca/nacryptosoil.htm
Channel Islands NP Resource Management Plan addresses crusts;
http://www.nps.gov/chis/rm/PDF/NR%20STATUS.pdf

Bill Ypsilantis, Bureau of Land Management: The Bureau of Land Management (BLM) is very interested in having biological soil crusts described in conjunction with soil survey activities. Biological soil crusts play a vital ecological role on public rangeland and are an important indicator of rangeland health. Most soil surveys on public land are conducted through Interagency agreements with the Natural Resources Conservation Service (NRCS), though we do have one BLM Ecological Site Investigation team in eastern Oregon inventorying soils. BLM is actively working with the National Cooperative Soil Crust Task Group to develop standard inventory protocols for biological soil crusts. Until those protocols are approved, the Bureau is strongly encouraging soil survey project leaders to use one of the draft procedures identified in the Soil Crust Task Group report and recommendations to the 2002 Western Regional Cooperative Soil Survey Conference.

Subaqueous Soil Mapping

Martin Rabenhorst
University of Maryland

National Conference Committee Members

Marty Rabenhorst, University of Maryland (Chair); Peter Veneman, University of Massachusetts; Steve Park, NRCS, CO; Wade Hurt, NRCS, FL; Susan Casby-Horton, NRCS, TX.

NE Regional Conference Committee Members

Martin Rabenhorst, Chair; Phil King, Co-Chair; Steve Carlisle; Margie Faber; John Ladd; Conrad Neitsch; Laurie Osher; Phil Shoeneberger; Mark Stolt.

Developments in Subaqueous Soils

Subaqueous soils research over the last five years has led to the following developments:
1. Recognition of pedogenic processes leading to horizon differentiation in subaqueous soils
2. Modification to the definition of soils in ST 1999 to accommodate subaqueous soils.
3. Extension of the soil landscape paradigm into subaqueous settings.
4. Pilot projects for subaqueous soil survey.

Summary of the work of the NE Regional Conference Committee

Committee Charges:

1. Develop a general strategy or protocol for conducting subaqueous soil survey, which could serve as a guide in initiating subaqueous soil survey work
2. Develop a list of resources available for addressing the unique situations and problems
3. Compile a list of preferred terms and definitions for describing subaqueous soil landscapes and features
4. Consider possible proposed changes to Soil Taxonomy to accommodate subaqueous soils.
5. Compile a list of possible soil interpretations for subaqueous soils

Activity related to Charges 1 & 2

1. A draft document is being prepared, outlining a strategy/protocol for subaqueous soil survey. This is intended to be a resource for initiating subaqueous soil survey.
2. It was proposed that an informational meeting (1 day symposium) be organized to facilitate communication and collaboration with other federal, state and local agencies, to help give us an opportunity to explain the strengths and benefits of using a pedological approach to mapping subaqueous substrates. The original plan was to hold this meeting during the Winter of 2003. The current plan is to hold this meeting in Jan. or Feb. 2004, possibly at NOAA headquarters, Silver Spring, MD. The title of the meeting will be: “Habitat Assessment for

Management and Restoration of Estuarine Environments: Focus on Substrate"

3. It was proposed that a 1 week workshop be organized in the summer of 2003 in MD or DE, to provide an opportunity for soil scientists in the National Cooperative Soil Survey to gain experience in subaqueous soil survey. This workshop has been organized and is scheduled to run from July 14-18, 2003 in Georgetown and Rehoboth Bay Delaware. For more information visit http://www.agnr.umd.edu/sawgal/SubaqSoils/workshop/workshop.html

Activity related to Charge 3

Dr. Mark Stolt (URI) has written a draft glossary of soil geomorphological terms pertinent to subaqueous systems and landscapes that was circulated among the committee. Some feedback has been received from Phil King and Phil Schoeneberger, and revisions are underway. Efforts will be made to ensure that terms are as consistent as possible with terms in the Glossary of land forms and geologic materials (Part 629, National Soil Survey Handbook).

Activity related to Charge 4

A proposal was reviewed by the various regional Soil Taxonomy Committees to adopt the use of subaquic subgroups of various great groups of Aquents. A number of good questions were raised during the review process and several folks are in consultation with Craig Ditzler and others to address the questions raised. It appears that we might end up proposing changes to recognize subaqueous soils at the great group level, by introducing a great group of subaquents or hyperaquents.

Activity related to Charge 5

A list of potential interpretational needs is being prepared. It was suggested that preliminary interpretations could be developed for some of the current subaqueous soil survey areas, even if they need to be revised at a later date as additional research is conducted and as information is gathered.

Activity of the Current Committee

A short questionnaire was sent out to all state soil scientists in an attempt to surmise the state of general awareness and attitudes toward subaqueous soils.

Sixteen responses were received from the following states/agencies (AR, BLM, CO, IA, IN, LA, ND, NE, NY, OK, OR, Pacific Basin Area, TX, VA, WY).

The questions asked were:

1. *How would you describe your familiarity or comfort level with the concepts of subaqueous soils?*
2. *Do you have significant areas of shallow water (< 10 ft deep) ecosystems in your state?*
3. *Do you have any immediate or longer term plans for implementing an inventory of the subaqueous soils?*
4. *What do you see as the major benefits of subaqueous soil survey in your state?*
5. *What do you see as the major problems associated with conducting subaqueous soil survey in your state?*

Summary of Responses to the Questionnaire

Respondents to the survey generally fell into three categories.

The first group included folks who generally met these characteristics:

a) were relatively familiar with the concepts of subaqueous soils,
b) were located in areas which probably had fairly extensive areas of subaqueous soils in shallow water environments,
c) recognized the ecological and environmental importance of the areas and thus affirmed the importance of mapping subaqueous soils and
d) either had already begun to undertake, or were seriously considering, subaqueous soil mapping in their state.

A second group, while far less familiar with subaqueous soils than the first group, were also open, and were generally interested in and supportive of subaqueous soil mapping.

The third group

a) were relatively unfamiliar with the concepts of subaqueous soils,
b) were located in areas which probably had negligible areas of subaqueous soils,
c) saw little or no value in the mapping of subaqueous soils and therefore,
d) had no plans to map subaqueous soils in their state.

Those individuals who were familiar with subaqueous soil survey and who were located in states/regions with extensive areas of subaqueous soils, generally recognized numerous potential benefits of mapping these soils. These benefits were related to such issues as: water quality,
shellfish habitat, submersed aquatic vegetation (SAV). In some states numerous state, federal and other agencies were already utilizing bathymetric maps and SAV maps in an attempt to manage shallow water ecosystems and resources.

The respondents also perceived difficulties in conducting subaqueous soil survey. These fell into two groupings of what might be described as 1) Broad or Philosophical Questions/Difficulties, and 2) Technical Difficulties.

Philosophical Difficulties

1. Applying soil-landscape models in under water settings is a new technique and is not widely accepted outside of the Soil Science community. Many of those who normally work in these settings (engineers, geologists, limnologists, etc.) probably do not have a high level of comfort with this approach relative to the techniques that they traditionally employ.
2. Even within the soil science community we must continue to emphasize that soil-landscape relationships exist in shallow water environments. We must overcome the bias (even within our agencies) that mapping subaqueous soils is outside of our responsibility.
3. What is the priority for subaqueous soil survey in relation to other soil mapping efforts. Should subaqueous soils be considered part of initial mapping or update

soil mapping?

4. How will funding be provided and is there political support for this effort?

Technical Difficulties

1. Accessibility to observe and sample sub-aqueous soils.
2. Lack of official/accepted terminology to adequately describe these soils and landscapes.
3. Inability to generate interpretations utilizing current databases.
4. Additional costs due to specialized equipment needed
5. Lack of training in the techniques/Lack of a "Methods Manual"
6. Need for better recognition in Soil Taxonomy
7. In certain inland locations (such as the prairie pothole region), how should the cyclic or irregular nature of the depth (and extent) of water due to variations be handled?

Addressing the Difficulties

1. Most of the technical difficulties presently are in the process of being addressed. Others will be addressed in the near future.
2. The broader issues are also being addressed through meetings, conferences (such as this one), technical presentations at scientific meetings and informally in discussions at the regional and state level.
3. Progress has been made, but there is more work to be done.

Summary

1. Shallow water/estuarine areas are critical ecological systems, and soils are a fundamental component of those systems and must be considered by managers.
2. There are numerous difficulties associated with conducting subaqueous soil surveys.
3. Most of the technical difficulties are being addressed, although it is likely to always be more challenging than traditional soil survey.
4. Because the need is real, we must find a way to address the broader structural/political issues so that we can provide the kind of information needed by users (managers, planners and policy makers.)

ICOMANTH Circular Letter No. 4-- Review and Testing

National Cooperative Soil Survey
Standing Committee on Standards
John Galbraith, Virginia Tech, Blacksburg, VA
June, 2003

Introduction: As part of the activities of the NCSS Standing Committee on Soil Survey Standards, a subcommittee to test proposals presented in ICOMANTH Circular Letter #4 was established. Members of the subcommittee were Craig Ditzler, Bob Ahrens, Bob Engel, Sam Brown, Luis Hernandez, Richard Shaw, and Tim Sullivan.

The ICOMANTH proposal includes new master horizon nomenclature (H and M), a definition for "Human Transported Material" (HTM), criteria for 3 types of HTM (garbic, spolic and dredgic), and new texture modifiers ("puric", "garbic", and "urbic"). To test the proposal we applied it to 28 Official Series Descriptions (OSD's) representing an array of soils including sanitary landfills, dredge materials, deep plowing, land leveling, urban fill material, and mine soils.

Findings and Discussion:

1) Master Horizons "H" and "M"

It is not clear whether these are to be viewed as traditional "Master Horizons" or as a sort of "prefix" to be used in combination with the traditional master horizon designations O, A, E, B, or C. The discussion on p. 9 of the circular letter refers to them both ways. The examples shown on p. 9 seem to portray H as a prefix to be used in front of master horizons in the form of HA, HB, and HC to denote a specific type of parent material (human transported material). This implies that unlike other master horizon designations, H is not used alone. The intent, (master horizon or prefix), needs to be clarified.

Our current use of capital letter designations is to denote master horizons. Master horizons A, E, and B reflect general pedogenic processes. C and R reflect minimal pedogenic process as well as degree of consolidation. O, L (relatively new for limnic materials), and W reflect a type of material. Most commonly there is just one capital letter designation used for a horizon. Current provisions for using multiple designations allow for the recognition of horizons that are dominantly like one form of master horizon, but which have subordinate properties of another. Two types, transitional (e.g. EB,) or combination (e.g. B/E) horizons are recognized.

Given our traditional approach to designation of master horizons, "H" would be considered a master horizon (not a prefix) used to denote human transported material. In many instances it would simply be "H" or maybe include a subscript such as "Hd". Over time, it may become darkened with organic matter (HA), or develop weak structure and color (HBw). Under this concept, the combination HC may not be logical because human transported material would not be expected to transition to C. The combination HO (see the Bulkhead OSD) also seems problematic if we apply normal conventions for

combination horizon designations. A reasonable question will be: "Given enough time for pedogenic processes to act, won't a horizon composed of human transported material become just "A" or "Bw"? Or do we say "once H always H"?
If it is the intent to only use "H" in combination with other master horizons as a type of prefix, we possibly should explore the alternative of using a subscript (u?) to denote movement and deposition by humans. This could result in a sequence such as Au – CBu - Cdu.

In the examples provided in the circular letter for profile 6 (pg. 9), master symbol "M" is used in combination with "H", implying a sort of transition. For layer 4 in the example (concrete) the notation is "HMm". The use of both upper and lower case 'm' seems redundant. This raises the question, "Do we need a master horizon "M"? Would it suffice to label consolidated man-made layers such as concrete and asphalt as "Hm"?

2) Difficulties in Identifying Human Transported Material (HTM).

a. Garbic, Spolic, and Dredgic Criteria

The concept presented in the circular letter is that HTM is any material intentionally moved by humans from a source outside of the pedon itself. Vertical mixing in place is excluded. Three types of materials are considered, Garbic, Spolic, and Dredgic. Of the three, garbic material is uniquely defined because it requires $\geq$ 35% "garbic artifacts" (defined in the circular). It is mutually exclusive of spolic and dredgic materials because they must have <35% garbic materials. (Note that spolic and dredgic materials do not require the presence of any artifacts). In addition to having more than 35% garbic-type artifacts, garbic materials must have one or more of 15 other listed criteria.

Spolic and dredgic materials have definitions that are not mutually exclusive. No unique property is required for either type. They simply must have at least 2 of 16 possible properties listed for spolic or 2 of 12 possible properties listed for dredgic. The 12 listed for dredgic are also included in the 16 for spolic. As a result, many materials qualify for both based on their properties and unless you know the origin of the material you can not necessarily tell which it is.

Garbic materials seem to be the most useful of the 3 proposed "materials". More discussion needs to take place to determine if we have a practical need for both spolic and dredgic materials. Maybe we don't need to formally define either one. One reviewer noted that no definition is provided for "urbic materials" and it is not clear if this was intentional or an omission. Collectively, we experienced some difficulty with the proposed new terms because they appear from 1 to 3 times in various parts of the proposal with slightly different meanings or intended uses. The following table summarizes them. It may be helpful to summarize these again in the next circular letter in a way that clarifies these relationships and intended uses.

Term	Artifact Type	Artifact subtype	Material Kind	Texture Modifier
Garbic	X		X	X
Urbic	X			X
Spolic			X	
Dredgic			X	
Puric				X
Noxious		X		
innocuous		X		

One significant problem is that, as defined, soil materials that are not HTM could meet the criteria of "2 or more" of the listed properties. For example, a colluvial deposit resulting from a landslide might have:

- Freshly fractured rock fragments with splintered or sharp edges; or
- Bridging voids between rock fragments; or
- Randomly oriented rock fragments; or
- Random magnetic orientation within the soil matrix of a single horizon or layer; or
- Irregular distribution of organic carbon not associated with depositional vertical stratification, leaching or podzolization; or
- Dark colored (value and chroma 3 or less), high carbon rock fragments such as coal or carbonaceous shale;

Or consider a pedon in a plowed field where erosion has allowed the plow to mix clayey B material into a loamy plow layer (possibly meeting "*Masses of contrasting parent materials in the same horizon or layer that have differences in texture*"); that has formed a tillage pan (meeting the criteria for *A layer of anthropogenically-compacted densic materials*); and with a few bricks and broken bottles from an old homesite mixed in (qualifying for *artifacts*). This too could be misidentified as HGM based on the listed criteria.

So the definitive identification of HTM seems to require not only documentation of it's properties, but some ability to identify human intent, as a cause of deposition as well as origination from outside the current pedon. In some cases this may be fairly obvious, but in others it may not be. If the presence of human artifacts were required this would lessen the possibility of natural deposits being identified as HTM. But of course this would also eliminate many deposits of "clean fill" from the concept.

b. Recognizing Individual Layers as HTM.

The experience from our testing of the circular letter proposals with existing Official Series Descriptions revealed a progression from easily identified HTM on one end of a continuum of human-influenced soils to more difficult identification and lack of agreement on the other end of the continuum.

Fill with artifacts throughout	Clean fill over Fill with artifacts	Clean Fill over Buried Natural Soil	Clean Fill (Deep)

Increasing Difficulty (decreasing agreement)

Here are some examples based on a few of the OSD's tested: (New nomenclature and textural modifiers shown in bold).

Laguardia Series – This soil is formed in thick deposits (entire 2 meter profile) of fill material with human artifacts throughout. This soil is easily identified as HTM by considering the evidence in the individual horizons themselves.

HA-- 0 to 8 inches; brown (10YR 4/3) **urbic** sandy loam, (10YR 6/3) dry; weak very fine subangular blocky structure; friable; few very fine and medium roots; 15 percent brick and concrete fragments, 5 percent asphalt, and 5 percent glass gravel sized fragments, and 5 percent cobble-sized rock fragments; neutral; gradual wavy boundary. (2 to 12 inches thick.)
HB-- 8 to 26 inches; brown (10YR 4/3) **very urbic** coarse sandy loam; weak very fine subangular blocky structure; friable; few very fine roots; 25 percent brick and concrete, 5 percent asphalt, 5 percent metal, and 5 percent plastic gravel sized fragments and 5 percent cobble-sized rock fragments; neutral; gradual wavy boundary. (1 to 20 inches thick.)
Hd-- 26 to 79 inches; brown (10YR 4/3) **very urbic** coarse sandy loam; compaction related plate-like divisions; very friable; few very fine roots; 25 percent brick and concrete, 10 percent asphalt, 5 percent glass, 5 percent metal, and 5 percent plastic gravel sized fragments and 7 percent cobble sized rock fragments; neutral.

Greatkills Series – This soil is a landfill. Note that because of the "clean" nature of the cap, no human artifacts are described in the upper 2 horizons. Unlike the Laguardia soil, the 2 uppermost horizons do not have obvious morphology to indicate HTM. In soils like these, the evidence of human influence must be inferred from the relation to the material below.

HA-- 0 to 2 inches; dark brown (7.5YR 3/2) **puric** coarse sandy loam; weak medium granular structure; very friable; many very fine and fine plus common medium and coarse roots; common coarse 3/4 inch thick, hollow Phragmites rhizomes; 10 percent gravel rock fragments; neutral; abrupt smooth boundary. (1 to 7 inches thick)
HBw-- 2 to 7 inches; dark reddish brown (5YR 3/4) **puric**, gravelly coarse sandy loam; weak medium subangular blocky and platy structure; friable; common fine roots; common coarse rhizomes; 20 percent gravel rock fragments; neutral; clear wavy boundary. (3 to 8 inches thick)
Hd-- 7 to 12 inches; dark reddish brown (5YR 3/4) **slightly urbic**, gravelly coarse sandy loam; weak medium platy structure; firm; few very fine roots; common coarse rhizomes;

20 percent gravel rock fragments; 5 percent pieces of broken glass bottles; neutral; clear wavy boundary. (3 to 8 inches thick)
2H-- 12 to 80 inches; dark brown (7.5YR 4/4) **extremely urbic** loam; massive; friable; few medium and coarse roots; few coarse rhizomes to a depth of 60 inches; 5 percent cobble rock fragments; 15 percent decomposable cobble-sized coarse fragments such as wood, iron, cardboard, and paper; 40 percent non-decomposable cobble-sized coarse fragments such as bricks, concrete, rugs, plastic bags, glass bottles, plastic toys and objects, and rubber pipes; few stone-sized coarse fragments of concrete and tires; neutral; clear smooth boundary.

Bagger Series – This soil is forming in locally derived fill (due to land leveling) with a buried soil below. Here it is more difficult to discern that this is fill material from evidence in the pedon alone. The buried soil provides a good clue, but with no human artifacts present, you need to consider additional clues outside of the soil itself (like local land leveling practices) to infer the nature of the upper mantle as human transported.

H1--0 to 9 inches; mixed pale brown and yellowish brown (10YR 6/3, 5/4) sandy loam, dark yellowish brown (10YR 4/4) moist; massive; hard, friable, slightly sticky and slightly plastic; common very fine, fine and medium roots; many very fine and fine interstitial pores; about 10 percent by volume 2 to 35 mm hardpan fragments which can be broken by hand; hardpan fragments have same color as soil matrix; neutral (pH 7.2); gradual smooth boundary. (4 to 12 inches thick)
H2--9 to 16 inches; mixed light gray, white and brown (2.5Y 7/2, 8/2; 7.5Y 5/4) light sandy clay loam, grayish brown and brown (2.5Y 5/2; 7.5YR 4/4) moist; massive; hard, friable, sticky and slightly plastic; few very fine roots; common very fine and fine interstitial pores; common thin silica colloids bridging sand grains; about 10 percent by volume 2 to 35 mm hardpan fragments which can be broken by hand; hardpan fragments have same color as matrix; fragments of Bt (argillic) dark brown (7.5YR 4/4) moist clay and clay loam; about 5 percent by volume black (N 4/) Fe-Mn soft concretion ranging up to 5 mm in diameter; slightly calcareous with lime segregated in few fine filaments, moderately alkaline (pH 8.0); clear wavy boundary. (0 to 20 inches thick)
H3--16 to 30 inches; mixed pale brown and brown (10YR 6/3, 7.5YR 5/4) loamy sand and sandy loam, dark brown (10YR 4/3, 7.5YR 4/4) moist; massive; hard, friable, nonsticky and slightly sticky and nonplastic and slightly plastic; few very fine roots; common very fine interstitial pores; about 3 percent by volume Bt (argillic) fragments having many very fine tubular pores and common thin clay films lining the tubular pores and common thin silica colloids bridging sand grains; in small pockets 20 percent by volume 2 to 5 mm gravels encased by loamy sand fill; about 25 percent by volume 5 to 35 mm hardpan fragments within small pockets in the lower 2/3 of the horizon having the same color as the horizon matrix; few black (N 2/) 2 to 5 mm Fe-Mn flakes; mildly alkaline (pH 7.5); abrupt smooth boundary. (0 to 20 inches thick)
2Ab--30 to 35 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; common fine distinct yellowish red (5YR 5/6) mottles, dark reddish brown (5YR 3/4) moist; massive; hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular and interstitial pores; 1/4 inch organic residue at top

of horizon, few black (N 2/) 1 to 5 mm Fe-Mn concretions; medium acid (pH 6.0); gradual wavy boundary. (0 to 10 inches thick)
2C—)35 to 49 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine, fine and medium tubular and common very fine and fine interstitial pores; few black (N 2/) 1 to 5 mm Fe-Mn concretions; mildly alkaline (pH 7.5); clear wavy boundary. (0 to 20 inches thick)
2Cq--49 to 60 inches; light yellowish brown (10YR 6/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; massive; very hard, firm, slightly sticky and slightly plastic; no roots; few very fine interstitial pores; weakly cemented with silica; moderately alkaline (pH 8.0)

Quonal Series - This non-HTM soil illustrates the difficulty of inferring HTM in the absence of artifacts. This soil has been deeply plowed to break up a duripan, but has little lateral movement of soil material and so it does not qualify as HTM as defined in the circular letter. (one reviewer felt this should qualify as HTM, the others did not).

Ap1--0 to 7 inches; grayish brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) moist; weak fine, medium and coarse subangular blocky structure; very hard, friable, sticky and plastic; few very fine roots; common very fine and fine tubular pores; strongly effervescent, carbonates are disseminated; electrical conductivity is 0.5 decisiemens per meter; sodium adsorption ratio is 2; moderately alkaline (pH 8.3); gradual smooth boundary.
Ap2--7 to 9 inches; brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; massive; extremely hard, firm, sticky and plastic; few very fine and fine roots; few very fine and fine tubular pores; few thin clay films in pores of displaced fragments of a natric horizon; strongly effervescent, carbonates are disseminated; electrical conductivity is 3.1 decisiemens per meter; sodium adsorption ratio is 6; very strongly alkaline (pH 9.3); gradual smooth boundary.
Ap3--9 to 16 inches; brown (10YR 5/3) clay, dark brown (10YR 3/3) moist; massive; extremely hard, firm, sticky and plastic; few fine and very fine roots; common fine and very fine tubular pores; few thin clay films in pores of displaced fragments of a natric horizon; strongly effervescent, carbonates are disseminated; electrical conductivity is 4.1 decisiemens per meter; sodium adsorption ratio is 12; common fine and medium faint very dark grayish brown (10YR 3/2) moist, relict redox depletions; very strongly alkaline (pH 9.2); gradual smooth boundary.
Ap4--16 to 20 inches; light yellowish brown (10YR 6/4) clay, dark yellowish brown (10YR 4/4) moist; massive; extremely hard, firm, sticky and plastic; few thin clay films on displaced fragments of a natric horizon; strongly effervescent, carbonates are disseminated; electrical conductivity is 7.5 decisiemens per meter; sodium adsorption ratio is 27; very strongly alkaline (pH 9.2); gradual smooth boundary.
Ap5--20 to 32 inches; yellowish brown (10YR 5/4) silty clay, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; extremely hard, firm, sticky and plastic; few very fine roots; common very fine tubular pores; common thin and moderately thick clay films coating faces of and in pores of displaced fragments of a natric horizon; strongly effervescent, carbonates are disseminated; electrical

conductivity is 5.9 decisiemens per meter; sodium adsorption ratio is 35; common medium faint dark brown (10YR 3/3) relict redox depletions; very strongly alkaline (pH 9.7); clear wavy boundary.

Ap6--32 to 41 inches; yellowish brown (10YR 5/4) silty clay, dark yellowish brown (10YR 4/4) moist; strong fine and medium angular blocky structure; extremely hard, firm, sticky and plastic; common very fine tubular pores; few thin clay films in pores of displaced fragments of a natric horizon; 15 percent very fine and fine subangular blocky duripan fragments that are extremely hard and extremely firm; violently effervescent, carbonates are disseminated and segregated as many moderately thick coats on faces of peds and as many fine and medium filaments; electrical conductivity is 7.4 decisiemens per meter; sodium adsorption ratio is 50; very strongly alkaline (pH 9.9); abrupt wavy boundary. (The combined thickness of the Ap horizons is 40 to 60 inches).

2Bkqmb--41 to 44 inches; light yellowish brown (10YR 6/4) strongly silica and lime cemented duripan with 50 percent discontinuous 1/8 inch thick laminar cap, and with fractures 4 to 8 inches apart, dark yellowish brown (10YR 4/4) moist; massive; extremely hard, slightly rigid; strongly effervescent, carbonates are disseminated and segregated as many fine and medium threads and many moderately thick coats in fractures; brittle when wet; clear wavy boundary. (2 to 20 inches thick).

2Bkb1--44 to 50 inches; light yellowish brown (10YR 6/4) clay loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine tubular pores; violently effervescent, carbonates are disseminated and segregated as many fine and medium filaments and as many moderately thick coats on faces of peds; electrical conductivity is 0.9 decisiemens per meter; sodium adsorption ratio is 4; moderately alkaline (pH 8.3); gradual wavy boundary. (0 to 16 inches thick).

2Bkb2--50 to 62 inches; light yellowish brown (10YR 6/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; medium fine angular blocky structure; hard, friable, slightly sticky, slightly plastic; few very fine tubular pores; few thin and moderately thick clay films lining pores and on ped faces; strongly effervescent, carbonates are disseminated and segregated as few thin filaments and many moderately thick coats on faces of peds; electrical conductivity is 0.8 decisiemens per meter; sodium adsorption ratio is 2; moderately alkaline (pH 8.0).

Distinguishing the morphology of a non-transported but deeply plowed soil such as Quonal from a soil formed in thick HTM without artifacts (such as a mined soil like Blocker, Schuline, or Ironbridge, not included here) will encourage recording soil descriptions more detailed than the current OSD's.

<u>3) Proposed Textural Modifiers</u>.

The definition for puric simply requires < 2% artifacts. The definition includes zero, so it does not actually require that any artifacts be present. The intent for the term puric seems to be to recognize a clean fill. The intent is good, but using this modifier when <u>**no**</u> artifacts are present seems questionable and unnecessary. If we describe the horizon as "H", and it is just "sandy loam", then the fill will be understood to be clean. Consideration should be given to requiring that at least small amounts of artifacts be present before a modifier is used. Maybe it would be just as well to drop the "puric" class and just use the texture alone for materials with few or no artifacts. Why should an aeolian sand on a dune be called "sand" but if it is hauled 10 miles and dumped in a low area or simply moved 100 feet during leveling and smoothing, it becomes "puric sand"? This should be debated more fully.

There will need to be further discussion and clarification of the relationship between textural modifiers for human artifacts and those traditionally used for rock fragments. It is the intent of the circular letter proposal that these be treated as separate categories of items and they are **not** to be combined when assigning modifier terms. As a result, a sandy loam horizon with 10% artifacts in the form of brick, glass, paper, and concrete fragments along with 30% granitic gravel is to be called "slightly urbic, gravelly, sandy loam." This is a reasonable approach.

As we look ahead however, we will likely want to be sure we are capturing information about artifacts in a way that will allow us to integrate the information for possible family taxonomic placement. Distinctions like "noxious" and "recalcitrant" seem to have possible application to potential mineralogy families. In addition, some of the urbic artifacts may have application for particle-size classes (i.e. skeletal). We likely will still need additional detail however if we anticipate a need to be able to aggregate rock (or pararock) fragments and urbic artifacts. It appears that a plastic bag, a rubber tire, a piece of styrofoam, and a brick all fall under "urbic", but these may not all be appropriate to consider as being like "rock fragments".

A related situation is how we describe "texture" for landfill materials that have little or no fine earth. For example, the Latrass series, from 42 – 80 inches, is described as "general refuse of trash, garbage, rocks, and/or concrete." Maybe a new term in lieu of texture would be appropriate such as "garbic material" with a description of the kinds and amounts of various materials observed. However, it is interesting to note that as described in the Greatkills series, the 12 – 80 inch layer of this landfill soil apparently will not qualify as garbic material because only 15% is "decomposable". This (NY) soil is documented as having a hyperthermic temperature regime due to high biological activity and seems to be what is intended for "Garbic". We may need to revisit the 35% requirement for garbic materials.

4) Lithologic Discontinuities and Buried Genetic Horizons

The circular letter suggests that once "H" horizons are noted, number prefixes for lithologic discontinuities and lower case "b" for buried genetic horizons are not needed. This should be considered further. There are cases where it is helpful to include one or both of these notations. For example, consider the Matlatcha series (copied below). The "2" emphasizes that the particle-size is significantly different below the fill layer, and the 'b' emphasizes that genetic formation of the A and E is believed to have occurred before burial. While not essential to understanding the soil, these notations seem useful.

H--0 to 35 inches; mixed black (10YR 2/1), dark brown (10YR3/3), light brownish gray (10YR 6/2), very dark gray (10YR 3/1), and very pale brown (10YR 7/3) gravelly fine sand with discontinuous olive brown (2.5Y 4/4) and grayish brown (2.5Y 5/2) loamy textured lenses; massive; friable; about 25 percent shell and limestone fragments less than 3 inches in diameter; moderately alkaline; abrupt wavy boundary. (20 to 48 inches thick)
2Ab--35 to 40 inches; dark gray (10YR 4/1) fine sand; weak fine granular structure; very friable; slightly acid; clear smooth boundary. (4 to 8 inches thick)
2Eb--40 to 80 inches; light gray (10YR 7/1) fine sand; common medium distinct dark grayish brown (10YR 4/2) stains along old root channels; single grained; loose; slightly acid.

Summary of Recommendations

1) Master horizons
   - Affirm that we should follow the same conventions for using letters alone or in combination as we would for other "traditional" master horizons.
   - Consider whether we need "M" or would Hm suffice?
   - For the next circular, draft wording for a proposed definition of "H" (and M if really needed) to be included in the Keys to Soil Taxonomy alongside the other master horizon definitions. (alternatively, consider the use of subscript 'u').
2) Garbic, Spolic, and Dredgic Materials definitions need further work.
   - Greatkills series should meet the garbic materials definition, but currently does not.
   - Spolic and dredgic are not mutually exclusive . Do we really need them?
   - Some natural soil materials seem to be able to meet requirement for at least 2 of listed criteria.
3) Textural modifiers – defining puric to include an absence of artifacts may not be desirable.
   - Consider either requiring that some artifacts be present before puric is used, or drop it altogether and just use the texture alone.
4) Artifact types and terms.
   - For the next circular it would be useful to present all of the proposed new terms in a way that easily shows their relation to each other and intended use. This would facilitate further debate and discussion.
   - Explore refinements to the concept of "urbic" artifacts so that their relationship to rock and pararock fragments will be clearer.
   - Artifacts have potential use in mineralogy and particle-size family classes, so we need to be sure the descriptive terms can help to facilitate that eventually.

International Committee for the Classification of Anthropogenic Soils (ICOMANTH) Circular Letter No. 4 released January 31, 2003

By: Galbraith*, J.M., D. Fanning, and J. Sencindiver
Responses due July 1, 2003

This is the fourth circular letter of the International Committee on Anthropogenic Soils (ICOMANTH) following Circular Letter #3 issued Jan. 15, 1998. The purposes of this letter are to distribute Version 1.0 of the Anthropogenic Soils CD-ROM in Part 1, announce rejuvenation of committee activities in part 2, propose additions and changes to Soil Taxonomy in Part 3, answer commonly-asked questions in Part 4, and solicit reader feedback in Part 5.

Anthropogenic soils are defined here as those soils that form in anthropogenic materials or have major properties and behavior that have been significantly altered by human activities and tools. The committee is open to all who wish to become involved. The new permanent web site for ICOMANTH at http://clic.cses.vt.edu/icomanth/ contains committee registration information along with committee charges and vision statement. All previous circular letters and responses are found in Chapters 3 and 4 of the AS_Articles folder on Version 1.0 of the Anthropogenic Soils CD-ROM. The committee operates cooperatively through the chairman and the USDA-NRCS Soil Survey Division and the National Soil Survey Center (NSSC) in Lincoln, Nebraska, USA. ICOMANTH began in 1995 under the direction of Dr. Ray B. Bryant of Cornell University, Ithaca, New York, USA. In July 2002 Dr. John M. Galbraith from Virginia Polytechnic Institute and State University (also known as Virginia Tech) in Blacksburg, Virginia, USA assumed leadership after former chairman Dr. Ray B. Bryant accepted a new job as Research Leader at the USDA-ARS Pasture Systems and Watershed Management Research Unit in University Park, Pennsylvania, USA.

Part 1. Version 1.0 of the Anthropogenic Soils CD-ROM

The USDA-NRCS Soil Survey Division and the National Soil Survey Center (NSSC) has actively pursued the collection of data for Anthropogenic Soils since the early 1970s when Horace Smith published his soil survey for Washington D.C. Twenty years later, the Soil Survey of LaTourette Park on Staten Island, New York was published. Both of these surveys collected profile descriptions, characterization analyses, and urban inventory data for anthropogenic soils.

The data and information on CD-ROM Version 1.0 represent a compilation of published materials and data from the Internet and from USDA-NRCS archives concerning anthropogenic soils from around the world. These soil profiles can be used to propose new horizon nomenclature, terms for describing anthropogenic soil properties, and to document and describe human-influenced features for these soils. The authors and their referenced works are cited. Material for future versions is invited and should be submitted to the USDA-NRCS staff through the contact on the permanent web site for ICOMANTH at http://clic.cses.vt.edu/icomanth/.

* Contact Information is found on the web site at http://clic.cses.vt.edu/icomanth and below:

USDA-NRCS-NSSC Attn: ICOMANTH
Federal Building, Room 152 - Mail Stop 35
100 Centennial Mall North
Lincoln, NE 68508-3866
Telephone: 402-437-4002
fax: 402-437-5336
e-mail: margaret.hitz@nssc.nrcs.usda.gov

John M. Galbraith, ICOMANTH Chair
Virginia Polytechnic Institute and State Univ.
239 Smyth Hall (0404)
Blacksburg, Virginia, USA 24061
Telephone: 540-231-9784
fax: 540-231-7630
e-mail: ttcf@vt.edu

Part 2. ICOMANTH Plan of Action

ICOMANTH has a current plan of action (Table 1, updated September 4, 2002). ICOMANTH will develop a collection of soil descriptions representing an array of anthropogenic soil morphologies and publish that information. The committee will work closely with the USDA-NRCS Soil Classification and Standards Staff, and the Urban Soils and Interpretations Program to insure that proposed classes are useful for mapping and interpretation of soil surveys and fit into established plans and operating procedures, but ICOMANTH will not lead the development of the interpretations themselves. Definitions of materials and new horizon designations will allow urban soil surveys the tools they need to set up new series and speed correlation of surveys in progress.

The committee will continue in existence until at least the 2006 IUSS meeting in Philadelphia, PA, USA. Two short field tours will be used for testing of the additions to Soil Taxonomy and for collection of opinion of the attendees. Further revisions will then be proposed if needed. Publication of field tour data, meeting symposia (if held), and related talks and posters will take place through NRCS, the International Union of Soil Scientists, or the Soil Science Society of America. ICOMANTH will then dissolve at a point where enough additions to Soil Taxonomy have been made to allow for preliminary use for mapping and correlation of series in urban and other human altered landscapes. Further revisions to Soil Taxonomy and the National Soil Survey Handbook and the Soil Survey Manual will continue to take place through normal channels and standard operating procedures.

Table 1. ICOMANTH plan of action 2002-2007.

#	Item	Date
1.	Compile existing pedon data, pictures, and classification systems of Anthropogenic soils on CD-ROM for distribution.	September 2002
2.	Send out 4th circular letter	January 2003
3.	Publish CD-ROM with data collected Ver. 1.0 (available through the web site)	January 2003
4.	Begin to plan for a tour in conjunction with the 2006 International Union of Soil Scientists meetings in Philadelphia, PA USA.	Summer 2004
5.	Host a special topics section at the Annual American Society of Agronomy Meeting in Denver, Colorado, USA entitled "Interpretation and Management of Anthropogenic Soils."	Fall 2004
6.	Publish CD-ROM with data collected Ver. 2.0 (available through the web site)	Summer 2005
7.	Send out 5th circular letter for comments about proposed changes	Summer 2005
8.	Attend and assist with tours of Anthropogenic soils in conjunction with the 2006 International Union of Soil Scientists meetings	Summer 2006
9.	Symposium or workshop at IUSS meeting in Philadelphia, PA USA.	Summer 2006
10.	Publish CD-ROM with data collected Ver. 3.0 (available through the web site)	Summer 2007
11.	Send out 6th circular letter for additional proposed changes	Fall 2006
12.	Submit proposed changes to Soil Taxonomy	January 2007

Part 3. Proposal for Definitions and Horizon Designations

The following definitions and horizon designations are presented for comment until July 1, 2003. Please use the information and data on the Anthropogenic Soils CD-ROM Version 1.0 to supplement acquired knowledge of anthropogenic soils, then review the proposed changes to Soil Taxonomy and respond with written comments to the Chairman or the USDA-NRCS at the address below. Additional references include:

Fanning, D.S., and M.C.B. Fanning. 1989. Soil – Morphology, genesis, and classification. John Wiley and Sons, New York, NY, USA.

Kimble, J.M, R.J. Ahrens, and R.B. Bryant. 1999. Classification, correlation, and management of anthropogenic soils, Proceedings-Nevada and California, September 21-October 2, 1998. USDA-NRCS, National Soil Survey Center, Lincoln, Nebraska, USA.

Lal, R. 2002. Encyclopedia of Soil Science. Marcel Dekker, Inc. New York, New York, USA.

Reference list posted at the ICOMANTH web site http://clic.cses.vt.edu/icomanth/ and on the Anthropogenic Soils CD-ROM Version 1.0.

Rice, T.J., and H. Eswaran. 2002. Soil classification: A global desk reference. CRC Press, Boca Raton, FL.

Sencindiver, J.C., and J.T. Ammons. 2000. Minesoil Genesis and Classification. Ch. 23. *In:* R.I. Barnhisel, R.G. Darmody, and W.L. Daniels (Eds.) Reclamation of drastically disturbed lands. Agronomy Series #41. American Society of Agronomy, Madison, Wisconsin, USA.

Section I. Proposed Definitions:

A. Artifacts – (from the online version of Merriam-Webster Collegiate Dictionary (2002) Latin arte by skill + factum to do. Something created (or modified) by humans usually for a practical purpose, including both organic and inorganic materials. Artifacts may be deposited within or on top of the soil and become part of the soil unless they are mobile or transient. From a practical purpose, artifacts that become part of the soil should be split into categories that relate how readily they persist in the soil and then to human safety concerns and to their behavior as part of the soil. The following categories are proposed:

   1. Degradable artifacts (garbic)
      a. Innocuous degradable artifacts
      b. Noxious degradable artifacts (these soils should not be described, sampled, or classified to a low level by soil surveyors. Areas known to contain noxious artifacts could be delineated if certainty exists).
   2. Recalcitrant artifacts (urbic)
      a. Innocuous recalcitrant artifacts
      b. Noxious recalcitrant artifacts (these soils should not be described, sampled, or classified to a low level by soil surveyors. Areas known to contain noxious artifacts could be delineated if certainty exists).

   Component terms:
      1. Degradable – (from Latin de- + gradus away from + step. Capable of being degraded or worn down by erosion or reduced in complexity. Also capable of decomposing or being separated into constituent parts or elements or into simpler compounds). Degradation is the chemical, physical, or biological breakdown of a complex material into simpler components. Biodegradation is the metabolic

breakdown of complex materials into simpler components. The time scale implied is within several generations or a few centuries of time. Examples would include: food and human waste, paper, wood, carbohydrates, biodegradable plastics and chemicals, certain heavy metals, asphalt, and steel products in warm, humid, acidic environments.

3. Innocuous - (from Latin innocuus, from in- + nocEre. Harmless, producing no injury.

4. Noxious - (from Latin innocuus, from noxa. Harm). Potentially harmful or destructive to living beings unless dealt with carefully. Also dangerous, exposing to or involving danger, able to or likely to inflict injury or harm. There is a range of risk from simple danger to known risk. The magnitude of danger ranges from artifacts that cause harm from long-term or indirect exposure to those that cause harm from single-exposure or immediate contact.

5. Recalcitrant – (from Latin recalcitrare to be stubbornly disobedient). Artifacts that are not responsive to treatment and resistant to degradation. Materials or substances that are degraded at an extremely slow rate if at all when released into the environment. Examples would be: Concrete and steel in dry, cold, or alkaline environments, bricks, nondegradable plastics and chemicals, radioactive fallout, certain heavy metals, glass, galvanized steel, aluminum cans, and polyester fabric.

6. Garbic artifacts – (proposed by Delvin Fanning. There is no single word of origin to describe these materials, but the word derives from Middle English offal, food waste. Waste comes from Latin vastus and then Middle English waste, refuse from places of human or animal habitation such as worthless or useless part of something, rubbish, leftovers, scraps, trash, excrement, and sewage). Garbage includes largely organic material such as food and household cooking waste, sewage, sludge, and raw human waste products. The intent was to describe degradable materials that would normally be deposited in landfills but also to include materials that would degrade in-situ in their climate or site of deposition and might cause problems with subsidence or methane gas production as they decompose.

7. Urbic artifacts – (proposed by Delvin Fanning. From Latin urbanus, of, relating to, characteristic of, or constituting a city and Middle English waste, from Latin vastus, damaged, defective, or superfluous material produced by a manufacturing process). This includes materials used commonly in association with human living, construction, and activity. It includes largely inorganic material such as iron ore slag, metal objects, chemicals, and human manufactured material such as fiberglass, brick, cinder block, concrete, metals and alloys, and other building debris. Also included are manufactured or altered materials derived from hydrocarbons such as coal ash, asphalt, synthetic fabrics, and plastics. Organic types of urbic materials include organic compounds and chemicals, human processed natural materials such as cotton and wool clothing, and lumber products. The intent was to describe materials deposited in landfills or buried in landform construction and would include materials that would not degrade within a few hundred years in their climate or site of deposition and would not pose danger of subsidence or methane gas production.

B. Human transported materials – any material (artifacts, soil, rock, or sediment) moved horizontally from a source area outside of the pedon by direct intent human activity, usually with the aid of machinery. This excludes vertical mixing within the pedon. The resulting transportation or deposition results in the creation of an anthropogenic-altered landform. These materials may be used in the keys to Soil Taxonomy to define classes. Major types are:

1. Human transported soil materials (Garbic, spolic, or dredgic materials)
2. Impervious liners (Asphalt, concrete, recalcitrant plastic, or geotextile layers)

<u>Component terms:</u>

1. Garbic materials – (proposed by Delvin Fanning. Garbic materials are mixtures of > 35% by volume garbic artifacts with inorganic and/or organic materials such as soil, regolith, and rock transported and deposited on the landscape or in pits through human activity such as landfill operations, construction, and other earth excavations. The redistribution of material is of such extent that original soil horizonation and geologic stratification have been destroyed or are unrecognizable in the altered layers. Spolic materials occur on anthropogenic landforms and lie unconformably upon the soil or regolith material below that was not transported by humans. Garbic materials have less than 3% by volume recognizable fragments of diagnostic soil horizons that are arranged in discernible order. Garbic materials are likely to have danger associated with their use because of high likelihood of subsidence or methane gas production if set in anaerobic conditions.

2. Spolic materials - (proposed by John Sencindiver. From Latin spoliare, earth and rock waste materials) are mixtures of inorganic and/or organic materials such as soil, regolith, and rock transported and deposited on the landscape or in pits through human activity such as mining, quarrying, road construction, and other earth excavations. These materials may include up to 35% by volume garbic materials and up to 100% by volume urbic materials. The redistribution of material is of such extent that original soil horizonation and geologic stratification have been destroyed or are unrecognizable in the altered layers. Spolic materials occur on anthropogenic landforms and lie unconformably upon the soil or regolith material below that was not transported by humans. Spolic materials have less than 3% by volume recognizable fragments of diagnostic soil horizons that are arranged in discernible order. Spolic materials associated with mining may qualify as sulfidic materials.

5. Dredgic materials – (proposed by W. Lee Daniels. From Latin excavatus, past participle of excavare, from ex- + cavare to make hollow, to dig out and remove; and Old English drecge or dragan to draw, to dig, gather, or pull out with a dredge, to deepen a waterway with a dredging machine). This includes sediment, rock, and soil materials removed from subaqueous sources and artificially redeposited. The redeposition may occur either behind dikes or in pits isolated from fluvial processes, or it may occur in subaqueous environments without constraining structures. These materials may include up to 35% by volume garbic materials and up to 100% by volume urbic materials. Dredgic materials typically have low bulk density and high n value when they are deposited. This can lead to a high degree of cracking when they dry out and the soils in them are then likely to qualify for "cracked" families as that term is defined in Soil Taxonomy. Dredgic materials occur on anthropogenic landforms and lie unconformably upon the soil, sediment, or regolith material below that was not transported by humans. Dredgic materials have less than 3% by volume recognizable fragments of diagnostic soil horizons that are arranged in discernible

order. Also many dredged materials, but certainly not all, qualify as sulfidic materials as that term is defined in Soil Taxonomy.

Spolic materials have two or more of the following properties: (Proposed by John Sencindiver and others)

a. Artifacts; or
b. Easily weatherable minerals or rock fragments, or masses of soft, secondary minerals that have abrupt contact edges with dissimilar soil material; or
c. Easily weathered masses of soft, secondary minerals rock fragments that occur in common or greater abundance in near-surface horizons; or
d. Freshly fractured rock fragments with splintered or sharp edges; or
e. Mechanically abraded mineral grain faces; or
f. Bridging voids between rock fragments; or
g. Randomly oriented rock fragments; or
h. Random lithochromic mottling; or
i. Masses of contrasting parent materials in the same horizon or layer that have differences in texture, and/or type and percent of rock fragments; or
j. Dark colored (value and chroma 3 or less), high carbon rock fragments such as coal or carbonaceous shale; or
k. Abrupt layer boundary or boundaries (excluding the lower boundary of a plow layer) not associated with processes that produce diagnostic horizons such as natric, kandic, argillic, fragipan, duripan, petrocalcic, petroferric contact, petrogypsic, placic, or spodic horizons; or
l. A layer of anthropogenically-compacted densic materials or isolated fragments of densic materials; or
m. Random magnetic orientation within the soil matrix of a single horizon or layer; or
n. Irregular distribution of organic carbon not associated with depositional vertical stratification, leaching or podzolization; or
o. Scars or scrape marks left by mechanical tools during excavation or deposition events; or
p. Anthropogenic stratification or disoriented bedding.

Dredgic materials have two or more of the following properties:

a. Artifacts; or
b. Easily weatherable minerals or rock fragments, or masses of soft, secondary minerals that have abrupt contact edges with dissimilar soil material; or
c. Easily weathered masses of soft, secondary minerals rock fragments that occur in common or greater abundance in near-surface horizons; or
d. Freshly fractured rock fragments with splintered or sharp edges; or
e. Random lithochromic mottling; or
f. Masses of contrasting parent materials in the same horizon or layer that have differences in texture, and/or type and percent of rock fragments; or
g. Abrupt layer boundary or boundaries (excluding the lower boundary of a plow layer) not associated with processes that produce diagnostic horizons such as natric, kandic, argillic, fragipan, duripan, petrocalcic, petroferric contact, petrogypsic, placic, or spodic horizons; or

h. A layer of anthropogenically compacted densic materials or isolated fragments of densic materials; or
i. Random magnetic orientation within the soil matrix of a single horizon or layer; or
j. Irregular distribution of organic carbon not associated with depositional vertical stratification, leaching or podzolization; or
k. Scars or scrape marks left by mechanical tools during excavation or deposition events; or
l. Anthropogenic stratification or disoriented bedding.

Garbic materials have ≥ 35% by volume garbic artifacts one or more of the following properties:

a. Easily weatherable minerals or rock fragments, or masses of soft, secondary minerals that have abrupt contact edges with dissimilar soil material; or
b. Easily weathered masses of soft, secondary minerals rock fragments that occur in common or greater abundance in near-surface horizons; or
c. Freshly fractured rock fragments with splintered or sharp edges; or
d. Mechanically abraded mineral grain faces; or
e. Bridging voids between rock fragments; or
f. Randomly oriented rock fragments; or
g. Random lithochromic mottling; or
h. Masses of contrasting parent materials in the same horizon or layer that have differences in texture, and/or type and percent of rock fragments; or
i. Dark colored (value and chroma 3 or less), high carbon rock fragments such as coal or carbonaceous shale; or
j. Abrupt layer boundary or boundaries (excluding the lower boundary of a plow layer) not associated with processes that produce diagnostic horizons such as natric, kandic, argillic, fragipan, duripan, petrocalcic, petroferric contact, petrogypsic, placic, or spodic horizons; or
k. A layer of anthropogenically compacted densic materials or isolated fragments of densic materials; or
l. Random magnetic orientation within the soil matrix of a single horizon or layer; or
m. Irregular distribution of organic carbon not associated with depositional vertical stratification, leaching or podzolization; or
n. Scars or scrape marks left by mechanical tools during excavation or deposition events; or
o. Anthropogenic stratification or disoriented bedding.

Section II. Proposed Uses in Pedon Descriptions and Soil Taxonomy:

A. Description of Artifacts

Artifacts should be described by percent volume or concentration, average size (cm diameter in largest direction), and also as degradable or recalcitrant and as innocuous or noxious artifacts.

1. Texture modifiers for "H" horizons

% volume	Degradable materials	Recalcitrant materials
< 2%	puric	puric
2 to < 15%	slightly garbic	slightly urbic
≥ 15 to 35%	garbic	urbic

> 35% to 60%	†	very urbic
≥ 60%	†	extremely urbic

† Materials with this amount of garbic artifacts are defined as garbic materials. If both urbic and garbic material occur in the same horizon or layer, garbic takes precedence if it makes up more than half of the total volume of artifacts. Puric – (from Latin *purus* pure, fresh, new, unmixed with any other matter, containing nothing that does not properly belong. This human-transported soil or altered rock material contains less than 2% by volume or concentration of any artifact type.

2. Degradable artifacts would be described as coarse fragments similar to how buried logs are treated in organic soils. These artifacts may allow roots to grow into them and they may decompose within a person's lifetime if soil moisture and conditions for microbial growth are present. Recalcitrant artifacts would be described similar to rock and pararock fragments.

3. The percent by volume or concentration of innocuous and noxious artifacts would be estimated.

For example, a sandy loam "H" horizon with 5% by volume of concrete fragments, aluminum, plastic, and bricks would be called an "slightly urbic sandy loam". If that horizon also contained 20% gravel (pararocks or rock fragments) then it would be a "gravelly slightly urbic sandy loam".

B. Family particle-size class

For consideration of family particle-size class, all artifacts that act like coarse or rock fragments plus all natural coarse and rock fragments would be added together to determine if the soil is "skeletal" or not, regardless of which type made up more the majority.

Section III. Proposed Horizon Designations:

Table 2. Comparison between seven different hypothetical natural and anthropogenic soil types, with proposed changes in master letters and suffix designations. Each horizon is 25 cm thick. Human-transported material (HTM) thickness indicated. Changes from the conventional system are shown in bold text. Terms in parenthesis are comments for this letter to indicate > 2% by volume of urbic or garbic materials and are not part of the current system.

Profile 1	Profile 2	Profile 3	Profile 4	Profile 5	Profile 6	Profile 7
"Cropland soil"	"Cut and Fill" urban lawn soil with similar material sources	Urban soil buried by HTM from different material sources	Mine soil with similar spoil material sources	Mine soil with different spoil material sources	Urban soil with asphalt, gravel base, and concrete layers over an excavated soil	Dredged HTM soil mantle over "urbic" and "garbic" materials in a landfill
0 cm HTM	25 cm HTM	75 cm HTM	100 cm HTM	> 150 cm HTM	100 cm HTM	> 150 cm HTM

Example profiles using conventional designations:						
Ap	Ap	A	A	A	A	A
E	Bw1	Bw	AC	AC	Cd1 (asphalt)	Bw
Bt1	Bw2	C (urbic)	Cd1	Cd	Cd2 (gravel bed)	C1
2Bt2	BC	2Ab	Cd2	C1	Ckm (concrete)	2C2 (urbic)
2R	C	2Btb	Cr (or R)	2C2	2Bt	3C3 (garbic)
		3Cr		2C3	2BC	3C4 (garbic)

Master horizon changes: Same example profiles but with "H" master horizon to identify human-transported materials and "M" master horizon to identify root-limiting layers of nearly pure human-manufactured materials.						
Ap	**HA** †	**HA**	**HA**	**HA**	**HA**	**HA**
E	Bw1	**HBw**	**HAC**	**HAC**	**HMd** ‡	**HBw**
Bt1	Bw2	**HC** (urbic)	**HCd1**	**HCd**	**HCd**	**HC1**
2Bt2	BC	A	**HCd2**	**HC1**	**HMm** ‡	**HC2** (urbic)
2R	C	Bt	Cr (or R)	**HC2**	Bt	**HC3** (garbic)
		2Cr		**HC3**	BC	**HC4** (garbic)
Suffix changes: Same example profiles but with the suffix "+" to identify > 2% by volume urbic material content and the suffix "^" to identify > 2% by volume garbic material content.						
Ap	**HA**	**HA**	**HA**	**HA**	**HA**	**HA**
E	Bw1	**HBw**	**HAC**	**HAC**	**HMd**	**HBw**
Bt1	Bw2	**HC+**	**HCd1**	**HCd**	**HCd**	**HC1**
2Bt2	BC	A	**HCd2**	**HC1**	**HMm**	**HC2+**
2R	C	Bt	Cr (or R)	**HC2**	Bt	**HC3^**
		2Cr		**HC3**	BC	**HC4^**

Comments and footnotes: Use of "p" suffix would be redundant in recent deposits of human-transported materials and need not be used with "H" prefix, but would be used in all deeply-mixed (but not transported) horizons such as those in the Arents suborder. Use of "b" would be redundant under human transported materials, so it need not be used under "H" prefix. High content of coarse fragment materials other than artifacts are indicated in the texture name and not by suffixes. The Arabic numeral prefixes are used to indicate significantly different geologic sources or deposition processes within natural soils but would not be needed between different types of HTM materials or between HTM and natural soil horizons or layers. (continued below)

Table 2 Comments and footnotes: (continued)

† The master letter "H" would be used to identify human-transported materials as defined earlier.

+ Used to identify > 2% by volume urbic material content. An alternative symbol could be the undercase letter "u". Proposed by Stan Buol.

^ Used to identify > 2% by volume garbic material content. An alternative symbol could be the symbol "@" or "~". Proposed by Stan Buol.

‡ Master letter "M" would be used to identify physically root-limiting layers of nearly pure human-manufactured materials such as asphalt, concrete, and geotextile liners. These layers are completely root-limiting as deposited but that property may be lost over time as they weather or are broken, and they may eventually develop into C, B, or A horizons

with "+" to indicate any remnant urbic material content. Proposed by Steve Fisher and Luis Hernandez. The "d" and "m" suffix are used to identify the degree of compaction or type of adherence of the particles.

Part 4. Questions and Answers About the Proposals in Part 3

1. Why not describe strongly different types of urbic and garbic materials with different suffix letters or symbols? The intent of this proposal is to keep the existing system in place and to provide simple new identifications for anthropogenic materials, layers, and horizons. Once a layer or horizon has identified as human-transported material with the master letter "H" or that it has undergone extreme mixing from anthropogenic tools with a suffix of "p", the reader should be alerted to refer to the full layer or horizon description and databases carefully to identify its materials and properties. Impervious, physically root-limiting layers and liners would be labeled as M layers.
2. Some anthropogenic soils undergo rapid soil genesis. How does this proposal address the possible reclassification of layers, horizons, and taxa over time? Once they are left in place, anthropogenic soils undergo natural soil genesis and change over time until they reach a dynamic equilibrium. Others are excavated, covered, or mixed and then the processes start again. They may need a new description as would any other transported soil such as a floodplain deposit or a landslide.
3. Concrete and steel weather under different rates in different climates. Thus they may be degradable in one area but recalcitrant in another. How can that be resolved? Some artifacts would be degradable within a few generations or a few hundred years given the proper climate and soil conditions, such as concrete or asphalt in a warm, humid, acid environment. Concrete and asphalt may last a very long time in the desert. Therefore, they could be classified as degradable or recalcitrant by the soil scientist based on professional judgment.
4. Why not use Arabic numerals with "H" horizons to represent discontinuity? The use of Arabic numerals is optional, but all "H" layers and horizons are transported by definition, making it is easily understandable that each layer could be from a different source. The materials and properties are described and documented in full detail elsewhere.
5. Are all suffixes and prefixes allowed with H and M? Yes, but many times they are redundant. For instance, the use of Arabic numeral prefixes and "b" suffixes in natural soil horizons covered by "H" layers is unnecessary.
6. Why not use Greek letters as suffixes instead of symbols? Stan Buol pointed out that most modern correspondence is by computer keyboard, so we used logical choices available on a standard keyboard.
7. Why not use the "p" in all anthropogenic layers and horizons? The use of the "p" suffix is not needed with "H" master horizons because transported material is "mixed" during movement. The "p" is more of a description of a management process rather than of a property or material. It seems more appropriate to use the "p" to identify layers that have been mixed in place as in Arents suborders (see Chapter 11 on the CD-ROM) and use the "H" to identify transportation from an outside source.
8. Why use such a small number like 2 % to indicate presence of artifacts? Artifacts are important in small concentrations because of the potential pollution or health risks involved with many types and because they are used as evidence of anthropogenic processes and materials. Most soil scientists can see 2% by volume easily, and the break already exists in the system to indicate "common" abundance in many descriptions of other features. Concentrations higher than 15% are described as texture modifiers.
9. Why are inorganic and organic artifacts grouped together in urbic materials? This proposal is a simple approach to begin to differentiate soils with artifacts. There may be

a need in the future to identify inorganic and organic artifacts separately, but the primary concern was stability of the artifacts in the system and then the potential dangers and risks they impart if deposited in urban areas. The system should be tested in some simple form and then modified as needed to prevent it from becoming so complicated that no attempt is made to use it at all.

10. Why are spolic and dredgic materials separated? They are both moved by humans. (from Delvin Fanning "Things that are important to consider in regard to dredged materials is that they typically have low bulk density and high *n* value when they are deposited. This can lead to a high degree of cracking when they dry out and the soils in them are then likely to qualify for "cracked" families as that term is defined in Soil Taxonomy. Also many dredged materials, but certainly not all, qualify as *sulfidic materials* as that term is defined in Soil Taxonomy"). Thus there are major management and interpretive implications between spolic and dredgic materials because of the nature of their deposition process and inherent properties.

Part 5. Questions for Readers about the Proposals in Part 3

Please respond to the following questions by email with electronic file responses attached or written response (with a copy of the file on disk if possible) to the following questions:

1. Is the highest division of artifacts into degradable and recalcitrant in section I the most logical, objective, and feasible for field surveyors?
2. Would an alternative division at the highest level of organic versus inorganic artifacts be more logical, objective, and feasible for field surveyors? If so, how would you define organic artifacts? Please keep in mind that plastics are made from hydrocarbons and may be considered organic.
3. Would an alternative division at the highest level of innocuous versus noxious artifacts be most logical, objective, and feasible for field surveyors? If so, how would you define innocuous artifacts? Should this separation be made by soil scientists? Please keep in mind that length of exposure, type of exposure, age and type of organism exposed, and quantity of material exposed to have a bearing on the health danger involved.
4. Are the horizon and layer designations in section II logical, objective, and feasible for field surveyors?
5. Can you suggest alternative section II designations that are more logical, objective, and feasible for field surveyors?
6. Are the terms for describing artifact content and kind in section III logical, objective, and feasible for field surveyors?
7. Can you suggest alternative section III Description terms that are more logical, objective, and feasible for field surveyors?
8. Are there other pieces of evidence that can be used to distinguish human-transported materials?
9. Should there be an upper limit on content of artifacts? For example, what texture would you call a horizon with 95% concrete rubble, twisted steel, and bricks?
10. Do you have other comments and suggestions for the proposals in this letter?

International Committee on Soil Moisture and Temperature Regimes (ICOMMOTR)

Wayne H. Hudnall, whudnall@agctr.lsu.edu
Louisiana State University Agricultural Center
Agronomy Department
Baton Rouge, Louisiana

Charges

1. Develop a statement describing why soil climate is an appropriate soil property to be included in Soil Taxonomy. This conceptual statement will serve as the guide to evaluate ICOMMOTR proposals.
2. Propose standard procedures for measuring soil moisture and temperature as well as a standard site condition. Provide guidance on correlation of other conditions to the standard. Also, consider methods for measuring moisture in Vertisols.
3. Test the use of measurements at fixed points at standard depths to replace the concept of the moisture control section.
4. Define moisture and temperature regimes separately from one another, including seasonal concepts (moist/dry and warm/cool seasons). Utilize combinations of the regimes to define appropriate taxa. Explore the use of near-surface measures of moisture and temperature for further defining some taxa, such as the very cold soils and very dry soils.

5. Plan a correlation tour, to be conducted in 3 to 5 years, that will address the most pressing problems.

Basic Concepts

- The proposed system is much simpler than the current system.

- The categories of soil temperature and soil moisture should be independent.

- Soil moisture is to be measured in the same manner as soil temperature - an energy measurement – soil matric potential (-tension) is a measure
- Soil moisture is to be measured in the same manner as soil temperature - an energy measurement – soil matric potential (-tension) is a measure of energy.
- Eliminate soil moisture control section and replace it with two point (depth) measurement. (20 and 75 cm)

Soil temperature at 50 cm lags behind air temperature. This lag is commonly around a month, but can be as long as two months. The length of lag depends on the thermal conductivity and heat capacity of the soil and atmospheric and vegetative factors. Soil thermal conductivity and heat capacity, in turn, are highly dependent on the soil water content. Currently, Soil Taxonomy uses the months of June, July and August to define mean summer soil temperature and December, January and February for mean winter soil temperature in the Northern Hemisphere

- Would it be better to use the three warmest and three coldest months to define summer and winter?

- Basing mean summer and winter soil temperatures on the three warmest and three coldest months would probably change the classification of some soils from iso to non-iso soil temperature regimes.

- Should there be an additional group of classes similar to iso- temperature regimes for soils that have large differences between mean summer soil temperature and mean winter soil temperature?

- Where and how should soil temperature and moisture be measured? Vegetated or bare soil conditions?

- There is some support for the addition of two new soil temperature regimes for areas where the mean annual soil temperature (MAST) is greater than or equal to 28#C. These would be called the megathermic and the isomegathermic soil temperature regimes. The isomegathermic regime would be restricted to soils with a difference between the mean summer and mean winter soil temperatures of less than 5#C.

- Is there a need for this from a soil management standpoint? From a soil genesis standpoint?

Recommendations

1. Eliminate the soil moisture control section. Make determinations of soil water matric potential at a single depth between 75 and 100 cm. Determinations of soil matric potential at 10 cm also should be made in case they are needed to separate intergrades, particularly in drier climates.

2. Base soil moisture regimes on mean seasonal and annual soil matric potentials determined at a single depth between 75 and 100 cm. Soil matric potential at 10 cm may also be needed to separate intergrades, particularly in drier climates.

3. . Eliminate the linkage of soil moisture regimes to soil temperature. Use ustic to occur in cryic and pergelic soil temperature regimes. Eliminate reference of xeric to a Mediterranean climate. Allow xeric to represent a seasonal variation in soil water state only.

4. Make xeric a special case of ustic; i.e., all xeric soils are also ustic. Perhaps a similar subgroup of ustic is needed for other seasonal variations in soil water state such as occurs in monsoon climates.

5. Eliminate cracking as soil moisture regime criteria in Vertisols. Use the same criteria for all orders. Elimination of the soil moisture control section and basing determinations on soil water matric potential at a single depth (25 or 75 cm) should make this possible.

Do we scratch what we have and start over or use some existing data and modify it to fit our needs?

NCSS Standing Committee on New Technology

Co-chairs:
Pete Biggam, NPS, Lakewood, CO
Bill Effland, NRCS, Washington, DC

Report to the National Cooperative Soil Survey Conference
Plymouth, MA
June 16-20, 2003

Committee Members In Attendance:

Bill Ypsilantis, BLM, CO
Bruce Frazier, WA St. Univ.
Brian Needelman, UMCP
Neil Peterson, NRCS, WA
Jim Doolittle, NRCS, NE (not attending)
David Howell, NRCS, CA (not attending)

Charges

"To develop and document procedures, processes and standards that will be used to integrate GIS, remote sensing, landscape analysis/modeling and other similar technologies into the mainstream of the soil mapping and landscape inventory programs."

Activities
Review and document progress on recommendations from 2001 report.
Review and document progress on recommendations from 1999 Task Force on Soil Survey Products of the Future.
Review recommendations of 2002 Regional Conference reports.
Develop a methodology for distribution of standards and make recommendations to the NCSS Steering Committee.
Report activities of NCSS New Technology Standing Committee at each National Conference.
Identify an Outstanding New Technology Transfer Project within the NCSS partnership at the National NCSS Conference.
Results

Previous committee recommendations were reviewed and some work is still impacted by limited funding and/or personnel issues. Various NCSS partners are increasing GIS support at state, project and MLRA offices; however, funding is not yet adequate for widespread adoption.

Research activities related to "new technologies" should be documented by scientific and technical reports and peer-reviewed journal articles.

Work is currently underway (outline drafted and applicable URLs identified) to develop a “New/Advanced Technology” web page on the NSSC soil geography web page that will define “new or advanced” technologies, increase communication, foster collaborative research and identify appropriate training, conferences and meetings.

A revised questionnaire is being developed that will be distributed to various NCSS partners (e.g., state soil scientists, universities, other federal agencies) to continue identifying and documenting “new technologies.”

The committee selected recent NCSS work on the soil survey of Denali National Park, Alaska as the "Outstanding New Technology Project." Mark Clark, soil scientist from Palmer AK, provided an excellent presentation describing the various components of the NPS-sponsored project at Denali National Park, AK.

Recommendations

Research projects involving landscape analysis [SoLIM and other examples applying new technology (e.g., use of LIDAR, geophysical tools, etc.)] should be adequately staffed and funded to maintain momentum for incorporating advanced technologies into the NCSS program.

Internet-accessible information should be available in 2003 for NCSS partners to increase communication, improve education and training, and foster collaborative research, development and application of “new or advanced technologies.

A NCSS task force should be formed to develop a proposal for symposia and pre/post-meeting field tours or workshops at the 2006 IUSS World Congress in Philadelphia that addresses scientific exchange and review of “new technology” research with the international soil science community.

The Standing Committee also discussed Internet-based delivery of soil survey information. Pilot applications of ESRI Arc Internet Mapping Server (ArcIMS) from Oregon and Missouri were described. Further work is needed to identify the required functionality for providing soil survey information via the Internet.

The Standing Committee is requesting a committee name change from "new technology" to "advanced technology." The NCSS charter by-laws will be reviewed to determine the correct procedure for this proposal.

USDI/NPS New Technologies Activities Report

Pete Biggam (USDI/NPS)

Submitted to the NCSS Standing Committee on New Technologies
June 20, 2003

Project Plan for the Evaluation of Soil Mapping at Great Smoky Mountains National Park Using GIS, Expert Knowledge, and Fuzzy Logic
May, 2001

Objective:

Utilize components of the new "SoLIM" approach to help assist in the development and evaluation of a computer generated-landscape model that captures existing soils and environmental knowledge, creates data layers for input into a GIS, and produces raster and vector maps suitable for use in soil survey, as well as providing the potential for the use of "fuzzy soil logic" in the development of "soilscape–based" soil interpretations. The project would be performed in 2 phases, with the initial phase within an area already mapped, and the second phase in an area which is virtually inaccessible, without any observations performed.

We would then evaluate these procedures and products as to their applications within the National Cooperative Soil Survey, as well as within the National Park Service and the Natural Resources Conservation Service. In particular, we will assess the adoption of these techniques for mapping soil resources over areas that are not easily accessible for field observation.

Soil Feature Distribution Modeling Pilot
Redwood National Park Soil Survey
General Concept Fact Sheet
Prepared by: David Howell, NRCS. Arcata, CA

The objective is to develop and evaluate spatial and statistical methods for modeling the distribution of defined soil features in order to assist field soil scientists in sample planning and data integration within a portion of the ongoing soil survey of Redwood National Park. The outputs from the models will not be a substitute for field soil mapping, and will be considered for broader uses and application to MLRA soil survey updates. This is considered an early phase in the long-term, multiple-approach development of spatial methods to assist soil survey workers.

Methods: This pilot will utilize field soil profile descriptions as point data to develop statistical spatial models using generalized linear model procedures. Data extraction from existing map units (combined spatially with soil-forming factor data) will also be tested to evaluate current data and provide information about data ranges and relationships. Other methods described in the literature will also be evaluated.

The initial list of Soil features which will be evaluated for modeling is:

Depth to bedrock
Epipedon thickness
Argillic horizon presence/absence
Argillic horizon classes (degree of development)
Particle-size family
Rock fragment content
Epipedon type
Subsurface diagnostic horizon type
pH
Color attributes

The model outputs will be continuous or polygon class map estimations of each soil feature under consideration. The decision to model individual soil features is based on the hypothesis that a simple, defined dependent variable will yield a more predictive relationship with soil-forming factors than would a complex set of soil features (e.g., soil series) considered as the dependent variable.

Combinations of model outputs will be evaluated also. Limitations in the resolution of the outputs and the specificity of the attributes being modeled will be unavoidable due to the characteristics of the available input soil-forming factor data. The maps can be plotted at any scale and tailored to meet user needs.

David Howell, Soil Scientist/GIS Specialist, USDA Natural Resources Conservation Service will provide soil science and GIS spatial modeling support.

Yoon Kim, Associate Professor, Mathematics, Humboldt State University (HSU) will provide statistical modeling and data analysis support.

Other HSU staff and other soil scientists may provide inputs as their time allows. Joe Seney, Project Leader, USDA Natural Resources Conservation Service, will interact with the model development and products as he maps soils in the pilot study area.

GIS-BASED MAPPING OF SOIL DISTRIBUTION IN THE THUNDER CREEK WATERSHED, NORTH CASCADES NATIONAL PARK, WASHINGTON

Crystal Briggs, Graduate Research Assistant
Department of Crop and Soil Sciences
Washington State University
Pullman, WA 99164-6420
Phone: (509) 335-4088; Fax: (509) 335-8674
Email: crystal1@mail.wsu.edu

Wilderness areas and National Parks in the western United States have historically been excluded from soil inventories due to the huge investments required to map the rugged and inaccessible terrain. This has led soil scientists to develop more efficient means of mapping soils in areas that would otherwise not be mapped. With GIS and remote sensing technology along with a focused effort at describing soils in the field, modeling the distribution of soils in these areas becomes a cost-effective alternative to traditional soil surveys. GIS is a powerful tool that will allow the prediction and mapping of soils in the 74,000 acre Thunder Creek watershed in North Cascades National Park. This work will serve as a demonstration-of-concept for an eventual project to map the soil resources of the entire North Cascades National Park.

Digital GIS data layers such as current vegetation and surficial geology serve as proxy indicators of the pedological processes that control soil properties and distribution. Examination of the digital information available, such as vegetation (Potential Natural Vegetation (PNV) and current), digital elevation models, multispectral remote sensing images, and maps of surficial geology will allow for an initial assessment of the controls on soil development in the watershed. This assessment will serve as a guide to divide the landscape into units that will be sampled in the field. The initial fieldwork will be geared toward describing and interpreting the soils present and recognizing the patterns of their distribution. The recognition of reoccurring combinations of climate, vegetation, topography and surficial geology for a given soil will facilitate development of a GIS-based map of soil types. Further, documentation of the location (as measured by GPS), plant community, and terrain characteristics of soil sites is crucial because this information will be integrated into the GIS model.
Primary and secondary terrain attributes such as slope gradient, aspect and curvature can be calculated accurately from a digital elevation model (DEM, essentially a digital topographic map) and portrayed in a GIS. These terrain attributes are proxy indicators for processes such as water gathering or water shedding on parts of the landscape that can drive or retard geologic (erosion/deposition) and pedologic (mineral weathering, translocation) processes. Terrain attributes thus also are used in building the model of soil distribution. We will use a GIS map-algebra command-line system to query and aggregate digital data layers in a hierarchical sequence. We will conduct a supervised data classification and use threshold data values to create meaningful soil map units. Map units of distinct kinds of soils will be assigned to mimic or represent key soil-landscape relationships observed in the field.
Intended Use of Results:

A digital map of the soils of the Thunder Creek watershed, as well as the GIS model used to generate the map, will be delivered to North Cascades National Park at the completion of Crystal Briggs's Master's degree project (estimated date: December, 2003). The map can be used by the park for resource management and visitor education. The GIS-based model will be very useful in designing the mapping project for the remainder of the national park and in developing a common protocol to achieve seamless soil mapping in National Parks in Washington state and adjacent lands administered by the U.S. Forest Service.

Objectives of Field Research:

Observe, describe, sample, and analyze soils at 60 observation sites (2002 field season) or as many as 100 observation sites (2002 and optional 2003 field seasons combined) on

combinations of surficial geologic map units and plant community types in the Thunder Creek watershed.
Use the observations from 1) to develop key functional relationships among climate, vegetation, geology and the resulting distribution of soils in the watershed.
Use the field observations and relationships to develop a functioning GIS model to predict (map) the distribution of soils in the watershed.

USDA/NRCS Soil Landscape Analysis Activities Report

William R. Effland (USDA/NRCS)

Submitted to the NCSS Standing Committee on New Technologies
June 20, 2003

The Natural Resources Conservation Service (NRCS) Soil Survey Division conducts and supports various research and application efforts to enhance the soil survey program through examination of new, modern or "advanced" technologies. Examples of these technologies include, but are not limited to, Geographic Information Systems (GIS), remote sensing, landscape analysis/modeling, application of geophysical tools and other similar technologies. This report describes various efforts for documentation of soil landscape models; identification and dissemination of information on new technologies; pilot projects using the UW Soil-Land Inference Model and 3dMapper technology; training of soil scientists and other natural resource professionals in new technologies; applications of remote sensing (both aerial and satellite platforms and ground based sensors) for soil survey; and web-based delivery of soil survey information.

Documentation of soil landscape models currently involves 2- and 3-dimensional visualization of soil landscapes and text-based examples. Multi-dimensional visualization tools consist of 2-dimensional hillslope profiles and catenary sequences and 3-dimensional representations using computer-enhanced block diagrams that illustrate soil landform relationships in conjunction with limited stratigraphic information. Text-based soil landscape model documentation ranges from qualitative descriptions to semi-quantitative, rule-based or decision tree examples.

A NRCS soil scientist and web administrator at the National Soil Survey Center, Lincoln, NE is assisting the Standing Committee publish an Internet-based home page to increase communication about new technologies, to foster collaboration and to share research project directions and findings. The preliminary outline and links to applicable topic-related internet sites (e.g., university collaborators, Pedometrics, SoLIM, etc.) were drafted along with information on relevant conferences and meetings. The Standing Committee recommended development and publication of a dictionary or glossary of soil landscape analysis terms to foster communication. The Standing Committee also recommended the web page include an interactive national map that provides users with the geographic location, brief project description and contact information for each NCSS-related project.

Results from a 2001 Questionnaire on New Technologies in Soil Survey received responses from only 9 state soil scientists. The objective of this questionnaire was to develop a database of new technology soil survey projects that would be available on the Internet to all NCSS cooperators and other interested groups. As a follow-up to the 2001 questionnaire, the Standing Committee developed an updated version which will be distributed in 2003-04 to all NCSS cooperators such as universities and government agencies.

The Soil Survey Division continues to support research and development of soil mapping techniques in Dane County, Wisconsin and other areas. Two University of WI-Madison Geography Dept. professors, Drs. A-Xing Zhu and James Burt, are the principal investigators on the Soil-Land Inference Modeling (SoLIM) work with the Dane County soil survey update project. Soil mapping was completed for the western "Driftless Area" portion of Dane County and the Wisconsinan glaciated area in the eastern half of the county. The 3dMapper landscape visualization and mapping tool was functionally enhanced from the original NRCS-funded version and is now commercially available through Terrain Analytics. Additional work on SoLIM technology was conducted in the Great Smokey Mts. National Park in NC and TN. Collaborative work among NRCS, NPS and the UWI completed soil mapping for two topographic quadrangles of the park (see also Biggam's project description in previous section). Several products from this study such as poster-size graphics, research reports, and scientific presentations and publications are currently being developed. Additional SoLIM-type work is being discussed or planned for untested regions of the southwest, midwest, northwest and northeast U.S. Several important research questions that should be answered before SoLIM is applied for production soil survey include the scale dependency of Digital Elevations Models (DEMs), the function of various GIS coverages or layers in soil landscape modeling (e.g., will surficial geology or geomorphic surface maps improve discrimination of soil landscape relationships?) as well as others not discussed in this report.

Current training opportunities for new technologies are available through universities, commercial vendors and NRCS-sponsored courses. The University of WI-Madison is developing a pilot training program for training soil scientists and geographic information specialists to apply SoLIM technologies for soil survey work. Pilot projects were initiated in May, 2003 for selected areas of Illinois and Arizona. The National Soil Survey Center is developing a course using the 3dMapper technology. The first 3dMapper course will be offered at the NSSC in Lincoln, NE during mid-August, 2003. The BLM is also developing an interagency course on "advanced technologies" to be presented in Phoenix, AZ beginning in 2004.

Investigations were discussed for further soil survey work in remote sensing -- aerial and satellite platforms (e.g., LIDAR, hyperspectral imaging) and ground based sensors [e.g., ground penetrating radar (GPR), electromagnetic induction]. A GPR soil suitability map created by Jim Doolittle, Sharon Waltman and others was recognized at two national conferences for its practical applicability with other federal agencies and commercial geophysical firms.

USDI/BLM New Technologies Activities Report

William Ypsilantis (USDI/BLM)

Submitted to the NCSS Standing Committee on New Technologies
June 20, 2003

Grand Staircase-Escalante Soil Survey, Utah

Suzanne Kienast, NRCS soil scientist utilized GIS products such as DEMs to a limited extent, to help conduct soil survey in the Grand Staircase-Escalante National Monument in southern Utah.

California Desert Soil Survey

A cooperative effort between NRCS and BLM is ongoing in Johnson Valley OHV area to correlate remote sensing band ratioing images and GIS layers such as slope curvature to soil/landscape relationships. Carrie Ann Houdeshell, NRCS soil scientist in Victorville, CA is the survey project leader. She is being assisted by David Howell, NRCS soil scientist in Arcata, CA who has responsibility for implementing a statewide plan for using advanced technology tools to assist soil survey. Russ Almarez, GIS specialist is also providing assistance. David developed and implemented a random sampling scheme for collecting soil profile data which will be statistically analyzed for correlation to remote sensing/GIS themes by Humboldt State University, Dr. Peter Scull, Colgate University, participated in the project as a Cooperative Ecosystem Study Unit contractor who helped introduce some advanced technology tools to the Victorville Soil Survey office, assembled available GIS data themes for Johnson Valley, developed a preliminary predictive soil map, and will assist in statistical analysis of the sampled soil survey information.

Wyoming Soil Survey Project

BLM hired Dr. Janis Boettinger, Utah State University soil professor, through a Cooperative Ecosystem Study Unit project to develop and test methodologies to utilize advanced technology to facilitate soil survey on public land. The project is divided into 3 phases. Phase 1 is to develop and test advanced technology strategies for soil survey in the Powder River Basin in north Johnson County. Nephi Cole, a Utah State University graduate student and recent NRCS hire, is conducting this portion of the project. Phase 2 will be to apply these strategies and strategies to soil survey on public land in Wyoming exhibiting different landforms and potentially different soils. Phase 3 is to collect existing soil survey information from former BLM contract surveys and assess the completeness and usefulness of the information for future soil survey updates.

Outstanding Project Using New Technology- Into the Wild with Technology-The Making of the Denali Park Soil Survey, Alaska

Mark Clark, NRCS-Soil Scientist, Palmer, Alaska

The Denali Park Soil Survey Area includes six million acres of remote mountainous and lowland terrain in South Central and Interior Alaska. In 1996 the Natural Resources Conservation Service (NRCS) entered in an agreement with the National Park Service to provide an order four level soil map at 1:63,360 scale and associated physiographic map at 1:250,000 scale. Fieldwork was completed during 1997 through 2002. Standard soil physical and chemical properties as well as ecological site descriptions are principal baseline information layers provided as well as digital maps.

The remote and extensive nature of the project required that available technology be used to help complete the project within the six allocated field seasons. Mapping tools include 1:60,000 color infrared Alaska High Altitude Photography (AHAP) in stereo coverage as the mapping base and 1:63,360 USGS ortho-photography as the compilation base. Global positioning systems (GPS) provided coordinates of field stops, hand-held field computers (Husky) for field data collection, and soil temperature sensors (HOBOS) to document soil climate. Also, several land satellite images (SPOT) in mosaic provide continuous coverage of the Park and were used in conjunction with Arc View software. In addition to populating the standard National Soil Information System (NASIS) national database, soil and vegetation field data were automated within the Alaska NRCS Soil Survey Field Data Database (SSFDD) and provided to the Park Service as a standard product.

A draft physiographic map of the park at 1:250,000 scale was developed from available resources prior to field work and served as an initial reference for park personnel and also used as a tool for planning field work and developing mapping rules. Field data collection involved the location of representative areas of from two to four adjacent map unit polygons that could be traversed in a single day and these representative areas are referred to as “Study Sites”. A line-intercept transect method was used to document map unit composition. Site, soil and vegetation cover data were recorded at each stop along an individual transect.

Tools that provided the most utility during the mapping effort include the AHAP photography, GIS tools, GPS, HOBOS, and the field database (SSFDD). The Husky hand-held field computers proved inadequate due to limited battery life, eye strain problems associated with a small screen and malfunction attributed to severe field conditions. The national database (NASIS) proved poorly suited to project data population from scratch. Also, storing duplicate component records and derived variables within the database also proved to be an inadequacy in the database design.

IN-Conference Committee Reports

2003 Committee 1 –Rapid Response Quality Improvement Team for Soil Survey Publications

(Substituted for Selling Soil Science Society – Promoting Partnerships)
NCSS Conference
June, 2003

Charges

1. Strategize a streamlining of the publication process to incorporate the options of electronic media products and develop a plan to eliminate publication backlog in 3-5 year (emphasis on 3).
2. Develop issue papers that clarify the pros and cons of eliminating printed media of soil survey publications.
3. Evaluate and make recommendations on print on-demand maps and publication documents.
4. Evaluate the standardization of digital soil survey format for CDs, DVDs and Web-based products.
5. Evaluate and develop implementation strategies to transition from hard copy NCSS soil survey publications to electronic media publications.

Comments from Committee 1

Consider eliminating tables from publication
Look at streamlining process not just eliminating parts of the survey
Work with software vendors to help look for solutions
Would like to keep block diagrams
GSM has value to some users – leave as state options
Need to keep information instead of data
Formation of soils should be required
May need help form information architect
Comments from Committee 1
Need to retain block diagrams, update with 3dMapper
Don’t eliminate any thing not replaced with technology
Keep cultural features (located features)
Keep taxonomic units
Stress the importance of the publication, and the minimal percent of overall cost
Minor components are important piece of information
Might a marketing survey on soil survey publication needs

Questions

Does any one feel they can produce a high quality map with legible symbols in every polygon from an ArcIMS or other type of internet map sever?
What states plan to continue to publish GSM in future surveys?
What states plan to continue to use hydro in future?

2003 Conference Committee 2 -- Ecological Interpretations and Principles Committee
2003 NCSS National Conference
Plymouth, MA

Co-Chairs: Randy Davis, USFS
Curtis Talbot, NRCS

Committee Members:	Submitted Paper	Attended Meeting
Susan Andrews, NRCS	X	X
Brandon Bestelmeyer, ARS	X	
Joel Brown, NRCS	X	
Mark Clark, NRCS		X
Randy Davis, USFS	X	X
Tom DeMeo, USFS	X	
Bill Dollarhide, NRCS		X
Carol Franks, NRCS	X	X
Thomas Hahn, NRCS	X	
Kris Havstad, ARS	X	
Jeffery Herrick, ARS	X	X
Duane Lammers, USFS		X
Chad McGrath, NRCS	X	X
Gregory Nowacki, USFS	X	
George Peacock, NRCS	X	
Bill Puckett, NRCS		X
Tom Reedy, NRCS		X
Wayne Robbie, USFS	X	
Pat Shaver, NRCS	X	
Curtis Talbot, NRCS	X	X
Arlene Tugel, NRCS	X	X
Sharon Waltman, NRCS	X	

The committee reviewed a collection of 18 "white papers" voluntarily submitted by various authors. Topics ranged from current approaches to mapping, spatial and temporal scale issues, the need for ecological models, soil function and change, data element and database issues. These papers will be bound and released at a later date, separate from the conference proceedings.

After release of these papers, this committee recommends that the 2004 NCSS Regional Planning Conferences select any or all of the ecological topics for inclusion in their respective agendas. The attached questionnaire should provide some guidance for suggestions. Results from the regional conferences/committees will likely result in a continued and advanced discussion at the 2005 NCSS National Conference.

2003 Conference Committee 3--New Inventory Techniques and Delivery Systems in Production Soil Survey

This committee is to concern itself with development and training of soil scientists and geographers in new inventory techniques, data collection, use and application of interpretations, and information technology issues concerning the delivery of soil data and applications to the public and private sectors.

Charges (Address the following issues):

5. What is the national strategy for data collection and data interpretation with the public at large? How will this be applied towards encouraging national and regional interpretations?
6. What new inventory techniques have emerged recently and what are the strengths and weaknesses of these new techniques?
7. How will database strategies change with new inventory techniques and the desire for more complex analysis of soil inventory information?
8. What is the potential with new inventory techniques to better describe landscapes for site-specific inventories and management?

Co-Chairs:
Henry Mount, NRCS, NSSC in Lincoln, Nebraska
A-Xing Zhu, University of Wisconsin at Madison
Bruce E. Frazier, Washington State University at Pullman

Committee Members:
Shawn Finn, NRCS, MA
Fred Young, NRCS, MO
Sam Indorante, NRCS, IL
Toby Rodgers, NRCS, WA
Suzann Kieanst, NRCS, UT
Wayne Robbie, USFS
Janice Boettinger, Utah State U., Logan UT
Joey Shaw (University of Auburn)
Tommy Coleman (AL A&M)
Terry Cooper (MN)
Susan Casby-Horton, NRCS, Temple TX
Doug Miller, PSU
Brian Needleman, UMD
Patrick Drohan, Sheppard College, WV
Lyle Steffen, NRCS, NSSC

Committee Discussions

June 17, 2003

1. Need a web-based delivery system.
2. Agency needs to set up pilot sites to go ahead with landscape modeling technology.
3. Perhaps a risk-assessment clause is needed for our raster-based products.
4. Discussion of a minimum set of soil properties for our database. These would be the primary properties used for pedo-transfer functions.
5. Perhaps we need paid interpreters of our data.
6. Discussed PEDON and transect data in conjunction with the Soil Data Warehouse.
7. Bruce Frazier explained the Remote Soil Landscape Model used in Washington by Toby Rogers. Though mapped at the family level there was some thought that perhaps the series level would be better for users of the data.
8. Brian Needleman explained the LIDAR emerging technology. Perhaps some investigations are needed to tell us the comparison of LIDAR and georeferenced ground surveys. A-Xing thought LIDAR might tell us the scale at which soil-landscape models break down.
9. The SBAAG group is needed as an interface between raster-based data and the NASIS data structure.

Recommendations

1. Retrieve all georeferenced available pedon data.
2. Continue to foster research for emerging technologies including LIDAR terrain modeling.
3. Continue the SBAAG interface for integrating spatial raster data from SoLIM and other landscape models into the NASIS structure.
4. Carry forth charge 4 to the next National Work Planning Conference.

Written Responses To Charges

Dr. A-Xing Zhu

1. We need to **improve the transition from the office to the field**. A-Xing indicates that field gear and glasses need to work outdoors in a better fashion. The Hammerhead technology does not do a good job in the field.
2. The **inference process** needs to be simplified (R&E - not sure if Committee 3 should explore this).
3. A **training program** is needed for GIS specialists. Ken Lubich reiterated that all soil scientists need training on 3dMapper. He would like to see a training cadre of 5 to 6 people. Texas had cross-trained soil scientists with GIS. Bill Efflund suggested that soil scientists core college courses and training courses could and should change in the future. We need a strong coupling between soils and GIS. A-Xing tells us about testing the research mode and the training development process. He says a 10-day

intensive training class will be held in Madison. Documentation of the testing phase is needed so that the inference engine is not a total black box. Eventually, we want a production mode. A mass mode will be within 2 to 3 years. Tommy says NRCS will bring people into training. UCGIS Consortium will help, according to A-Xing.

4. Need to integrate SoLIM (landscape models) with **NASIS**.
5. Continue to explore **data mining** techniques.
6. We need to explore the possibility of a **National GIS Institute** to foster progress in landscape analysis.
7. A **marketing** strategy is needed; e.g. SoLIM tears down the artificial soil boundaries that muddle the soil continuum. Soils Division oversold the product and forgot the knowledge during our previous soil survey efforts. SoLIM offers us the opportunity to produce knowledge. A SoLIM symposia is need at the National Soil Survey Center to foster progress and support. The Denver ASA meetings has a thematic mapping section. A new technologies webpage is needed at the NSSC website.
8. An **agency statement** is needed for technology development tools and research such as SoLIM and 3dMapper. We need an urgent issue statement to address SoLIM. Send out a call to states that want to participate.
9. Tom Calhoun suggested that we put **Joseph J. Jahnke**, SQI from Minneapolis (MO 10), on Committee 3 for the National Soil Survey Work Planning Conference.

Dr. Patrick Drohan

Note: I have taken a position at the University of Nevada, Las Vegas (UNLV) effective August 1, 2003. I will be doing GIS/Soils work in Environmental Studies, but sharing a lab with Brenda Buck (pedologist) in Geosciences.

What is the national strategy for data collection and data interpretation with the public at large?

I'll answer this in two parts with the first in three sections*: (1) Who is our audience, (2) how can we address what type of data and format is best for the public* and *(3) what is the most efficient way of gathering data for public use?* I'll start with the first part.

(1) Who is our audience? At present our audience seems to focus on those who have a basic knowledge of soils. What we need is to have users who have no knowledge of soils be able to pick up a soils document, like a survey, and be able to use it correctly with minimal effort. This will require whoever produces future soil surveys to place strict interpretations on soils in a region, which in turn would require a higher level of accuracy and complexity in mapping. This leads into my second point of the type/complexity of data we should be collecting for the general public.

(2) Data available to the general public in soil surveys or digitally in SSURGO and STATSGO is still presented too technically. I believe the data should be of the highest quality, but presented in a very simple way. Data that is presented too technically prevents the present soil survey form from being used by many who would benefit the most from it: real estate agents, homeowners, planners, developers, county commissioners…For example, instead of presenting data on shrink swell, drainage class (a whole problem in itself), and depth to bedrock put out a map that simply has the

suitability for buildings with basements. I have often thought there should be two levels of soil survey document. One for the general public (much smaller, less technical, mostly maps) and one for soil scientists (more similar to today's, but digital and database linked via a free-source code language like PYTHON). With today's' soils survey format, I find that students in an introductory soils class typically require a solid 20 hours of working with the soil survey until they can use it effectively. This doesn't include the time spent in lecture and on their own studying soils. Even at the completion of such a course, there are still deficiencies. SSURGO data is whole different story. Not only does the user need to be adept in the concepts of the soil survey, but now they also need to be familiar with the use of spreadsheets and a GIS. This adds a much higher level of complexity. The bottom line is that the complexity results in miss-use or misinterpretation. For example, I find with new users of SSURGO that there is a tendency to zoom in at a scale larger than that technically feasible with SSURGO data and they then use this new "resolution" as an acceptable source of information. Lastly, I believe that the soil survey, or whatever forms it evolves into, must be legally defendable. Because it is not legally defendable, leads to it not being used by some who should be using it (real estate agents, developers, planners).

(3) *What is the most efficient way of gathering data for public use?* I would recommend putting out a simplified document with more of the interpretations already made for the user. Make these legally binding somehow. For example, suitability for buildings with basements instead of shrink/swell data. Present these as maps instead of soil mapping units. Use fuzzy boundaries and get rid of the mapping unit line. The problems the mapping unit line causes with students, let alone the general public, results in more miss-understanding of the usefulness of the soil survey than almost any other aspect I teach in soils. Require new mapping levels (scales/orders) for the soil survey based on population density in order to meet the needs for more detailed mapping in increasingly urbanized areas. This will prevent a nationally mandated sweeping change in scale (resulting in overspending unnecessarily) and focus scale changes only on areas that need it. Put a timeline on updates that is legally binding so that users know the data will be current. Make this enforceable.

How will this be applied towards encouraging national and regional interpretations?

If national and regional interpretations apply to formats like STATSGO, I would say shy away from such an idea. Too coarse for the scale that I think is most effective. If you mean standardization of methodology, than adjusting the scale of mapping by population density should work fine. I can answer this again when I speak with you. I probably am missing something that you are getting at.

What new inventory techniques have emerged recently and what are the strengths and weaknesses of these new techniques?

I believe the replacement of mapping unit boundaries at present with fuzzy boundaries is key. Zhu or Needelman would be better at addressing this. However, I believe the idea of the fuzzy boundary effectively conveys how soils change on the landscape. Taking this to the 3D level is the next step. Grunwald's work at Florida is an example. I don't know how (nor think it is now possible) we can get such data (Grunwald's) across a broad area like the states of WV or NV?

However, I think mapping a state the size of WV with fuzzy boundaries is possible. I would also encourage more field tests that simplify interpretations. For example, I and my students were very excited to see the work being done by Herrick and Tugel (ARS and National Soil Quality Institute, NM) (Criteria for dynamic soil property selection for soil survey) and Grossman and Seybold (National Soil Survey Center, NE)(Aspects of incorporating use-dependent data into soil survey) at the SSSA meeting in Indianapolis. More of this type of work will make getting the updates out in a reasonable amount of time a reality.

How will database strategies change with new inventory techniques and the desire for more complex analysis of soil inventory information?

- First, shoot to put it all on the WWW in the end using a GIS map server and a database as powerful as Oracle. Make it integrate with ESRI products too. The whole idea of centralizing data collection through NASIS is great, but too slow from what I understand from some of the field people in my area. Speed will probably change as more areas get a better hard line. A lot of the interpretation calculations should continue to be integrated into the database, as with NASIS, so that real time updates can take place. This will eliminate delays in getting information out and make adjusting broad scale interpretation calculations/models easy. Just upload the new "model" for suitability for buildings with basements into the national database and every mapping unit in the US is updated instantly! The WWW and a map server like Soils Explorer are the key to success I believe. The data base has to be flexible and accurate. Look at the new Survey Analyst coming out from ESRI. The ability to store multiple coordinates for a single location so that long term accuracy of a point is very clever and useful. Compounded error via line updates in a GIS is a problem and the new Survey Analyst seems to have found a handy way of dealing with this. I'll probably be hung for this, but get the ESRI folks involved in suggesting improvements to digitally outsourcing soils data. For example, use a free code source like PYTHON so that all soil scientists across the country can write scripts to use in a centralized soils GIS. This will help NRCS quickly acquire new, creative updates to deliver soils data.

What is the potential with new inventory techniques to better describe landscapes for site-specific inventories and management?

Whatever techniques are developed, the key will be finding more money to do it. I think we are still quite a ways from using satellite data for 1:5,000 (or less) scale type of work. Therefore, new developments that are most cost effective should focus on simplicity and field collected information…like the work I referred to earlier by Herrick and Tugel (ARS and National Soil Quality Institute, NM) (Criteria for dynamic soil property selection for soil survey) and Grossman and Seybold (National Soil Survey Center, NE)(Aspects of incorporating use-dependent data into soil survey). This is the type of information that could be automated nationally once basic, high-quality data for the mapping unit became available.

Dr. T. L. Coleman

1. What is the national strategy for data collection and data interpretation with the public at large? How will this be applied towards encouraging national and regional interpretations?

   In my opinion, the national strategy for data collection and data interpretation with the public at large is centered around the Major Land Resource Areas (MLRA); the detailed inventory of areas known as Primary Sampling Units (PSU) within the National Resources Inventory (NRI) Program; and the initial and/or updating of the county soil survey using Soil Taxonomy, and converting the county soil surveys into a digital database. The MLRA concept provides a seamless database of the county soil surveys that allows national and regional interpretations of soils and landforms. The MLRA is based on the fact that soil boundaries do not stop at county or state boundaries; therefore, national and regional interpretations of soils are no longer limited by political boundaries.

The NRI is a statistically based survey that has been designed and implemented using scientific principles to assess conditions and trends of soil, water, and related resources on non-federal lands. It is a compilation of natural resource information on nearly 75% of the Nation's total land area. It captures data on land cover and use, soil erosion, prime farmland, wetlands, habitat diversity, and other related resource attributes on thousands of scientifically selected sample sites throughout the Country.

2. What new inventory techniques have emerged recently and what are the strengths and weaknesses of these new techniques.

A new inventory technique that has recently emerged is the use of multispectral remote sensing systems on-board aircrafts and satellites to assess soils, terrain and landforms, vegetation, and water bodies of the Earth's surface. The substantial and continuous improvements in multispectral remote sensing sensors since the early seventies have brought this technology to the forefront as a capable tool for inventorying and monitoring our natural resources. The National Aeronautics and Space Administration (NASA) through its Earth Science Enterprise have invested billions of dollars in the development of this technology and interpretative techniques used to extract features and usable information from these data. The National Oceanic and Atmospheric Administration (NOAA) have also contributed to the use of this technology through its development of a series of satellites that not only monitor the Earth's weather but also the Earth's terrestrial surface and water bodies.

The strengths of these new techniques are embedded in the improvements made in the use of multispectral sensors to assess terrestrial surfaces and features, vegetation, and water bodies. The most significant improvements were in the spectral and spatial resolution of the sensors, the ground resolution of the data, the algorithms used to classify the data, and the interpretative skills of the user.

Prior to the seventies remote sensing systems were primarily used by the military to assess terrain conditions, identify and monitor military sites, and weapons inventories. During the late sixties and seventies, we began to test the use of this technology in differentiating soil boundaries (Bower and Hanks, 1965; Myers and Allen, 1968). Several laboratory studies utilizing spectro-radiometers, ground-based multi-band radiometers, and low flying aircrafts using radiometers and optical-mechanical scanners were performed to identify areas of the electromagnetic spectrum that were most sensitive in detecting differences in soils and identifying selected soil properties important in soil mapping (egg., Baumgardner, et al., 1970; Kristof, 1971; Cipra et al., 1971; Mathews et al., 1973; Page, 1974; Montgomery, 1976; Stoner et al., 1980; Coleman and Montgomery, 1987). Soil parameters such as surface texture, percentages of clay, silt and sand, soil structure, mineralogy, organic matter percentage, iron oxide percentages etc, could be adequately predicted using multi-spectral remote sensing (egg., Stoner et al., 1980; Coleman and Montgomery , 1987; Lee et al., 1988a and b).

In 1965 Bowers and Hanks showed that computer-implemented mapping of variations within specific soil parameters was possible. Those findings lead to several studies in which it was soon discovered that useful information could be obtained that could lead to a reduction in the time required to complete a country soil survey. These studies showed that multi-spectral data and computer analyses of these data can be effectively used to produce spectral maps that delineated boundaries between soils (egg., Kristof and Baumgardner, 1975; Westin and Freeze, 1976; Weismiller and Kaminsky, 1978; Seubert et al., 1979; Horvath et al., 1984; Thompson et al., 1984; Coleman and Montgomery, 1985; Lee et al., 1988a and b). Henderson et al. (1989) reported that Landsat Thematic Mapper (TM) data could be effectively used in grouping soils in terms of a broad level of soil classification but not in the detail used in conventional soil classification. However, they pointed out that because TM soil spectral classification depends on the spectral differences between soils, it could be used effectively where there are distinct differences in characteristics such as surface texture, organic matter content, or soil wetness. As research continued, it was discovered that the technology not only could be used to assess surface soil conditions and soil properties as stated above but there was an even grater potential for its use in monitoring vegetation conditions and forest mapping and inventory (egg., Beaubien, 1979; Fox et al., 1983; Benson and DeGloria, 1985; Hopkins et al., 1988; Coleman et al., 1990). It was also discovered that there was a potential for assessing pollution levels in water bodies using remote sensing sensors (e.g., Kritikos et al., 1974; David and Szabo, 1982; Harvey and Soloman, 1984; Amos and Topliss, 1985; Ritchie et al., 1987; Gao and Coleman, 1990).

Fueled by the successes demonstrated using the ground-based, aircraft, and satellite multi-spectral sensors and radiometers for monitoring natural resources substantial improvements were made in the design, spectral range, and spatial resolutions of the current Earth observing satellites and sensors. The French government developed the SPOT satellites that generated data with 10-meter on-ground resolution, the US Space Imaging Company form Colorado developed the Ikonos satellite with 4-meter multi-spectral and 1-meter black & white ground resolution (http://www.spaceimaging.com/products/ikonos/index_2.html), and Russia also develop satellites with 1-meter on-ground resolution for selected applications.

These significant achievements afforded scientists opportunities to focus on developing sensor for specific applications such as the SeaSpace TeraScan Systems. This company provides products such as normalize difference vegetation index (NDVI) of the Earth's vegetation; ocean chlorophyll; cloud products; brightness temperatures of the Earth's surface; snow/ice detection; and fire detection (www.seaspace.com). The NASA scientists and collaborators are developing a series of satellites as part of its Earth Observing System (EOS), an international Earth-focused satellite program aimed at improving our understanding of the Earth/atmosphere system, along with changes occurring within it, through the monitoring and analysis of dozens of Earth variables from a space-based platform orbiting the Earth. One of those satellites is the current Aqua satellite which carries six major Earth-observing instruments. These instruments are; the Atmospheric Infrared Sounder (AIRS); the Advanced Microwave Scanning Radiometer for EOS (AMSR-E); the Advance Microwave Sounding Unit (AMSU); the Clouds and Earth's Radiant Energy System (CERES); the Humidity Sounder for Brazil (HSB); and the Moderate Resolution Imaging Spectro-radiometer (MODIS). Data products available from AIRS/AMSU/HSU include radiative flux products, atmospheric temperature products, humidity products, cloud products, ozone products, trace constituent products, and surface analysis products such as land surface skin temperature. MODIS can provide atmospheric, ocean, and land and ice products. Some of the land products most important to the soil survey program are land surface temperature and emissivity, land cover type and land cover change, leaf area index, snow cover, and thermal anomalies. The AMSR-E products include level 2A brightness temperatures, level 2 and level 3 Rainfall, snow-water equivalent on land, and surface soil moisture (Parkinson and Humberson, 2002).

The electromagnetic induction sensors have been shown to be excellent for identifying sites where soil properties contribute to high or low yields. They also showed relationships between soil nutrients such as phosphorus (P) and potassium (K) and electrical conductivity. However, these relationships were primarily attributed to differences in soil texture and organic matter which resulted in differences observed in cation exchange capacity and the ability of the soil to hold P and K (Heiniger and McBride, 2000).

The algorithms used to classify the data have also improved significantly over the past three decades from the simple cluster (minimum spectral distance) routines to sophisticated neural networks that not only incorporates the spectral and spatial qualities of the data but the surface, subsurface and ecological properties of the area being investigated (Goldberg et al., 1985; Gong and Howarth, 1990; Hung et al., 1997; Hung et al., 1998; Hung et al., 1998; Hung et al., 1999; Hung et al., 2000).

Additionally radar sensors are also being used more to collect remotely sensed data and map land areas. For example polarimetric multi-spectral high-resolution E-SAR data was used to map an agricultural terrain in southern Germany. Using the object-oriented approach of eCognition an advance rule base was defined to classify different basic land use classes and several crop types. The overall accuracy reached 86%. This was comparable to a result derived from hyper spectral data using a similar concept (Muller, 2001).

The development of Geographic Information Systems (GIS) and the Global Positioning Systems (GPS) technology have also emerged recently that added an entirely new dimension to inventory techniques. Combined with multispectral remote sensing these technologies provide a powerful inventory and assessment tool for natural resource managers to use in data collection and interpretation. The GIS offers a robust means of data analyses and predictions while the GPS offers precise location and re-visitation to a given area (Ehlers, et al., 1989; Gugan, 1989; Lo and Shipman, 1990; Coleman, 1992).

There are very few weaknesses, if any, in the use of these new techniques for data collection and interpretation. However, there is a required level of education and computer skills one needs in order to make full use of the technology.

3. How will database strategies change with new inventory techniques and the desire for more complex analysis of soil inventory information?

   The new inventory techniques and the desire for more complex analysis of soil inventory information will require that the strategies to populate the database utilize remote sensing, GIS, and GPS technology. It will be necessary to update the database more frequently than what was done previously because of the public demand for soils information. The remote sensing techniques offer a quick means of data collection and the use of GPS and GIS offers the best possible means of re-visitation to primary sampling units (PSU) and data analyses of change overtime. The older databases will have to be reorganized to allow for the inclusion of remote sensing thematic data layers depicting vegetative cover of the PSU.

4. What is the potential with new inventory techniques to better describe landscapes for site-specific inventories and management?

   There is great potential for development of new techniques to better describe landscapes for site-specific inventories and management. Scientists at universities, private laboratories, and government agencies are engaged in research and development of these technologies to aid natural resource managers in inventory and management operations. There are a number of professional conferences held annually where new technologies and techniques are presented describing site-specific inventories and management techniques. For example, at the 2003 International Geosciences and Remote Sensing Society (IGARSS) Symposium in Toulouse, France (July 21-25, 2003) there are several sessions where over 100 scientific papers will be presented addressing new inventory and analysis techniques.

   Funding agencies are also providing substantial research and development dollars in support of research programs that could lead to new inventory techniques that better describe landscapes and for monitoring the Earth surface and climate. For example, the President's FY '04 budget request for the Networking and Information Technology Initiative is $2.18 billion and increase of 122 million or 6% over last year. The request for the National Science Foundation (NSF) Geosciences Division is approximately $687.9 million of which $144.26 million goes to Earth Science. The requested budget of the United State Geological Survey (USGS) for mapping, remote sensing, and geographic investigations come to $132 million.

This clearly indicates to desire to continue the move toward the full development of these technologies in managing our natural resources.

References:

Amos, C. L., and B. J. Topliss. 1985. Discrimination of suspended particulate matter in the Bay of Fundy using the Nimbus 7 coastal zone color scanner. Canadian J. Remote Sens. 11(1):85-92.

Baumgardner, M. F., S. J. Kristof, C. J. Johannsen, and A. L. Zachary. 1970. The effects of organic matter on multispectral properties of soils. Proc. Indiana Acad. Sci. 79:413-422.

Beaubien, H. 1979. Forest type mapping with satellite data. J. For. 74(8):526-531.

Benson, A. S., and S. D. DeGloria. 1985. Interpretation of Landsat-4 Thematic Mapper and Multispectral Scanner data for forest surveys. Photogram. Eng. & Remote Sens. 51(9):1281-1289.

Bower, S.A., and R. J. Hanks. 1965. Reflection of radiant energy from soils. Soil Sci. 100:130-138.

Cipra, J. E., M. F. Baumgardner, E. R. Stoner, and R. B. MacDonald. 1971. Measuring radiance characteristics of soil with a field spectro-radiometer. Soil Sci. Soc. Am. Proc.35:1014-1017.

Coleman, T. L., and O. L. Montgomery. 1985. Spectral classification of soil characteristics to aid soil survey of Sumter County, Alabama. Alabama Center for Applications of Remote Sensing. Technical Rep. no. 013185. Alabama A&M University., Normal, Al.

Coleman, T. L., and O. L. Montgomery. 1987. Soil moisture, organic matter, and iron oxide content effect on the spectral characteristics of selected Vertisols and Alfisols in Alabama. Photogram. Eng. And Remote Sens. 52:1659-1663.

Coleman, T. L., L. Gudapati, and J. Derrington. 1990. Monitoring forest plantations using Landsat Thematic Mapper data. Remote Sens. Environ. J. 33(3): 211-221.

Coleman, T. L. 1992. Three-dimensional modeling of an image –based GIS to aid land use planning. Geocarto Int. 7(4):47-53.

David, L., and J. Szabo. 1982. Analysis on the spatial distribution of water quality and pollution source of a shallow lake by digital image processing. International Symposium on Remote Sensing of Environment. First Thematic Conference, p. 1023.

Ehlers, M., G. Edwards, and Y. Bedard. 1989. Integration of remote sensing with geographic information systems: A necessary evolution. Photogram. Eng. & Remote Sens. 55:1619-1627.

Fox, L., K. E. Mayer, and A. R. Fobes. 1983. Classification of forest resources from Landsat data. J. For. 81(5):283-287.

Gao, T., and T. L. Coleman. 1990. Use of satellite spectral data for mapping aquatic macrophytes and nutrient levels in lakes. p. 109-116. *In* R. Mills (ed.). *Proceedings, 10th Annual International Geosciences and Remote Sensing Symposium.* 20-23 May 1990. College Park, MD. IEEE Catalog No. 90CH2825-8. The Institute of Electrical and Electronics Engineers, Inc., New York, NY.

Goldberg, M., D. G. Goodenough, M. Alvo, and G. M. Karam. 1985. A hierarchical expert system for updating forest maps with Landsat data. Proceedings of the IEEE. 73:1054-1063.

Gong, P., and P. J. Howarth. 1990. The use of structural information for improving land-cover classification accuracies at the rural-urban fringe. Photogram. Eng. & Remote Sens. 56(1): 67-73.

Gugan, D. J. 1988. Satellite imagery as an integrated GIS component. Proceedings GIS/LIS '88. San Antonio, TX. 1:174-180.

Harvey, J. R., and S. I. Soliman. 1984. Satellite remotely-sensed land-use land-cover data for hydrological modeling. Canadian J. Remote Sens. 10(1):68-91.

Heiniger, R. W. and R. G. McBride. 2000. Using soil electrical conductivity to improve nutrient management. p. 82. *In Agron. Abstr*. American Society of Agronomy, Madison, WI.

Hopkins, P. F., A. L. Maclean, and T. M. Lillesand. 1988. Assessment of Thematic Mapper imagery for forestry applications under Lake States conditions. Photogram. Eng. & Remote Sens. 54(1):61-68.

Horvath, E. H., D. F. Post, and J. B. Kelsey. 1984. Relationships among Landsat digital data and the properties of Arizona rangelands. Soil Sci. Soc. Am. J. 48:1331-1334.

http://www.spaceimaging.com/products/ikonos/index_2.html

http:// www.seaspace.com

Hung, C. -C., M-S. Yang, S. Y. Shin, and T. L. Coleman. 2000. Evolution, fuzzy logic, and neural networks in unsupervised training algorithms. *In Proceedings of SNPD '2000 Conference.* p. 464-468. *In Proceedings of SNPD '2000*. ACIS International Conference on Software Engineering, Applied to Networking and Parallel Distributed Computing. H. Fouchad and R. Y. Lee (eds.). ISBN 0-9700776-0-2. Remis, France.

Hung, C. -C., T. L. Coleman, and V. Atluri. 1999. The radial basis function neural network and genetic K-means for multispectral image classification. p 111-114. *In Proceedings of the ISCA 14th International Conference on Computers and Their Applications*. R. Y. Lee (ed.). ISBN : 1-880843-27-7. The International Society for Computers and Their Applications, Cary, NC.

Hung, C. C., A. Fahsi, and T. L. Coleman. 1998. Integration of digital elevation models and contextual information to improve image classification accuracy. p. 83. *In Proceedings of the 22nd CAPASUS Annual Conference.* 3-5 July 1998, Atlanta, GA.

Hung, C.-C., P. Scheunders, and T. L. Coleman. 1998. Using genetic differential competitive learning for unsupervised training in remotely sensed data p. 4482-4485. *In Proceedings of the IEEE International Conference on Systems, Man, and Cybernetics*. 11-14 October 1998, San Diego, CA.

Hung, C.-C., A. Fahsi, W. Tadesse, and T. L. Coleman. 1997. A comparative study of remotely sensed data classification using principal components analysis and divergence. *In Proceedings of the IEEE International Conference on Systems Man and Cybernetics. Vol*. 3:2333-2339.

Kristof, S. J. 1971. Preliminary multispectral studies of soils. J. Soil and Water Conservation 26:15-18.

Kristof, S. J., and M. F. Baumgardner. 1975. Changes of multispectral soil patterns with increasing crop canopy. Agron. J. 67:317-321.

Kritikos, H., L. Yorinks, and H. Smith. 1974. Suspended solids analysis using ERTS_A data. Remote Sens. of Environ. J. 3:69-78.

Lee, K. S., G. B. Lee, and E. J. Tyler. 1988a. Determination of all characteristics from Thematic Mapper data of a cropped organic-inorganic soil landscape. Soil Sci. Soc. Am. J. 52:1100-1104.

Lee, K. S., G. B. Lee, and E. J. Tyler. 1988b. Thematic Mapper and digital elevation modeling of soil characteristics in hilly terrain. Soil Sci. Soc. Am. J. 52:1104-1107.

Lo, C. P., and R. L. Shipman. 1990. A GIS approach to land-use change dynamics detection. Photogram. Eng. & Remote Sens. 56(11):1483-1491.

Mathews, H. R., R. L. Cunningham, and G. W. Peterson. 1973. Applications of multispectral remote sensing to soil survey research in southeastern Pennsylvania. Soil Sci. Soc. Am. J. 37:88-93. Horvath, E. H., D. F. Post, and J. B. Kelsey. 1984. Relationships among Landsat digital data and the properties of Arizona rangelands. Soil Sci. Soc. Am. J. 48:1331-1334.

Montgomery, O. L. 1976. An investigation of the relationships between spectral reflectance and the chemical, physical and genetic characteristics of soils. Ph.D. Dissertation, Purdue Univ., West Lafayette, IN. Microfilms. Ann Arbor, MI. (Diss. Abstr. 37/08-8:3707).

Myers, V. I., and A. W. Allen. 1968. Electro-optical remote sensing methods as nondestructive testing and measuring techniques in agriculture. Appl. Opt. 7:1819-1838.

Muller, A. 2001. eCognition Application Note. FSU Jena, Institute of Geography. Vol.2(6), August 2001.

Page, N. R. 1974. Estimation of organic matter in Atlantic Coastal Plain soils with a color-difference meter. Agron. J. 66:652-653.

Parkinson, C. L. and W. Humberson. 2002. Aqua Brochure. NASA, Goddard Space Flight Center. Greenbelt, MD. p. 40...

Ritchie, J. C., M. C. Charles, and Y. Q. Jiang. 1987. Using Landsat multispectral scanner data to estimate suspended sediments in Moon Lake, Mississippi. Remote Sens. Environ. J. 23(1):65-81.

Seubert, C. E., M. F. Baumgardner, and R. A. Weismiller. 1979. Mapping and estimating aerial extent of severely eroded soils of selected sites in Northern Indiana. Institute of Electrical and Electronic Engineers. New York, NY, pp. 234-239.

Stoner, E. R., M. F. Baumgardner, R. A. Weismiller, L. L. Biehl, and B. F. Robinson. 1980. Extension of laboratory measured soil spectra to field conditions. Soil Sci. Soc. Am. J. 44:1161-1165.

Thompson, D. R., K. E. Henderson, A. G. Houston, and D. E. Pitts. 1984. Variations in alluvial-derived soils as measured by Landsat TM. Soil Sci. Soc. Am. J. 48:137-142.

Westin, F. C., and C. J. Frazee. 1976. Landsat data, its use in a soil survey program. Soil Sci. Soc. Am. J. 40:81-89.

Weismiller, R. A., and S. A. Kaminsky. 1978. Applications of remote sensing technology to soil survey research. J. Soil and Water Conserv. 33:288.

Fred Young, NRCS, Columbia MO, 4/30/03

What is the national strategy for data collection and data interpretation with the public at large? How will this be applied towards encouraging national and regional interpretations?

I don't have a response on this. I don't think I understand the question. I am not familiar with a "national strategy" on this issue.

What new inventory techniques have emerged recently and what are the strengths and weaknesses of these new techniques?

The allied technologies of GIS and GPS provide powerful tools. GPS improves our capability for accurate georeferencing of sampled pedons. GPS also makes it much easier to conduct random sampling for statistical analysis. For example, one could generate a number of random x, y coordinates from a digital soil map via GIS techniques, then use the GPS to locate and sample these points. Frankly, I don't know how much interest there is in random sampling for statistical analysis in production soil surveys.

Digital line placement via GIS is largely replacing the stereoscope and rapidograph, at least in Missouri. The soil-landform paradigm is generally more consistently applied with stream-mode "heads-up" digitizing over an orthophoto with hypsography lines and perhaps a semi-transparent slope map as backdrops, coupled with field observation and verification. Some landforms (notably footslopes and the backslope/floodplain line) may still need to be verified via stereoscope.

The weaknesses of GIS and models derived via GIS is the allure of a computer model and the notion that if a computer did it, then it must be right. All of our inputs (soil maps, hypsography and the DEM derived from it, orthophotos, etc.) are models of reality, and should not be confused with actual reality. I once gave a brief presentation comparing the differences between a soil survey model of slope vs. the DEM model of slope. There were many areas of disagreement. In some places, it seemed clear that the soil map was wrong. However, in other areas I suggested that interpolation created errors in the DEM-derived slope model: flattening convex ridges, creating non-existent footslopes, etc. After the presentation, a highly placed individual in the NRCS came up to me, complemented me on my presentation, and told me I was wrong in my conclusions about the soil-DEM comparison. The DEM, he assured me, was correct. I disagreed then, and I disagree now. I weary of sitting through presentations at meetings of GIS-based landscape models, wherein results are not verified in the field. GIS provides us with powerful methods of hypothesis generation; we must never forget to test these hypotheses against reality by designing an appropriate sampling scheme and going to the field.

With all the hoopla over GIS and geostatistics (more on this later), many of us seem to have forgotten or are oblivious to the large body of literature on sampling and inventory techniques, and how these are appropriately applied in soil survey. GIS can be of enormous assistance in applying these methods. GIS does not cause these techniques to be obsolete.

How will database strategies change with new inventory techniques and the desire for more complex analysis of soil inventory information?

NASIS (for tabular data) and SSURGO (for spatial data) continue to be our main databases in the soil survey. NSSL laboratory data is a separate database, if I'm not mistaken. Local soil survey offices maintain local databases to suit their needs. As digital databases increase in number, size and complexity, access and database integrity become major issues.

One of the fundamental errors of database management, I believe, is to store the same data in more than one location. It virtually guarantees error, as one source is updated and the other is not. If local survey areas store their own data, and enter it sporadically or inconsistently into NASIS, then where does the "official" data reside, and who has access to it?

Missouri provides a case study (ongoing) of integrating data across databases and agencies. Thanks to State funding we have data on over 8,000 sampled pedons in Missouri. The data resides with the University, and is currently being converted into a Web-accessible database (http://soils.missouri.edu). This database includes not only the laboratory analytical results, but the pedon name, horizon designations, and taxonomic class. Ideally, any sampled/described pedon should be entered into NASIS, perhaps via Windows Pedon. Not all have been entered into NASIS, by a long shot.

Currently, a user can query the web site for data, and get a printable report of pedon data extracted from the database. In the future we would like the pedon description to be available as well, and to have a mapping feature that places a dot (or dots) on a map to show pedon locations. I contend that the pedon description and all site data (location, landform, slope, etc.) should be extracted from NASIS to populate the Web-based database. If the taxonomic class is revised or corrected (based on sample results), this information should be revised in NASIS and then extracted from there; ditto the name ("sampled as" vs. "correlated as").

There are institutional barriers to this. Some offices still have slow internet connections. Windows Pedon works OK for getting data into NASIS one time, but it is possible to enter duplicate pedons (not a good thing). Furthermore, there is no ready-made report to export pedon data from NASIS into a set of tables suitable for reading into a database, such as an Access template. The path of least resistance, and quicker results, would be to provide pedon information directly to the University. But, this establishes a database that duplicates portions of NASIS. I have resisted this. Some offices have developed databases on, for example, pedon locations, but have not entered these data into NASIS, because 1) it's too slow, and 2) they have the data for their own use, and NASIS entry is "low priority" (translation: it's not gonna happen). SO, to get our Web site mapping feature to work, I have to either convince them to do the NASIS entry, or have them send the data directly to the University, thereby abandoning NASIS as an overarching database.

I don't know what the 'optimal" database structure is. A few giant NASIS-type creatures, or a series of smaller databases? What I do know is that compatibility, inter-linking, access by appropriate individuals, and avoidance of duplication are enormous issues facing us as the volume of data increases exponentially.

What is the potential with new inventory techniques to better describe landscapes for site-specific inventories and management?

The potential is quite high, of course. The pedometrics group is constantly developing geostatistically-based interpolation techniques that create impressive soil property maps on small areas. Automated sampling techniques are being developed from the precision agriculture group to supply the massive amounts of data needed to run these models.

A critical question in my mind is, how does this fit in to soil survey? It's one thing to do this on a 160 acre dead-level rice field in the Missouri bootheel, and quite another to approach a soil survey county (or multi-county) update. Most of the presentations I have seen on these site-specific techniques seem oblivious to landform. It's all data, data, data. The precision agriculture people generally sample on a grid; in other words, they assume that all variability is random and inexplicable, at least until the geostatisics reveals trends. For example, the model might show that the topsoil gets sandier close to a little creek. Well, duh! Any GS-7 soil mapper applying the soil-landform paradigm could have figured that out.

I haven't kept abreast with the literature and research as much as I would have liked, but I have not seen the melding of the soil-landform paradigm with the pedometric approach, which I had hoped for.

2003 Conference Committee 4--Recruitment and Retention of Soil Scientists in Soil Survey

This committee is to concern itself with recruitment and retention of Soil Scientists in soil survey and soil resource management.

Charges (Address the following issues):

1. Investigate what incentives and programs are available to the NCSS to recruit soil scientists with Office of Personnel Management for the federal government.
2. What are the reasons that students do not apply for federal jobs when they are made available?
3. What impedes applicants from registering with OPM for positions such as soil scientist or soil conservationist?
4. What scholarships are available nationwide that support students in soil science?
5. Gather recommendations from past national and regional committee reports for retention of soil scientists in agencies and report on progress.
6. Explore options for electronic or internet clearinghouse that improves information flow on positions, student applicants, scholarships, grants, and contacts within NCSS.
7. Promote internships and career intern program in federal government to provide more opportunities for high school and college age students to consider soil science as a career.

Contributors

Joe Moore
Doug Malo
Marty Rosek
Tom Rice
Ginger McGill
Monday Mbila
McArthur Floyd
Dan Fritton
Henry Lin
Randy Southard
Donald Hauxwell
Dewayne Mays
Travis Neely
Neil Peterson
Gary Steinhardt
Cleveland Watts

James Brown
Leander Brown
Steve Carlisle
Margie Faber
Jon Gerken
Warren Henderson
Luis Hernandez
Sheryl Kunickis
Mike Lily
Earl Lockridge
Charles Love
Brian Needelman
Darwin Newton
Randy Southard
Bruce Thompson

Charge 1: **Investigate what incentives and programs are available to the NCSS to recruit soil scientists with Office of Personnel Management for the federal government.**

Discussion at the committee meeting revolved around the need for incentives and challenges in recruiting. Written comments prior to the meeting identified the following incentives:

> The Federal Employees Pay Comparability Act (FEPCA) of 1990 was designed to address recruiting and retention problems of employees in the General Schedule. This pay flexibility is intended to assist in solving recruitment, relocation or retention problems.
>
> The FEPCA included authority to permit agencies to make:
>
> (a) Advance payments of basic pay.
>
> (b) Payment of a recruitment bonus for a newly appointed individual or an individual to whom a written offer of employment has been made.
>
> (c) A relocation bonus to a Federal employee who accepts a position in a different commuting area when, in the absence of such a bonus, the agency would have difficulty in filling the position with a high quality candidate.
>
> (d) Payment of a retention allowance to a current employee if the unusually high or unique qualifications of the employee or a special need for the employee's services makes it essential to retain the employee, and the employee would be likely to leave without a retention allowance.

Details about these incentives are included in the NRCS General Manual, Title 360, Part 407. This can be referenced via the internet at:

> http://policy.nrcs.usda.gov/scripts/lpsiis.dll/GM/GM_360_407.htm

A more detailed discussion of these incentives is also included in the report of Committee 4 from the 2001 National Soil Survey Conference. That document is included in this report as **attachment 1.**

Recommendation: That the Division hold a pool of dollars to be used to assist in recruitment and retention of soil scientists.

Charge 2: **What are the reasons that students do not apply for federal jobs when they are made available?**

Most of the discussion at the committee meeting dealt with one of two points: competition by the private sector for the few qualified candidates, and ineffective methods of advertising positions that are available.

In addition to those issues, written comments noted that many students prefer jobs involving new technology rather than field investigations. Also, signs that students see (declining staff and long term lack of hiring, and threats of outsourcing positions) suggest that federal employment in soil survey is not a wise career choice.

Recommendation 1: That the Division Director elevate an increased pay proposal for Soil Scientists at the entry level (Similar to Engineering discipline)

Recommendation 2: Encourage State Soil Scientists to work with cooperators to utilize WAE, intern program, or other programs to assist in providing job opportunity. Offer incentive for employees who mentor soil scientist.

Recommendation 3: Encourage that recruitment plan be developed by HR and be reviewed with the technical specialists at the state office level.

Charge 3: What impedes applicants from registering with OPM for positions such as soil scientist or soil conservationist?

Discussion at the committee meeting included two main areas: lack of understanding of the open register process, and the difficulty associated with the use of the OPM web site.

In addition to these issues, written comments included the following factors: low pay, private sector competition absorbing most of the available candidates, ineffective methods of communicating or advertising availability of jobs, and lack of willingness on students' part to wait as long as the register method normally takes to identify potential jobs.

Recommendation 1. Develop brochure to explain the process of applying for job through OPM. Request assistance from OPM to assist with the brochure. (Gary Steinhardt of Purdue University expressed a willingness to assist with the implementation of this recommendation.)

Recommendation 2: Communicate with OPM that potential employees express frustration with navigating their Web site.

Recommendation 3. That HR be involved in the follow up on recommended changes to web site.

Charge 4: What scholarships are available nationwide that support students in soil science?

There was no discussion of this charge at the committee meeting due to lack of time.

Written comments included discussion of possible incentives that could be offered. They also encouraged offering and communicating information relating to scholarships.

The following information was provided relating to scholarship availability:

The following OPM web site gives a variety of information relative to student employment and scholarships:

http://www.studentjobs.gov/e-scholar.htm

Also, check out professional organizations and societies. Link to professional societies:

http://soils.usda.gov/education/organizations/pro_soc.htm

- The USDA/NRCS Soil Science Scholarship Program for undergraduates provides the yearly costs for tuition, fees, books, room and board.
- The USDA/1890 National Scholars Program for undergraduates provides tuition, employment/benefits, use of pc/software, fees, books, room and board.
- The American Society of Agronomy administers the following scholarships:
  1) the Harry J. Larsen/Hydro Memorial Scholarship provided to a graduate student in practical soil fertility and crop production in the amount of $5,000
  2) the J. Fielding Reed Scholarship provided to an undergraduate senior in soil or plant science in the amount of $2,000
  3) the Hank Beachell Future Leader Scholarship to a rising junior in agronomy, soil science, or other majors relating to these scientific disciplines in the amount of $3,500 plus travel expenses between the recipient's home base and the scholarship experience site
- The Soil Science Society of America administers the Francis and Evelyn Clark Soil Biology Scholarship to a graduate student in soil biology or biochemistry or microbial ecology in the amount of $2,000.

A list of scholarships and related web sites is included with this report as **Attachment 2**.

Recommendation: Develop a comprehensive list of school grants and loans available.

Charge 5: Gather recommendations from past national and regional committee reports for retention of soil scientists in agencies and report on progress.

There was no discussion of this charge at the committee meeting due to lack of time.

Written comments expressed concern about the effect out sourcing will have on retention of soil scientists.

A copy of the report of Committee 4 from the 2001 National Soil Survey Conference is included with this report as **attachment 1**.

None of the Regional conferences included a committee to address these issues in 2002.

There is no known ongoing activity to address recommendations from the 2001 committee report. Several activities have been undertaken by the Division Director since that meeting including an agenda topic at the 2002 State Soil Scientist meeting and internal communication to all states to make them aware of incentives available.

Recommendation 1: Attach 2001 report as addendum to this report to ensure follow up on those recommendations continues. (Report is attached.)

Recommendation 2: SSD should ensure that recommendations, follow up work and work status be effectively communicated between regional and national conferences and between SSD and partners.

Charge 6: Explore options for electronic or internet clearinghouse that improves information flow on positions, student applicants, scholarships, grants, and contacts within NCSS.

Discussion at the committee meeting included where such a clearing house could be housed and who would maintain it.

Written comments identified and encouraged continuation of internal communication regarding interns that might be available for employment in other states. It was also suggested that programs in other agencies such as USDA-Forest Service be studied for usable ideas.

Recommendation: Explore the possibility that SSSA will host a site for a internet clearinghouse that improve information flow on position, student applicants, scholarships, grants, and contacts with NCSS. **(Randy Southard volunteered to make contact with SSSA)**

Charge 7: Promote internships and career intern program in federal government to provide more opportunities for high school and college age students to consider soil science as a career.

There was no discussion of this charge at the committee meeting due to lack of time.
Written comments identified the following potentially useful web site:

The following USDA web site provides a variety of information on student employment programs:

http://www.usda.gov/da/employ/intern.htm

The link "Recent College Graduates and Experienced Professionals" provides information specific to the Career Intern Program.

The following NRCS web site also provides information on student employment and the career intern program:

http://policy.nrcs.usda.gov/scripts/lpsiis.dll/GM/GM_360_403_i.htm

http://policy.nrcs.usda.gov/scripts/lpsiis.dll/GM/GM_360_403_h.htm

Written comments also strongly supported internships as an important activity to be continued. Comments also restated the importance of having good recruiters making student contacts.

General: A detailed copy of written comments was forwarded to the Soil Survey Division Director for reference. In addition, a copy of those comments will be maintained until the 2005 National Soil Survey Conference, by Jon Gerken, committee chairman. Requests for copies can be sent to:

jon.gerken@oh.usda.gov

Attachment 1 --2001 Conference Committee 4—Recruitment and Retention of Soil Scientists in Soil Survey

Co-Chairs:
Bob McLeese, NRCS, IL
Richard W. Griffin, Prairie View A&M, TX
Committee members: 21 individuals from 11 states and 10 entities

Charge 1: Investigate incentives and programs available to the NCSS to recruit soil scientists with assistance from the Office of Personnel Management (OPM) for the Federal Government.

Incentives available now
Relocation allowances for entry-level employees

1. Recruitment bonuses—up to 25 percent of salary, approved at national level. State Conservationists can use up to 10-15 percent from their state funds. At present, NRCS is suggesting less than the OPM-approved guidelines. Keeping soil scientists for 3 years (or to the GS-9 level) greatly increases the chance of employees remaining with the agencies. Suggestions were offered that State Conservationists be allowed to use up to the 25 percent salary bonus level. According to current OPM statistics: 1) There are currently 1,750 eligible candidates on the soil conservationist (GS-0457) inventory, and 2) there are approximately 500 people on the soil scientist (GS-0470) inventory. A suggestion was made to negotiate a service agreement (such as a 3-year commitment) with recruitment bonuses. We must look at private sector incentives and strive to match or compete at a competitive level. Information from NRCS Human Resources Management, obtained by Ginger McGill, indicated approval of the 25 percent level with

justification letters and quick turnaround being encouraged as part of agency commitment to recruitment and retention.

2. Retention bonuses—up to 25 percent of salary. Discussion focused on: 1) Shortening the eligibility listing; 2) RECRUIT NEW EMPLOYEES AND RETAIN CURRENT EMPLOYEES; 3) 40 percent of previous salary is actual money available at retirement age; 4) Encourage staff to stay on at current positions; 5) Major "brain drain" in USDA in next 5 years; 6) Retention bonuses available for any employee; 7) Entry-level numbers are good, but retaining new employees is the major issue; 8) Retirement and return of current employees as consultants or temporary employees; and 9) "Begging" current employees to stay on for another year or two.

3. Student loan repayment program—up to $6000/year and up to a maximum of $40,000. Information from NRCS Human Resources Management, obtained by Ginger McGill, indicated that no departmental guidance from USDA is presently available. Also, a pilot made for this program is in place for Information Technology and Administration. Additionally, hiring below the GS-9 level without competition may be in conflict with the Leuvano consent decree for administrative positions; however, THIS IS NOT AN ISSUE FOR PROFESSIONAL POSITIONS, SUCH AS SOIL SCIENTIST AND SOIL CONSERVATIONIST. Finally, NRCS is waiting on the USDA to make a decision on this particular item.

4. Additional incentives—Career Intern Program and Student Employment Programs available from the Federal Government based on noncompetitive appointments. Students can sign up for the Career Intern Program long before graduation. Discussion focused on: 1) Recruiting in November and December before summer employment applications; 2) Career Intern Program and Student Employment Programs can be used in combination, thus securing candidates when they are freshman and sophomores; 3) Meeting minimum qualification requirements upon graduation is the only requirement; 4) Marketing of philosophy of soils toward high school students as potential career option; 5) Elementary and 5th grade recruiting is not too early; 6) new, fresh marketing materials must be made available; 7) NRCS employees have linked with the GLOBE program; 8) Grade and pay banding will most likely not be available to the general agency populations of the Federal Government (except through demonstration programs) for 5 years.

Charge 2: What are the reasons that students do not apply for Federal jobs when they are made available?
Discussion focused on: 1) Students may not know about job listings; 2) Students have a preconceived idea that the Federal Government is a big bureaucracy that requires a long waiting period before hiring (this is often because agencies may recruit but then not have any vacancies to fill); 3) Lack of vacancy announcements for entry-level positions; 4) Salaries compared to those of the private sector; 5) Pay scale for soil scientists in the 470 series must be placed in a special salary rate; 6) Flexibility to stay in selected areas with additional experiences gained from details and other agency structured initiatives; 7) Employees given choice of work sites and better inputs on site movement patterns as well as timing; 8) Career days should be attended with focused message based on occupations available in soil science; 9) Encourage soil scientists to actively engage in recruiting and career awareness; 10) Focus on student needs and areas of interest; and 11) Recruiting teams should consist of a Human Resource person, specific jobs person (soil science or conservation), and a supervisory person.

Charge 3: What impedes applicants from registering with OPM for positions such as soil scientist or soil conservationist?

Discussion focused on: 1) Human Resource people know the procedures, but the procedures are unfamiliar to students; 2) State Personnel Office and actual job filling office disconnect is present and must be minimized through communication; 3) RECRUITING DIFFERS FROM EXAMINING; 4) OPM and NRCS inventory model is not targeted toward specific jobs at specific points in time; and 5) Forwarding job requests and applications at the same time can drastically lower applicant waiting time.

Charge 4: Explore options for electronic or Internet clearinghouse that improves information flow on positions, student applicants, scholarships, grants, and contacts with NCSS.

Discussion focused on: 1) Evaluation of transcripts for number of hours for soil science; 2) Curricula being revised constantly; 3) Online database of every single accredited college/university course catalog is currently being used by OPM to assist in evaluating coursework; 4) About 60 percent of transcripts are clear with the remaining 40 percent being unclear; 5) Listserve from GA is older; 6) OPM has a Web page, http://www.usajobs.opm.gov/wfjic/jobs/ck0001.htm, and also an e-mail distribution system that will greatly increase communication with selecting officials and colleges; 6) Online course descriptions are available and continue to be developed; and 7) Strategies and networks need to be developed between universities and agencies.

Action Items

1. Implement a special salary rate for GS 5-11 soil scientist positions nationwide.
    - Entry-level $25,000 for NRCS cannot compete with private sector $50,000.
    - High recruitment turnover and retention problems.
    - Philosophical point: Retention bonuses for younger employees will cause some upper level individuals to become upset; parity and impending retirements force us to be more proactive; and targeted levels may cause intra-agency pirating.

2. State Conservationists should receive a bonus for maintaining personnel goal levels.

3. Soil Scientists must be encouraged to become more active in recruiting.
    - New hires make best recruiters.
    - Undergraduates and interns make excellent recruiters.
    - Business and public contacts development.
    - Interns can actively participate in recruiting.

4. Develop marketing materials for recruitment and retention.
    - OPM is available for formal recruitment training, marketing material development, and recruitment management.
    - Cooperative effort focused on recruiting between state agencies and national agencies.
    - Strategic Plan for NRCS includes national marketing plan for FY 2002.

5. Promote the student loan repayment program so that it is fully supported by USDA.

6. Develop contact lists for NCSS university cooperators, OPM, and agency personnel so that the process can be streamlined and communication greatly improved.
    - Potentially, 50 percent of the soil survey workforce will reach retirement age in the next 5 years.

7. Advance the possibility of Career Intern Program positions not included in the state FTE to develop "overhires" or "floating positions" that have acquired knowledge that will benefit agencies that pool knowledge for future transfer to other employees.

8. Consolidate nationwide mailing list of university contacts with various backgrounds, such as soils, forest soils, and natural resources.
- Check ASA for lists available.
- List of organizations and societies, chat or bulletin boards, and newsletters for posting of announcements and other opportunities.
- Perceived knowledge of soils as related to agriculture as compared with environmental (urban planning, wildlands, range, and forestry).
- State Conservationists' budgets are very tight and highly competitive, so recruitment can be tied to GIS and other technology to use as bonuses for new employees.

9. Develop Career Intern Program Plan so that entry-level employees are adequately prepared for future work.

Attachment 2--Subject: Listing of Scholarship Programs

Following is the listing of scholarship programs shared by Armando Fernandez, Department of Labor. Please share this information with other colleagues in your organization.

1) Ron Brown Scholar Program (major Scholarships)
http://www.ronbrown.org/
2) Scholarships On The Net (1,500)
http://advocacy-net.com/scholarmks.htm
FastWEB Scholarship Search
http://www.fastweb.com/
4) THE HARRY S. TRUMAN SCHOLARSHIP SITE
http://www.truman.gov/
5) THE HISPANIC COLLEGE FUND
http://hispanicfund.org/scholar.html
6) JACKIE ROBINSON FOUNDATION SCHOLARSHIPS
http://www.jackierobinson.org/
7) MARINE CORPS SCHOLARSHIPS
http://www.marine-scholars.org/
8) McDONALD'S Education Scholarships (with UNCF)
http://www.mcdonalds.com/countries/usa/community/education/scholarships/uncf/uncf.html
9) Target Scholarships
http://www.target.com/target_group/community/community_scholarships.jhtml
10) UNITED NEGRO COLLEGE FUND MERCK SCIENCE INITIATIVE
http://www.uncf.org/merck/program.htm
11) ACADEMY FOR EDUCATIONAL DEVELOPMENT FELLOWSHIPS
http://ppia.aed.org/index.html
12) Minority Health Program
http://www.ahcpr.gov/fund/minortrg.htm
13) AMERICAN ASSOCIATION OF HISPANIC CPA's Scholarships
http://www.aahcpa.org/scholar.htm
14) AMERICAN GEOLOGICAL INSTITUTE Minority Geoscience Scholarships
http://www.agiweb.org/ehr/mgsftp.html
15) Minority Scholarships (doctoral students in accounting)
http://www.aicpa.org/members/div/career/mini/fmds.htm
16) AMERICAN SOCIETY FOR MICROBIOLOGY Undergraduate Fellowships
http://www.asm.org/edusrc/edu23b.htm
17) Research Program for Women & Minorities Underrepresented in the Sciences
http://www.research.att.com/academic/urp.html
18) BRISTOL-MYERS SQUIBB Minority Fellowships in Academic Medicine
http://www.bms.com/aboutbms/fellow/data/
19) DEVELOPMENT FUND FOR BLACK STUDENTS IN SCIENCE Scholarship
http://ourworld.compuserve.com/homepages/dlhinson/dfb_sch.htm
20) Tylenol Scholarships
http://scholarship.tylenol.com/
21) Coca Cola Scholarships
http://www2.coca-

cola.com/citizenship/education_scholarsfoundation.html

22) STATE FARM INSURANCE Achievement Scholarships
http://www.statefarm.com/foundati/awards.htm

23) STATE FARM INSURANCE Hispanic Scholarships
http://www.statefarm.com/foundati/hispanic.htm

24) McNair Scholars Program
http://trc.dfrc.nasa.gov/trc/Undergrad/space.html

25) Undergraduate Scholarships (national Institutes of Health Scholarships)
http://ugsp.info.nih.gov/InfoUGSP.htm

26) National Scholarships at all levels
http://scholarships.kachinatech.com/scholars.html

27) The ROTC Scholarships
http://www.todaysmilitary.com/chart_mil_rotc.html

28) Sallie Mae's free Online Scholarship http: file://www.salliemae.com/planning/scholarships.html

29) Scholarship Search - From FreSch!
http://216.110.42.89/search-logon.phtml

30) Astronaut Scholarship Foundation
http://www.astronautscholarship.org/

31) College Fund/UNCF
http://www.uncf.org/

32) Art, Film, Writing Scholarships/Competitions List
http://www.xensei.com/users/adl/

33) Ambassadorial Scholarships
http://www.rotary.org/foundation/educational/amb_scho/

34) NACME Scholarship Program
http://www.nacme.org/univ/scholars.html

35) Athletic Scholarships
http://scholarships-ar-us.org/athletic.htm

36) Baptist Scholarships
http://www.free-4u.com/baptist_scholarships.htm

37) Methodist Scholarships
http://www.free-4u.com/methodist_scholarships.htm

38) Project Excellence Scholarships
http:// www.project-excellence.com

39) Intel Science Talent Search
http:// www.sciserv.org/sts

40) Alpha Kappa Alpha Scholarships
http://www.akaeaf.org/scholarshipprogram.html

41) Discover Card Tribute Award Scholarships
http://www.aasa.org/Discover.htm

42) United States Institute of Peace National Peace Essay Contest
http://www.usip.org/ed/npec/index.shtml

43) Scholarships and Grants
http://www.elclick.com/lulfoundation/html/resources.html

44) Gateway to 10 Free Scholarship Seaches
http://www.college-scholarships.com/free_scholarship_searches.htm

45) Gateways to US Government Grants/money
http://www.students.gov/link_search/listlinks.cfm?cfid=1481339&cftokenv597759&topic01&Criteria=

46) Accounting Scholarships
http://www.aicpa.org/members/div/career/edu/jlcs.htm

47) American Psychological Association (APA) Scholarships and Fellowships
http://www.apa.org/students/funding.html

48) American Sociological Association Graduate funding
http://www.asanet.org/student/funding.html

49) Americorps,
http://www.cns.gov/

50) Minority Scholarships
http://content.sciencewise.com/newscholarship/scholarships3.cfm

51) BELL LABS FELLOWSHIPS FOR UNDERREPRESENTED MINORITIES
http://www.bell-labs.com/fellowships/CRFP/info.html

52) Student Inventors Scholarships
http://www.invent.org/collegiate/

53) Student Video Scholarships
http://www.christophers.org/vidcon2k.html

54) Coca-Cola Two Year College Scholarships http://www.coca-colascholars.org/programs.html

55) Holocaust Remembrance Scholarships
http://holocaust.hklaw.com/

(56) Ayn Rand Essay Scholarships
http://www.aynrand.org/contests/

(57) Brand Essay Competition
http://www.instituteforbrandleadership.org/IBLEssayContest-2002Rules.html

58) Gates Millennlum Scholarships (major)
http://www.gmsp.org/nominationmaterials/read.dbm?ID=12

59) Xerox Scholarships for Students

http://www2.xerox.com/go/xrx/about_xerox/about_xerox_detail.jsp?viewiitorial&id142&sub=2&trk=/Working_at_Xerox/
60) Sports Scholarships and Internships
http://www.ncaa.org/about/scholarships.html
61) National Assoc. of Black Journalists Scholarships (NABJ)
http://www.nabj.org/html/studentsvcs.html
62) Saul T. Wilson Scholarships (Veterinary)
http://www.aphis.usda.gov/mb/mrphr/jobs/stw.html
(63) Thurgood Marshall Scholarship Fund
http://www.thurgoodmarshallfund.org/sk_v6.cfm?rdn=&CFID806&CFTOKEN301928
64) FinAid: The Smart Students Guide to Financial Aid (scholarships)
http://www.finaid.org/
65) Presidential Freedom Scholarships
http://www.nationalservice.org/scholarships/
66) Microsoft Scholarship Program
http://www.microsoft.com/college/scholarships/minority.asp
67) WiredScholar Free Scholarship Search
http://www.wiredscholar.com/paying/scholarship_search/pay_scholarship_search.jsp
68) Hope Scholarships & Lifetime Credits
http://www.ed.gov/inits/hope/
69) William Randolph Hearst Endowed Scholarship for Minority Students
http://www.apsanet.org/PS/grants/aspen3.cfm
70) Multiple List of Minority Scholarships
http://gehon.ir.miami.edu/financial-assistance/Scholarship/black.html
71) Guaranteed Scholarships
http://www.guaranteed-scholarships.com/
72) BOEING scholarships (some HBCU connects)
http://www.boeing.com/companyoffices/educationrelations/scholarships/
73) ROTC Military Scholarships (Navy, Army, Marines, Airforce)
http://www.todaysmilitary.com/chart_mil_rotc.html
74) Easley National Scholarship Program
http://www.naas.org/senior.htm
75) Maryland Artists Scholarships
http://www.maef.org/
76) Jacki Tuckfield Memorial Graduate Business Scholarship (for AA students in South Florida)
http://www.jackituckfield.org/
(77) Historically Black College & University Scholarships
http://www.iesabroad.org/info/hbcu.htm
78) Actuarial Scholarships for Minority Students
http://www.beanactuary.org/minority/scholarships.htm
79) International Students Scholarships & Aid Help http://www.iefa.org/
80) College Board Scholarship Search
http://cbweb10p.collegeboard.org/fundfinder/html/fundfind01.html
81) Burger King Scholarship Program
http://www.bkscholars.csfa.org/
82) Siemens Westinghouse Competition
http://www.siemens-foundation.org/
(83) GE and LuLac Scholarship Funds
http://www.lulac.org/Programs/Scholar.html
84) CollegeNet's Scholarship Database
http://mach25.collegenet.com/cgi-bin/M25/index
85) Union Sponsored Scholarships and Aid
http://www.aflcio.org/scholarships/scholar.htm
(86) Federal Scholarships & Aid Gateways
http://www.fedmoney.org/
87) 25 Scholarship Gateways from Black Excel
www.blackexcel.org/25scholarships.htm
88) Scholarship & Financial Aid Help
http://www.blackexcel.org/fin-sch.htm
(89) Scholarship Links (Ed Finance Group)
http://www.efg.net/link_scholarship.htm
90) FAFSA On The Web (Your Key Aid Form & Info)
http://www.fafsa.ed.gov/
(91) Aid & Resources For Re-Entry Students
http://www.back2college.com/
(92) Scholarships and Fellowships
http://www.osc.cuny.edu/sep/links.html
93) Scholarships for Study in Paralegal Studies
http://www.paralegals.org/Choice/2000west.htm
94) HBCU "Packard" Sit ABroad Scholarships (for study around the world)
http://www.sit.edu/studyabroad/packard_nomination.html
(95) Scholarship and Fellowship Opportunities
http://ccmi.uchicago.edu/schl1.html
96) INROADS internships
http://www.inroads.org/
97) ACT-SO aEURoeOlympics of the Mind" Scholarships
http://www.naacp.org/work/actso/act-so.shtml
98) Black Alliance for Educational Options Scholarships
http://www.baeo.org/options/privatelyfinanced.jsp

99) ScienceNet Scholarship Listing
http://www.sciencenet.emory.edu/undergrad/scholarships.html
100) Graduate Fellowships For Minorities Nationwide
http://cuinfo.cornell.edu/Student/GRFN/list.phtml?category=MINORITIES

101) RHODES SCHOLARSHIPS AT OXFORD
http://www.rhodesscholar.org/info.html
102) The Roothbert Scholarship Fund
http://www.roothbertfund.org/scholarships.php

NCSS 2003 Committee 5--Water Movement and Water Table Monitoring in Soil Survey

Committee charges and committee members

Charges:
This committee will explore and discuss how soil survey should address water movement and water tables for regional updates of the soil survey and database representation.

1. This committee will review water table studies nationally to formulate regional guidance of measurement techniques, database documentation and interpretations for taxonomy and practical user applications in soil survey.
2. What are the lessons learned from the Wet Soil Monitoring Project, 1990-2001 that could be applied for future studies?
3. How might studies of regional or local hydrology apply to updating and refining soil survey information?
4. How might the concepts of hydro-pedology apply to soil survey?
5. How may Sub-Aqueous Soil Mapping be incorporated in soil survey?

Co-Chairs:
Henry Lin, PSU (henrylin@psu.edu)
Cathy Seybold, NRCS (cathy.seybold@nssc.nrcs.usda.gov)

Committee members:
Bob Arhens
Al Averill
Steve Carlisle
Craig Ditzler
Karen Dudley
Wayne Hoar
Wayne Hudnall
Wes Miller
Carolyn Olsen
Marty Rabenhorst
Lee Norfleet
Ron Paetzold
Moye Rutledge
Mike Sucik
Doug Wysocki
Lyle Steffen
Phil Schoeneberger
Larry West

Other people who provided inputs:
Nancy Cavallaro
Bill Effland
John Galbraith
Warren Lynn
Monday Mbila
Jerry Moore

Charge 1: This committee will review water table studies nationally to formulate regional guidance of measurement techniques, database documentation and interpretations for taxonomy and practical user applications in soil survey.

- There are numerous water table studies going on across the country. But these studies have diverse objectives, and protocols have been tailored to meet those particular ends. It would be a step in the right direction if the committee could recommend minimum requirements for water table field data specifically for NASIS purposes. Discussion of factual databases (site data) and generalized databases (NASIS) should be kept separate, and be clearly identified. While numerous water table studies have been cited, a large percentage of soil series do not have the benefit of real field data supporting their water table information. This information is filled out in NASIS, but is either inferred from apocryphal data in a similar soil series or is guessed at in a more straight-forward way. We should be thinking of some threshold of real data, perhaps on a soil survey area or MLRA basis, to support soil series.

- Ron Paetzold and Deb Harms have developed monitoring instrumentation and protocols. The only way to obtain records long enough to encompass climatic variability is by permanently installed sensors/instruments at stable sites, with automated electronic recording of data. Funding for maintenance is essential.

- Once the committee has accumulated a significant volume of water table data, there are a great number of applications for the data. The data could be used directly for populating the depth to water fields in NASIS. Soil taxonomy specialists could use the data to add to their knowledge of soil moisture regimes in different landscape settings which could result in modifications to soil classification. One of the best uses of the water table study data would be to more fully develop the relationships between soil profile descriptions and water movement in soil profiles and landscapes. This information would vastly improve the value of our Order 2 soil surveys and any updates. Soil scientists could describe the pollutant pathways in different soil landscapes and add that information to soil survey publications. If landowners, conservation planners, and other natural resource managers see and understand these pathways, they can adopt more effective management strategies to protect surface and ground water.

- The committee should pursue the development of soil-landscape models of water movement for a number of different sites across the country. Study site selection would involve combinations of different landscapes in different climates in both open and closed drainage systems. The committee should also pursue the feasibility of extrapolating the models to unstudied sites. The models would be of benefit to many users of soil information and to soil scientists involved in both soil survey mapping and updates.

- One of the most important items the committee should address is to refine the definition of aquic conditions and aquic suborders in Soil Taxonomy to include duration of saturation and reducing conditions. Current criteria in Soil Taxonomy (Second Edition, Soil survey Staff 1999) do not specify duration of saturation or reduction for aquic conditions. Because of this, many upland soils in the Texas Gulf Coast Prairie with episaturation and reducing conditions for very brief periods could be classified the same as prairie depression soils that pond, saturate and reduce for up to six continuous months each year.

- There is a need for technical guidance on making interpretations of climate and seasonal high water tables (SHWT) data. For example, during the past 35 years (1961 to 1996) in Victoria County, TX, there were 8 years with normal precipitation, 16 years above normal precipitation, and 11 years below normal precipitation. During the past 35 years, considering all of the years, there were 3 years with 5 months "normal" precipitation (other months in yearly precipitation were either below or above monthly normal), 3 years with 6 months normal precipitation, 1 year with 7 months normal precipitation, and 0 years with 8 months normal precipitation. Considering the 8 years with normal yearly precipitation during this time period, months with normal precipitation in these years ranged from 2 to 7 months. The average normal months in each normal year was 5. Therefore, in the central Texas Gulf Coast Prairie and based on this analysis, we would never meet the current standard in Soil Taxonomy for a "normal year" for soil moisture studies.

Charge 2 - What are the lessons learned from the wet-soil monitoring project, 1990-2001 that could be applied for future studies?

- Field Measurement of Reducing Conditions in Soils Using Platinum Electrodes and Alpha, Alpha Dipyridyl Dye: Several items and procedures were incorporated into the Technical Standards for Hydric Soils. A recent study by Dr. Phillip Owens as part of his Ph.D. field study of soil reducing conditions with Pt electrodes suggests the use of quality water proof or marine grade epoxy on the copper wire/Pt electrode connection for better accuracy and longer lasting field use of the Pt electrodes. Dr. Owens also conducted a critical examination of the best standards to use for testing the Pt electrodes before field use.

- Landscape position concept to assist with determining location and interpretation of other wet soils in similar landscape positions: This concept has proven to be very sound and has been used on numerous occasions to assist with classification and interpretation decisions. The concept is as follows: *The hydrologic nature of a wetland is the result of the balance between inflows and outflows of water, the soil and landscape topography in the wetland, and subsurface conditions. Major hydrologic inflows include precipitation, flooding rivers, surface flows, groundwater, and in coastal wetlands, tides. In the Texas Gulf Coast Prairie most upland areas that have wetland hydrology occur on landscape positions that receive run-on water from surrounding landscapes to cause wetness over and above normal precipitation. Other upland areas have a seasonal high water table due to high rainfall and impermeable layers below the soil surface or a ground water table that seasonally rises close to the surface.*

- In the past, before wet soil studies were conducted in Texas, soils were classified and interpretations made mainly based on soil color and landscape position. In many areas of TX, and especially in the Texas Gulf Coast Prairie MLRA, almost all upland Alfisols, Mollisols, and in some cases Vertisols, had gray colors with redox features in their subsoil. According to Soil Taxonomy at that time, soils with gray colors and mottles (redox features) were assumed to be wet and have high seasonal water tables (endosaturation). Several studies have shown that many of the soils with gray subsoils were currently not as wet as previously thought. The colors in these soils very likely formed during past geological wetter climates and therefore were relict features. Most of the soils in these studies were episaturated for brief periods, and the soils that had gray subsoils with redox features that did have long periods of either epi or endosaturation occurred in landscapes as described in the previous concept.

- Criteria for hydric Vertisols (Reduced Vertic Technical Standard) are forthcoming, including periods of saturation, reducing conditions, and thickness of horizons for the reducing conditions. Initial review of the field data from the Bottomland Hardwood Vertisol study in Texas indicates that 2 of the 3 ponded areas have a prevalence of hydrophytic vegetation, pond, saturate, and reduce (upper 30 cm, based on Pt electrode readings and AADP tests) for at least 4 cumulative weeks each year, but do not have readily visible soil redox features. The third site ponds at least 6 continuous months each year, and in most areas meets all 3 current wetland criteria.

- Flowing water and soil reducing conditions: moving water retards the onset of Fe reduction in soil. Many measurements of episaturation and ponded conditions in Texas during the past 15 years indicate that the upper 5 to 15 cm of the soil under these conditions at the soil/water boundary will reduce (alpha, alpha dipyridyl test and Pt electrodes) within a 2 to 7 day period.

- Equipment: The electronic equipment in some studies was very difficult to install and maintain under field conditions and required a lot of repair time. Initial review of the automated equipment data compared to actual field measurements indicates that automated data accuracy was not as great as expected, and the data will need to be adjusted to reflect actual field conditions. Frequent periodic checks of actual field conditions using automated equipment and data loggers are strongly recommended.

Charge 3 – How might studies of regional or local hydrology apply to updating and refining soil survey information?

- Wet soil study on a MLRA or smaller area basis is very important. We need to continue wet soil monitoring projects in other landscapes. We need to develop standards and guidance for interpreting and using the data.

- Water table studies in paired wetland situations to examine the effects of drainage on wetland hydrology and relict redoximorphic features are what we would want to support.

- The area of focus should not be only on hydric soils. The Lower Mississippi Valley is one of the most economically depressed areas in the U.S. If their soils are not as bad (for many uses) as we had thought, let's give the poor devils some good news.

- Soil survey water table information is static. Need to get dynamic water table information into NASIS data and interpretations.

- The preliminary results from an on-going water table monitoring in southeast MA indicate that the duration and period of SHWT is in contradiction with conventional interpretations as published in soil surveys.

- Pedologic processes produces heterogeneity and usually enhances discontinuities inherited from parent materials. Strength and expression of structure increase with time. Generally peds increase in size and shape related to depth in the soil. However, changing the moisture content of most soils changes the relative volumes of peds and pores, adding to the complexity of finding mathematical solutions for modeling water movement in a pedon. A model of water movement in a "soil" (pedon) in the context of a generalized database (NASIS) is likely impossible.

- 3D block diagrams are good representations of "expert knowledge" or conceptual models of soil-landscape relationships. Such block diagrams could be enhanced to help 1) develop conceptual models for water movement over the landscape and 2) link dynamic soil properties to landscape position and soil hydrology. For example, landscape hydrology may be conceptualized using 3D block diagrams to illustrate water flow direction and water table dynamics.

- We will make good progress if we have good information on geomorphology.

Charge 4 – How might the concepts of hydropedology apply to soil survey?

- By standardizing and promoting water table data acquisition, and utilizing the results of the "1990-2001 Wet Soils Monitoring Project," we should have a good foundation for beginning to more fully integrate many of hydropedology concepts into the soil survey program.

- Until we learn much more about water movement in soil profiles in real landscapes, we will probably not be able to develop new ways of predicting watershed and stream runoff volumes and patterns.

- Standardize how Ksat should be measured or estimated for input into the NASIS.

- The 5 charges of the Committee #5 are interrelated (with the possible exception of charge #5). Hydropedology could serve as an umbrella framework for addressing all these charges.

- There is a growing recognition that synergy could be generated by bridging traditional pedology with soil physics and hydrology to enhance integrative studies of landscape-soil-water relationships across spatial and temporal scales. Hydropedology is suggested as such a bridge that addresses: 1) knowledge gaps between pedology and soil physics, hydrology, geomorphology, and other related disciplines; 2) multiscale bridging from microscopic to mesoscopic and to macroscopic observations of soil-water interactions; and 3) data translations from soil survey databases into soil hydraulic information. The bridging of disciplines, scales, and data represents potentially unique contributions of hydropedology to integrative soil and water sciences and to the modern soil survey programs. Note that hydropedologic investigations should not be limited to the top two meters of the earth's surface but extend well into the deeper vadose zone. This requires a concerted effort to study the soil and underlying material to whatever depth is needed to meet our scientific needs.

- Hydropedology shifts the focus of classical pedology to a hydrology-driven approach reflecting the crucial role of water in many environmental and ecological processes. Fundamental issues in hydropedology may include: 1) Hydrology as a factor of soil formation and a driving force of soil dynamics; 2) Soil as an essential component in hydrologic cycle and a living filter for water quality; 3) Soil morphology as signatures of soil hydrology; and 4) Landscape-soil-water relationships across scales. Hydropedology intends to establish foundation knowledge of water movement in soil profiles, catenas in landscapes, and watershed/regional soil hydrology (e.g., MLRAs).

- Fuzzy logic application to soil mapping (as in the SoLIM approach) is being embraced by the NRCS as a significant advancement. One area that seems to be of critical importance in the successful applications of SoLIM in the area of capturing expert knowledge. Fundamental to such expert knowledge is the underlying soil-landscape relationships, which should include the role of hydrology. Hydropedology could potentially provide the enhanced scientific foundation to the successful applications of the SoLIM or any other applications of advanced technologies.

- Systematic understanding of the role of hydropedology in modern soil surveys include issues of bridging disciplines, scales, data, and education.

  1. Issues of knowledge gaps ("bridging disciplines"):

  - There is a need for integrated studies of the vadose zone/groundwater systems in understanding the role of hydrology in pedogenesis (physical, chemical, and biological), soil morphology (redox, hydric soil field indicators, water table dynamics, soil structure, etc.), classification, mapping, pedodiversity (variability), and biogeochemical processes. The role of hydrology in soil formation factor equation, generalized processes of soil formation, catenas, and soil-landscape relationships would provide enhanced scientific foundation for soil survey and mapping. For example, we should emphasize more on processes and systems linkages over soil-forming factors. Processes operate as a continuum; this is especially true of the processes driven by water in landscapes.
  - The importance of conceptual models of landscape-soil-water relationships could not be underestimated. "Where, when, and how" water moves through various landscapes and how water flow impacts soil processes and subsequently soil spatial-temporal patterns need to be better understood. In developing such conceptual models, we need to fully recognize the importance of stratigraphy and geomorphology in the role of hydrology in soil survey and mapping.
  - In addition, we may want to develop a soil classification for water flow and chemical transport characteristics. This could have significant practical applications, such as estimating a priori how important preferential flow is in a given soil, especially when it is linked to soil map units.

  2. Issues of scales ("bridging scales"):

- Scale transfer or multiscale bridging remains at the heart of many pedologic and hydrologic studies. Both pedologists and soil physicists/hydrologists have studied scale issues and spatial-temporal variability, but their efforts did not seem to have converged well in the past. The need for a systematic understanding of regional vs. local hydrology and modern- vs. paleo-hydrology in soil formation, morphology, and distribution is evident. We all recognize the need for better documenting and quantifying soil map unit variability in soil surveys. Also in need is a better understanding of spatial-temporal patterns of soil-water properties and processes from pedon to landscape and from annual to geological time scales.
- There is a need of theory for spatial aggregation (or upscaling) and disaggregation (or downscaling) of soil information. Two general conceptual frameworks are useful for hierarchical multiscale bridging in hydropedology. They are: 1) hierarchy of soil mapping (for soil distribution) and 2) hierarchy of soil modeling (for soil processes). The soil mapping hierarchy depicts soil spatial distribution over landscapes of varying sizes, considering five orders of soil surveys, spatial aggregations of soil map units, and various applications of geostatistics. The soil modeling hierarchy centers on soil process models. Current generation of surface and subsurface process models is strongly scale-dependent because of process representations, parameter requirements, and changes of support in model variables.
- We should emphasize the importance of soil maps, DEMs, land uses, and others in enhancing the use of geostatistics and the prediction of spatial-temporal patterns of soil properties across various landscapes.

3. Issues of data ("bridging data"):

- "Data rich, information poor" has been a common syndrome in many disciplines. This problem is largely due to data fragmentation, incompleteness, incompatibility, inaccessibility, or simply lack of interpretation or synthesis in spite of past extensive and costly data collections. For example, it is recognized that gaps exist between what we have (e.g., the National Cooperative Soil Survey Program databases) and what we need (e.g., dynamic soil properties required for simulation models). Improved procedures to extract useful information from the available databases through approaches such as PTFs and to interpret soil survey data for flow and transport characteristics in different soils and landscapes are very much needed. There are considerable benefits of formulating reliable PTFs for estimating soil hydraulic properties and for propagating data in the NASIS. Along the line of data issues, there is an obvious need to establish common methodologies for systematic and comparable data collections, documentations, and interpretations. This could benefit many nation wide programs such as wet soils monitoring, water table studies, hydric soils, and many others.
- Hydropedology could serve as a useful framework for bridging the gaps between dynamic soil properties and traditional soil survey databases. The idea of developing a dynamic soil properties database into the NCSS program is an encouraging one, which, once developed, would significantly enhance the values and applications of soil survey databases.
- The concept of "genoform" vs. "phenoform" as suggested by Droogers and Bouma (1997) is helpful in documenting use-dependent soil properties. "Genoform" is for genetically defined soil series and "phenoform" is for soil types resulting from a particular form of management in a given genoform. Such distinction between major soil management types within the same soil series could separate in concept the

reason morphogenetic properties used in taxonomic units while near surface temporal properties used in cartographic units that are management driven soil survey units.

- Quantification of soil morphology would vastly improve the value of soil surveys and updates, facilitate the development of PTFs, and permit a better assessment of soil profile descriptions in relation to water movement in soil profiles and landscapes. While qualitative use of soil morphology has been widely applied in the past, quantification of such data is generally lacking. For example, Ksat business is important for the NRCS. There are two relevant large programs already in existence in the NRCS: one is soil mechanics with lots of matrix Ksat determined (with consideration of rock fragment in some cases) and the other is official soil profile descriptions containing huge in situ soils information (including soil structure and sometimes macropores-related features). It would be desirable to find ways to combine the above two programs to provide more realistic estimations of Ksat for diverse field soils.

4. Issues of education ("bridging education"):

- Essential knowledge and skills needed for hydropedology students include landscape hydrology, geomorphology, soil mapping, soil physics, ecosystem science, geospatial techniques, geostatistics, environmental modeling, systems engineering, and others.
- New frontiers in education usually start with postgraduate research, the inoculation of MS and then Ph.D. programs, then trickle down to undergraduate programs, trickle down further to high school courses and eventually into elementary educational programs.
- Perhaps there is a merit of hydropedology as an interdisciplinary area for the NRCS Graduate School Program.

Charge 5 – How may sub-aqueous soil mapping be incorporated in soil survey?

- This committee should pass on this charge. This is a specialized topic that should probably be addressed by an entirely different national committee.

- The NRCS needs to apply a great deal of discipline to funding and supporting sub-aqueous soil survey activities. Human nature being what it is, there will be some clamor to implement these techniques wherever there are personnel interested in distinguishing themselves by jumping on the bandwagon of an emerging technology. This is self-determination, and in the NRCS there is great latitude for that kind of self-expression. Sub-aqueous soil survey techniques could be implemented in a great many places with a modicum of creativity. So there is potential, if the application of these techniques is uncontrolled, for the funding pie to be cut in too many slices to support high priority applications adequately. In addition, the NRCS field personnel are at an all time low, and the few that remain in the field need to be used efficiently.

- All potential sub-aqueous mapping projects are not created equally, and the geographic distribution of such projects is not uniform. For example, there are shallow water habitats throughout New York State, but it serves no great exigent purpose to separate one type of lily pad pond from another. On the other hand, Jamaica Bay, and the estuary of the lower Hudson River is vital to the human ecology of millions of people, and for that reason, millions of dollars are being spent assuring the viability, or attempting the restoration of SAV or benthic organisms. In terms of the distribution of high priority sub-aqueous mapping areas, with few exceptions, they are concentrated on the accretionary coast line from Maine to Florida. The west coast is for good reason characterized as an erosional coastline.

- Current soil survey activities in Texas concerning Sub-Aqueous Soil Mapping will primarily be along the Texas Gulf Coast and barrier islands. Work in these areas concerning new soil survey and updating old soil surveys has started, but we have not developed soil series or mapping unit concepts concerning subaqueous soils.

Recommendations and action items

Charge 1: This committee will review water table studies nationally to formulate regional guidance of measurement techniques, database documentation and interpretations for taxonomy and practical user applications in soil survey.

Recommendations and actions:

- To develop a soil survey investigation report (SSIR) on water table studies (the Soil Temperature SSIR could be used as a model.). The technical note could include the following subjects:

  - Basic concepts and standard terminologies
  - Designing a water table study.
  - Guidelines on how to identify the prevalent depth of water, with particular treatment of episaturation (perched water tables) vs. endosaturation (permanent groundwater tables), and their seasonal distribution.
  - How to stratify study designs (minimum data collection, vs. additional specific requirements for different kinds of studies (e.g. hydrologic, vs. contaminant , vs. food & fiber production studies, etc.)
  - Considerations in locating observation wells and piezometers, including some criteria for site selections (e.g., in benchmark soils, a catena or a sweet of soils that occur repeatedly in a soil survey area rather than isolated spots in the landscape). Need to monitor a) catenas rather than isolated soil types; b) major soils such as benchmark soils (extensive) rather than unusual or minor soils (except where substantial ecological or economic significance warrant it).
  - Site selection : sites should be carefully chosen to be geomorphically consistent or representative (i.e. summit – shoulder – backslope - footslope, toeslope vs. headslope – sideslope – noseslope, etc; avoid transition breaks).
  - Designing & constructing an observation well
  - Designing & constructing a piezometer and nested piezometers
  - Duration and frequency for measuring water levels (need to record data twice a day or daily using automated devices to capture the rate of change and duration. Once every two weeks or monthly is too coarse)
  - Spatial interpolation and extrapolation of water table data (including mapping water table elevation)
  - Linking water table observations to long-term climate records (e.g., the SCAN data links climate to water table data at selected sites). Emphasize advantage of placing results into the larger climatic record (dry years vs. wet years, both to explain the results observed and to extrapolate to key “what if …” climatic scenarios [possible tie in with the ICOMOTER 30-year soil moisture/rainfall map.].

- Emphasize the need for duration as well as height of water tables. Note the differences (advantages / disadvantages) of using continuous recording data loggers vs. static measurements (one reading every week or two)
- Other ancillary data collections (e.g., redox)
- Data interpretations and applications
- Record keeping
- Must record elevation of all sites (to facilitate developing potentiometric head models /flownet models.

• To find a way to coordinate among MOs for consorted efforts in water table monitoring (e.g., forming a team or committee). Should establish a coordination team to promote common approach (data methods, presentation,) for NRCS funded projects to make collected data comparable and more robust. This will ensure similar monitoring and data collection across the nation, and provide for coordination between funded studies.

• To conduct a survey (in a "check the box" format) to gather additional information regarding water table studies nation wide. Suggested questions could include:

- Location (MO, State, Co., geo-coordinates if available)
- Study leader & contact information
- Beginning & ending dates of study
- Purpose (annual fluctuation in depth to water, seasonal direction of movement, regional direction of movement, surface and ground water relationships, etc.)
- Type of study (pedon, transect, catena, or landscape)
- Climate (MAAT & MAP and soil moisture & temperature regime)
- Present land use
- Soil Series or soil map units studied
- Open or closed drainage system (locally in the study area)
- Unconfined or confined ground water system
- Methodology (test holes, pits, observation wells, piezometers, other)
- Number of measuring points (no. of wells, etc)
- Type of data collected (water surface elevation, pressure head, other)
- Accessibility of data (paper records, spreadsheet, database, other)
- Report published (reference)

Charge 2: What are the lessons learned from the wet soil monitoring project, 1990-2001 that could be applied for future studies?

Recommendations and actions #2:

• To put the wet soils monitoring data and all the relevant information on a CD-ROM and on the web. This effort should be expedited. The CD should include the following:

- All the data collected, and should be organized in a common format (A wet soil monitoring database is being developed by Warren Lynn)
- Methodology—what was tried, learned, and ultimate recommendations
- Funding and logistics: a) the highly effective approach of agencies providing seed money that can then be leveraged by researchers into viable funding from other sources; and b) coordination between participants to enable comparisons of data
- Key findings of the collective projects (highlights, overview, and summary of all products generated)

- Summary of the wet soils monitoring protocols and lessons learned
- All the relevant reports, publication list, and complete data sets.

- The committee should take on the task of actually analyzing the data and publishing the findings. Such a report would become a valuable tool for many in the NCSS.

- There is an increasing need to substantiate, with hard data, national and local standards as well as interpretations based on soil morphology. Expert opinion is no longer sufficient, especially in litigious situations.

Charge 3: How might studies of <u>regional or local hydrology</u> apply to updating and refining soil survey information?

Recommendations and actions #3:

- To compile a set of enhanced 3D block diagrams with added information of water table dynamics, water flow paths, hydric soils, restrictive layers, and other relevant information (to be part of the soil survey report). These block diagrams could serve as valuable conceptual models of water movement over the landscape in different soils and regions (e.g., MLRAs). It is suggested that the notes and arrows be added to the block diagram in the report and in the text.

- Three-D block diagrams are already underway by the NRCS's Soil Hydrology Team (chair: Schoeneberger) that has been compiling conceptual models, not only 3-D block diagrams of water flow but also developing matrixes and graphical examples of relevant factors that affect or control water movement through landscapes, e.g. specific climatic influences (regional, local, and recurrent ephemeral variations), pedo-stratigraphy, geo-stratigraphy, vegetation, and geomorphic and geographic contexts (settings). These materials are being compiled as a collection that can be drawn from for inclusion in soil survey reports or other soil geographic applications.

- If possible, a prototype of interactive 3D block diagram covered with color airphoto and linked with a dynamic flow simulation model be developed as a tool for refining and educating soil-landscape relationships.

Charge 4: How might the concepts of <u>hydropedology</u> apply to soil survey?

Recommendations and actions #4:

- To promote hydropedology as a useful framework for modern soil surveys and updates. To suggest hydropedologic studies as a priority research area in the NCSS. To suggest that the NCSS explore and promote the emphasis of water movement through landscapes as a lucrative framework for modern soil surveys and soil science in general.

- Based on the outcomes of the above three actions, develop a set of standard protocols for whole landscape hydropedologic studies. A new initiative is proposed for a nation wide coordinated hydropedologic study in major MLRAs. Such a new initiative may be considered as a step forward after the national wet soils monitoring project, but the soils to be studied should be more diverse. The proposed new initiative may consider the following:

- Establishing a long-term monitoring network for soil moisture, water table, hydraulic properties, and other dynamic soil properties in major types of soil-landscape systems using a set of common methodologies for data collection, analysis, and modeling. This network may be linked to the existing SCAN network for automatic data collections and synthesis.
- Studies could be initiated in several major and diverse MLRA's. This could include a nationally distributed and coordinated network of water table monitoring of catenas of major soil types and representative of major physiographic/landscape systems. Where possible, these projects should be coupled with existing study sites that provide climatic data (e.g., SCAN sites) and stable LTER's in order to minimize monitoring costs, maximize results, and to avoid redundancy of data acquisition.
- Development of comprehensive quantitative models of water movement over the landscape in a number of different soil-landscape systems across the country (major MLRAs).

Charge 5: How may sub-aqueous soil mapping be incorporated in soil survey?

Recommendations and actions #5:

- We recommend that a new committee be formed to address sub-aqueous mapping.

2003 Conference Committee 6--Report of the National Technical Committee for Hydric Soils(NTCHS)

Karl W. Hipple, National Leader, Soil Survey Interpretations and Chair NTCHS

The NTCHS did not meet formally during this conference because we had concluded our relevant business at the January 29-February 3, 2003 meeting at the National Soil Survey Center (NSSC) in Lincoln, NE. However, I would like to update you on several key issues and decisions from that meeting.

The first item of note is that the NTCHS would like to announce two new members. Dr. David Zuberer from Texas A&M University will fill an existing academia vacancy on the committee created when Steve Faulkner took a new job. Dr. Zuberer's expertise in soil microbiology is an excellent addition to the committee. Ralph Spagnolo from US EPA will also join the NTCHS to replace Bill Sipple who retired. Ralph is also a member of the Mid-Atlantic Hydric Soils Committee.

As announced earlier, the test indicators are being reviewed with the intention of approving or rejecting each of them in the near future. The NTCHS is issuing a "call for data" to support near term discussions and decision-making regarding the existing test indicators. Data should be sent to Wade Hurt, Chair of the NTCHS Field Indicator Subcommittee by June 2004. Decisions regarding the existing test indicators will be made during the 2005 NTCHS meeting. The process to propose test indicators has also been modified somewhat and is published in the *Field Indicators of Hydric Soils in the United States*, version 5.01. Data requirements may vary due to special circumstances but the intent is to have field data to support each indicator in the event NTCHS' decisions are challenged. It is recommended that all supporting data be geo-referenced.

The NTCHS also approved the National Hydric Soil Technical Standard with some minor modifications. The National Hydric Soil Technical Standard is available for review and downloading from the hydric soils website (http://soils.usda.gov/soils_use/hydric/main.htm). I would also like to point out that there have been several enhancements added to the hydric soils website; one improvement is the addition of minutes from NTCHS meetings.

The *Field Indicators of Hydric Soils in the United States*, v.5, 2002 has been updated to correct some minor typographic and misspelling errors, to add a definition of "biologic zero", and to redefine the procedure for submitting additional test indicator proposals. An addendum has been prepared for version 5.0 and will be distributed to customers with the remaining printed copies of version 5.0. There are no printed copies of version 5.01 available. However, version 5.01 can be downloaded from the hydric soils website and is also available on CD-ROM from the NSSC.

An updated National List of Hydric Soils is overdue. Hydric soil property data must be populated in the National Soil Information System (NASIS) to generate the new list. The existing report format will be modified slightly by the NSSC to meet the needs of the NTCHS. It is imperative that a single data source is used to generate all hydric soils lists regardless of user. An assessment indicates that states are in various stages of getting these data populated. An instruction has been drafted for the Deputy Secretary for Soil Survey and Resource Assessment's signature, that defines the process, provides a list of data elements that must be populated, and establishes the timeline leading up to developing a new national list of hydric soils. The target date to produce a new national hydric soil's list is January 2005. States are being asked to insure that all required NASIS data identified in the forthcoming national instructions are populated by December 2004.

NCSS Cooperator's Reports

The University Cooperator's Perspective-- Strategic Planning for the Future

Peter Veneman
Massachusetts Agricultural Experiment Station
University of Massachusetts
Amherst, MA 01003
veneman@pssci.umass.edu

In Attendance: N. Cavallaro (CSREES); E. Ciolkosz (PSU); B. Frazier (WSU); T. O'Green (UCD); W. Hudnall (LSU); W. Kingery (MSU); H. Lin (PSU); M. Mbila (AAMU); R. Southard (UCD); G. Uehava (UHawaii); B. Vasilas (UDE); P. Veneman (UMass); L. West (UGA).

The group was charged with the following two issues: ***(i.)*** what is the cause of low attendance of university representatives to the national conference and how can their participation be improved, and ***(ii.)*** provide recommendations to improve communication between university representatives and other groups participating in the NCSS.

At past conferences university personnel participated on a by-invitation only basis. This has resulted in a lack of interest and the feeling that interests of university cooperators were not necessarily taken into account when conference agendas were developed. Additionally, the lack of funding at the university level has forced academic staff to set priorities in regards to travel. Attendance of the Soil Science Society of America annual meetings and similar professional meetings has a higher priority for most university personnel. Perhaps in future conferences some funding could be provided to encourage involvement of junior faculty members in the NCSS. Low participation rates by university staff also may be do to a perceived lack in communication. Some of this is due to a lack of understanding about the role of cooperators in the NCSS. Expectations of NCSS partners should be better defined for future meetings. It also should be stressed that participation is an ongoing process, not just some activity just prior to or during the conference. We recommend that the provisionary agenda of NCSS conferences be widely distributed at an early date and that the announcement extends a specific invitation to university personnel to participate in the meetings.

The agenda should include topics that are of interest to non-NRCS cooperators. The agenda could include reports of ongoing NRCS-SAES collaborative projects. Recipients of NRCS distributed research funding should be required to attend the meeting to report on project results. Agendas for the regional conferences could be arranged to include less committees and more time to talk about issues of mutual interest. The 2002 Southern regional meeting was arranged around a specific theme and the agenda reflected that theme throughout. Perhaps this approach could be tried at other regional meetings as well.

Lack of communication is also cited as problematic. This could be improved through greater use of electronic media. Don't send NCSS related information through surface mail, when a much greater audience can be reached at lower costs using email and similar venues. In regards to meetings of the separate groups at the NCSS conference, ensure that people from other groups participate in a group's discussion. This could be done by scheduling individual group meetings at different times or by making sure that proper representation from other groups is present.

Among some university personnel there is a feeling that their expertise is not always valued. Faculty may have unique capabilities that may be helpful in resolving issues within NRCS. Joint NRCS/SEAS collaboration generally was rated as very effective at the local level, but the participation at the national level may not be always optimal. Some NRCS projects could benefit from an outside program review with strong university participation. Overall we recommend expanded joint research efforts. Announcing the availability of research funds would open up competition and perhaps make the projects more effective in regards to national NCSS research priorities.

BLM Report: Continuing to Meet the Challenges of Soil Survey on Public Lands
William Ypsilantis, Bureau of Land Management, Denver, CO

Introduction

The Bureau of Land Management has many challenges it must meet in adapting to the increasingly complex issues, priorities, and initiatives it faces and the ever increasing demands placed on the resources we manage. The West is the fastest growing region of the country with nine of the twelve fastest growing states in the country. Over 60 million people live in the West with over 22 million people living within 25 miles of BLM lands. We must adopt a new paradigm for collecting and using soil resource information by utilizing the latest technology available to us and conducting business with a fresh, innovative approach.

Current Priorities

Energy and mineral development are seen as vital to our Nation's economic well being. The Bureau is substantially increasing the number of energy leases and development applications for oil and gas, coal, coal bed methane, geothermal and other energy and mineral products. The backlog in rights-of-way for energy pipelines, powerlines, and other energy corridors is being aggressively reduced. Quality soil information is essential to ensuring that energy exploration, development, and transportation are implemented in an environmentally prudent manner.

The increasingly complex pattern of human habitation in close proximity to public lands offers many challenges. The risk of wildfire threatening public health, safety, and property in rural communities is highlighted here in Colorado and in Arizona where hundreds of homes were destroyed by wildfires in 2002. Ensuring visitor safety, maintaining adequate open space, maintaining habitat for wildlife and sensitive species, and providing recreational opportunities are among the many challenges facing us. Soil and associated vegetation information can be utilized to identify potential hazardous fuels zones, habitat potential, and other elements of this priority.

The Bureau is on an ambitious schedule of incorporating current issues into new and existing land use plans. Soil information is vital for impact assessment and to help identify potentials and limitations for resource uses on public lands

The National Landscape Conservation System incorporates the lands designated for special management by Congress and the President, including 15 National Monuments, 14 National Conservation Areas, 148 wilderness areas, 604 wilderness study areas, 36 Wild and Scenic Rivers, and 11 National Scenic and Historic Trails. Soils information is needed to develop land use plans to protect the special features of these lands.

Soil Survey Accomplishments

Soil survey accomplishments have been modest the past year, but there are some promising developments. Utah is completing mapping on the Grand Staircase-Escalante National Monument. Nevada has also been active with mapping being completed on Eastern White Pine County and starting on North Lincoln County surveys . California is working on soil surveys in the Desert District with an interagency team approach. A BLM ecologist is working right along side the NRCS party leader to capture plant information for ecological site classification. David Howell has developed and implemented a sampling scheme to conduct statistical analysis of soil properties relationship to remote sensing and GIS data layers. The North Lake County Survey, Oregon has field mapping completed and NASIS input is being provided by NRCS. A joint BLM/NRCS/Utah State University pilot project is underway in Wyoming to utilize advanced technology to improve mapping efficiency on selected quads in North Johnson County and another area to be determined.

A recent assessment was completed of BLM rangeland soil survey needs for a report to Congress. It clearly indicates the fact that the negligible acreage being mapped in many states is much less than what is needed to complete initial soil surveys in a reasonable 10 year time period. In fact, it is much less than the acreage of soil surveys becoming outdated in most states, so we are actually losing ground. The status of that Department of Interior and Agriculture rangeland soil survey/rangeland inventory report is that it is hung up at the Departmental approval levels and has still not been submitted to Congress.

Transition to New Technology

Decreasing budgets and increasing emphasis on cost efficiency point out the need to utilize new mapping technology to the full extent possible. The pilot effort in California to integrate new mapping technology into a progressive soil survey is very promising. Pete Scull, UC Santa Barbara, and David Howell, NRCS, are working closely with the party leaders to utilize remote sensing and GIS tools to help predict the pattern of soil characteristics on the landscape. BLM's National Science & Technology Center is assisting in this project as well. As previously mentioned, a test of new mapping technology is also underway in Wyoming.

> The Bureau's goal is for all future progressive soil surveys to be conducted using new mapping technology. Various approaches need to be tested to accomplish this task, especially in the initial phases of development of this emerging technology. This allows the ideas generated by various researchers and developers to be incorporated in our approach to ensure that the science moves forward free of artificial restrictions. We need to be flexible in our approaches and not rigidly locked into one method. Thus, the best ideas available will be used to help refine our techniques.
>
> Delivery of digital/automated soil information to the users in a form that is easy to use, easy to understand, and relevant to decision making needs is equally important. The soil data viewer holds lots of promise for soil information delivery. We need to develop non-standard interpretations relevant to rangeland and forest manager needs and incorporate them into interfaces for the soil data viewer. As an example, the Bureau is becoming

increasingly aware of the importance of biological soil crusts and needs this information available in our soil surveys.

Meeting New Challenges

The greatest challenges that face BLM are the increasing number and complexity of resource management issues while budgets and soil expertise shrink within the agency. The Bureau has lost most of its soil expertise in the past 15 years as a result of decreased funding but also due to a loss of support for the vision that soil information is vital to the land management decision making process. We need to demonstrate the need for soil scientists as part of the workforce planning effort to tailor future personnel composition to Bureau needs. There is also the potential that competitive outsourcing will be used if we can't demonstrate our superiority in acquiring and displaying soil data. Cost management emphasis requires that we use the most cost effective and efficient technology available.

Developing support for funding is also vitally important. Budgets for soil programs in all the Federal agencies have been steadily declining. Funding for soil survey is down to a trickle with no immediate relief in sight. We may need to use in kind resource skills sharing to help fund our portion of surveys in checkerboard land and other areas. Thus, outreach to the public is important to help generate a public outcry for more soil survey funding. The Bureau recently developed a soil environmental education web module for school children in 4^{th} through 6^{th} grade to help spark interest in soils within the younger generation.

We are also looking forward to cooperating with NRCS and other organizations in the proposed Smithsonian Museum soil exhibit. It is critical that we adopt novel approaches like these and fully utilize the partnering opportunities of the National Cooperative Soil Survey to attain our vision of a dynamic, state-of-the-science soil program that meets the needs of our users.

USDA Forest Service --Soil Survey on Public Lands: Special Needs and Opportunities

Randy L. Davis, Washington, DC

The USDA Forest Service (Forest Service) has been a cooperator with the National Cooperative Soil Survey (NCSS) since 1961. Forty-two years later, we are still engaged in the NCSS and are committed to continuing that partnership. The Forest Service is faced with many land management challenges that present special needs as well as unique opportunities. We, like many federal and non-federal agencies, face the challenge of a large percentage of its workforce nearing retirement, declining program budgets, and a host of land stewardship issues. Recently, the Forest Service Chief Dale Bosworth discussed land management concerns that he feels threaten National Forest System lands. They include: (1) fire and fuels management, (2) land conversion from rural to urban, (3) explosion of invasive species, and (4) increasing numbers of off-road vehicles on public lands. These threats are often complex and involve lands beyond those administered by the Forest Service.

Furthermore, many program development initiatives that began in the late 1990's are near fruition and moving into their implementation phase. These efforts were originally devised to resolve administrative challenges that could not be solved any other way. I will highlight some of these initiatives and outline their current status.

NRIS-Terra

The National Resource Information System – Terra (Terra) stores soil pedon and existing vegetation data including summary data and interpretations. Rangeland site information and invasive vegetation data are also stored in Terra. Version 1.1 was released in August 2002. Population of the database has been centered on NASIS map unit data. Some project soil pedons have also been entered. Recently the leadership of Terra has changed. Cindy Correll has accepted a resource management staff position on the Cibola National Forest, located in north central New Mexico. Peg Watry has been detailed in to cover the leadership of Terra until a final decision is made on how to fill the vacancy.

TEUI Technical Guide

The Terrestrial Ecological Unit Inventory (TEUI) Technical Guide was completed in March, 2003. The TEUI replaces Soil Resource Inventory (SRI) as the Forest Service integrated soil survey program. It includes a regimented protocol that outlines how soil and vegetative data are collected along with classification procedures. The soils portion of the Technical Guide is based on the NRCS National Soil Survey Handbook. The vegetation protocol is based on numerous sources including rangeland management, forest management, and other ecological references. With the completion of the Technical Guide, Eric Winthers has been transferred to the Bridger-Teton National Forest, located in Jackson, Wyoming.

TEUI Toolkit

The Forest Service Remote Sensing Applications Center along with other interested parties have been working on a GIS/Remote Sensing landscape modeling application. These efforts have produced procedures to analyze landscape features including soils, geology, hydrology, slope, and vegetation to produce "premaps." We have been testing various parameters to assist field efforts in their planning for progressive inventories and data gathering. The initial version of the

Toolkit was released in 2002 and work is underway to provide training to interested National Forests and other partners.

ECOMAP – Subsections Development

The early 1990's ushered in a host of initiatives intended to incorporate ecological principles in the management of National Forest Systems lands. One accomplishment was the publication of "Ecological Subregions of the United States" in 1994. In 1996, Forest Service along with the NRCS and a host of other federal agencies signed a memorandum of understanding (MOU) titled "Developing a Spatial Framework of Ecological Units." This spatial framework was to be the basis for interagency coordination and collaboration in the development of ecosystem management strategies. One of the objectives of the MOU was to develop of a map of common ecological regions of the conterminous United States. Later, the Forest Service developed "The National Hierarchical Framework of Ecological Units" (include citation?). This framework set the stage for mapping and describing ecological subsections, which represent the fifth level of the "Hierarchy." Work refining ecological subsections has been conducted by the Regional Offices and coordinated by the Washington Office.

Rangeland Health Initiative

In late 2001, Congress requested that federal land management agencies - develop a "National Rangeland Strategy" to address soil survey and ecological classification issues on rangelands across the United States. The Forest Service, BLM, and NRCS have been working on its formulation. A draft of the three-year strategy is currently being reviewed by the U.S. Department of Interior.

National Soil Management Strategy and Action Plan

Over the past two years the Forest Service has been developing a national strategy and action plan for the Soils Program. The strategy and action plan are intended to address critical land manage issues facing the Forest Service. Issues included in the strategy include: (1) maintenance of soil quality, (2) ecosystem restoration, (3) TEUI implementation, (4) research needs (5) information management, (6) workforce management, and (7) increasing partnerships. The action plan will revised annually in accordance to fluctuating budgets and priorities.

SBAAG/NCSS Committee Commitments

As mentioned earlier, Eric Winthers has been assigned to the Bridger-Teton National Forest. His reassignment leaves SBAG and NSIAG staffing commitments in question. This development along with the downsizing within the Washington Office (WO) of the Forest Service and static budgets has significantly increased the workload of the National Soil Program. I have been discussing the situation with WO leadership along with the Regional Soil Program Leaders and other staffs. In the short run, I will make every effort to participate in NCSS activities. Other colleagues will participate in my absence where feasible.

In conclusion, much progress has been made toward providing the most current and accurate information related to soil and ecological systems. But, as most of us know, the greatest challenge is to get land managers to understand and use that information.

National Park Service (NPS) Soil Resources Inventory
Pete Biggam, Natural Resources Program Center, Denver, Colorado

NPS Mandate:
"Only by having reliable scientific information can park managers take corrective actions before those impacts severely degrade ecosystem integrity or become irreversible"
"Leave parks unimpaired for the enjoyment of future generations"

NPS Soil Resources Management
"The Service will actively seek to understand and preserve the soil resources of parks, and to prevent, to the extent possible, the unnatural erosion, physical removal, or contamination of the soil, or its contamination of other resources".
Excerpts from, NPS Management Policies 2001, Part 4.8.2.4 - Soil Resource Management

Picture of surface of soil showing dynamic soil properties

Soil Quality and Vital Signs Monitoring
We need to know more about potential impairment to our valuable soil resources, and the ability of our soils to "properly function"
What are Vital Signs?

Vital-Signs Framework

NCPN Vital-Sign Categories, 5/11/03

THEME	VITAL-SIGN CATEGORY	EXPLANATION
1. Ecosystem structure & function	1.01. Climate	Abiotic & biotic indicators of climatic / meteorological conditions that drive ecological processes.
	1.02. Air quality	Abiotic & biotic indicators of air quality conditions.
	1.03. Upland soil & water resources	Abiotic & biotic indicators of upland (hillslope) hydrologic function, soil quality, soil-site stability, nutrient cycling.
	1.04. Upland disturbance regimes	Abiotic & biotic indicators associated with the occurrence, likelihood, or management of fire-, insect-, and drought-related disturbances.
	1.05. Upland & riparian communities	Integrity of vascular & nonvascular plant communities, key vertebrate communities, and & obligate communities associated with springs / seeps / hanging gardens.
	1.06. Aquatic, riparian & wetland hydrologic / geomorphic regimes	Abiotic & biotic indicators of hydrologic / geomorphic regimes; hydrologic function; water quantity.
	1.07. Water quality	Abiotic & biotic indicators of water quality.
	1.08. Aquatic communities	Integrity of aquatic vertebrate, & macroinvertebrate, and macrophyte communities.
	1.09. Landscape-level patterns	Indicators of system dimensions; connectivity; fragmentation; land-use, land-cover, and land-condition patterns.

Inventory & Monitoring Networks

How well are our soils functioning ?

Desired soil functions from NPS perspective:

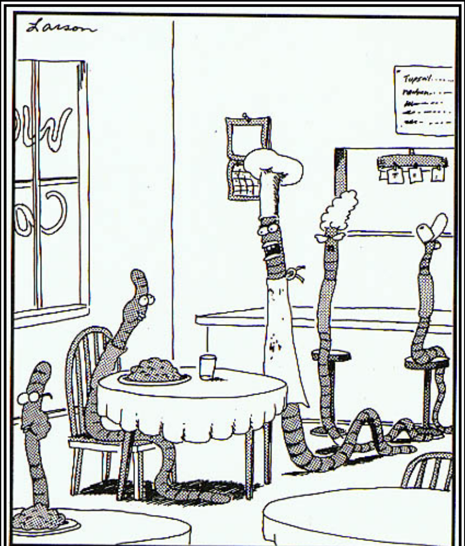
Regulate hydrologic processes
Support characteristic (native) plant & animal populations
Capture / retain / cycle nutrients

Applications of Soil-Site Information

Condition Inventories

Qualitative assessments of ecosystem condition for purposes of determining monitoring needs.

Soil Information and Education



"I've been told you don't like my dirt!"

We have a challenge to not only collect sound, scientific information on our soil resources for proper management, but we also have a certain responsibility to educate our Park visitors on the role soils play within these ecosystems"
"As stewards of the world's finest system of national parks, we have the responsibility to widely share our knowledge about park resources in order to enhance the public's ability to learn from, and enjoy, it's national parks"

Soil Resources Inventory-Field Mapping completed FY2004----
Denali NP
Grand Canyon NP
Santa Monica Mountains NRA
Bandelier NM
Chaco Culture NHP
Crater Lake NP
John Day Fossil Beds NM
Gateway NRA

Soil Resources Inventory-Field Mapping In-Progress FY2004—
Great Smoky Mountains National Park, TN/NC
Apostle Islands National Seashore, WI
Big Bend National Park, TX
Padre Island National Seashore, TX
Channel Islands National Park, CA
Redwood National Park, CA
Joshua Tree National Park, CA
Lake Mead National Recreation Area, AZ/NV

Yosemite NP

Soil Resources Inventory—Updates In-Progress---
Dinosaur NM; Mesa Verde NP; Rocky Mountain NP

Use of New Technologies in Soil Mapping on NPS Units

1. Due to issues regarding wilderness, cultural resources, or rugged inaccessible lands, NPS wants to pursue the use of new technology in the mapping of numerous units
2. SoLIM being evaluated at Great Smoky Mountains NP
3. Various other methods used at Denali NP, Redwoods NP, and Joshua Tree NP
4. Need to "partner up" with NCSS cooperators to help develop applicable methodologies to meet local needs
5. Planned for use in Washington State at North Cascades NP, Mount Ranier NP, and Olympic NP
6. These parks contain vast areas of rugged, inaccessible areas, but still require sound soil resource information for park management needs
7. Currently acquiring 1:24,000 surficial geology and landform information at North Cascades NP
8. Working with Washington NRCS and Forest Service to develop potential partnership for sharing of technologies across jointly administered lands

Future Directions

1. Continued interaction with NCSS and its Cooperators to facilitate completion of the Soil Resources Inventory
2. Coordination with Soil Quality Institute and Universities to assist in the development of a soil quality and assessment program for NPS Units
3. Coordination with USDA-ARS Jornada Range in the development of guidelines for sampling and interpreting dynamic soil properties and soil functions to meet NPS needs
4. Pursue opportunities with soil scientists in the private sector to provide products and services as needed
5. Continue the use of "new technologies" in soil resource inventory mapping concepts
6. Utilization of Ecological Sites and State and Transition Models in Park Restoration efforts
7. Work with NRCS to setup many of our larger NPS Units as distinct Soil Survey Areas
8. Work with the NSSL to identify all lab data obtained from NPS units
9. Clarify issues regarding on how NRCS "Competitive Outsourcing" affects our reimbursable soil surveys on NPS lands

Department of Defense(DOD)—NRCS Liaison to the Army
George Teachman, NRCS, Aberdeen, MD

The Army has some special needs and/or opportunities concerning soil surveys and/or attributes that it would like to share with the National Cooperative Soil Survey.

The areas discussed were:
1) The scale of a soil survey on military lands does not always correlate with similar areas in the private and/or state domain. The scale is not always the same from installation to installation. The scale does not necessarily have to remain the same over the entire installation.

2) The military has several concerns in regards to NRCS wind erosion attributes and interpretations.

3) The military does have similar requirements when it comes to agricultural soil surveys that are not readily apparent that are discussed.

4) There currently exists an opportunity to partner with DoD, as well as, several other federal agencies in regards to utilizing the NRCS and NCSS stores of soil and vegetative samples that have been taken over the years and for various projects. The current issue is centered around perchlorate. Perchlorate is a byproduct of rocket fuel production and the use of propellants in military munitions. Perchlorate is very persistent in water and recent evidence suggests that certain plants are accumulators.

National Association of State Conservation Agencies (NASCA) – Partnership in Soil Survey with State Government

Tim Gerber, NASCA Representative, Ohio Dept. of Natural Resources, Div. of Soil & Water Conservation

I was asked to offer this presentation because the National Association of State Conservation Agencies (NASCA) signed a memorandum of understanding to become a part of the National Cooperative Soil Survey (NCSS) this past February. Current NASCA President Steve Cauthen, of Alabama, and NRCS Chief Bruce Knight signed the document at a NASCA event held during the National Association of Conservation Districts' (NACD) annual meeting in Orlando. This signing took place about 18 months after then Soil Survey Director Horace Smith and I discussed the idea during the 2001 NCSS Conference. In the spring of 2002, former Director Berman Hudson and Maxine Levin met with the NASCA Board of Directors to answer questions about a draft MOU Maxine had prepared, and the Board agreed to terms of the MOU during the fall. Maxine and I worked behind the scenes this past winter to have the MOU finalized in time for an occasion when both Chief Knight and President Cauthen would be present with an audience of NASCA members.

Since my Chief was instrumental in promoting the proposal in NASCA, he volunteered me to serve as the contact person for the association regarding NCSS communications. Apparently, my correspondence about this conference to the other state conservation agencies was not too persuasive, since none chose to send a staff member this year. However, some of you may recall that the Missouri Dept. of Natural Resources was one of the hosts for the 1999 conference and sent a representative to the national conferences held in 1997 and 2001.

I want to offer a little information about NASCA and then to respond to the presentation title I was invited to address, by offering my perceptions of state and local users' perspectives on soil survey.

It's worth noting that soil survey predates the conservation movement by more than three decades. USDA and the Agricultural Experiment Stations were studying soils in the latter part of the 19th century, even before the soil survey began in 1999. I presume that the Cooperative Extension Service was the primary dispenser of soil survey information for the first one-third of the US soil survey history to date. Then came the Soil Conservation Act of 1935 and the writing of the Standard State Soil Conservation District Law in 1936. President Franklin Roosevelt sent a copy of the model legislation with a personal letter to each of the Governors in February, 1937. About a week later, Arkansas enacted the law. Twenty-one other states enacted a law based on the standard law during 1937, and by 1947, soil conservation districts laws were enacted in every state, plus Puerto Rico and the Virgin Islands.

My understanding is that NASCA was created in 1967. Today, it consists of 55 member agencies from the 50 states, the District of Columbia, Puerto Rico, American Samoa, the Virgin Islands, and Guam. Jim Cox serves as Executive Director for the association from his home in eastern Virginia. Roland Geddes is still involved with the association as Executive Director Emeritus.

According to the NASCA web site, the association "is a voluntary, non-partisan organization of state agencies responsible for administration of soil, water, and related natural resources conservation." To give you some idea of what "voluntary" means, about 30 of the state conservation agencies are dues-paying members. The agencies are represented by agency administrative officers, or their designees.

The NASCA web site and brochure recognize several purposes for the association, including "to promote and encourage the conservation of the nation's soil and water resources," and "to enhance the visibility and strengthen the regional and national role of state conservation agencies."

Last year, NASCA and the National Association of Conservation Districts (NACD) conducted a survey of state conservation agencies. As you might expect, the agencies that originated from a model bill submitted to 55 different legislatures more than 50 years ago are anything but identical today. Among the 44 member agencies that participated in the survey, full-time staff size ranged from 0 to about 160, in Arkansas. Some agencies pass on almost all state appropriations to local conservation districts. The member agencies in these states are commonly committees or boards established in the 1930s or 1940s to respond to petitions for the creation of local conservation districts.

At least 46 full-time soil scientists were employed by state conservation agencies in 2002, including 21 in Missouri, 14 in Ohio, six in North Carolina, three in West Virginia, and two in Kentucky. The survey did not specifically ask about the number of soil scientists, so other states may have had soil scientists that were not reported. The number reported for Ohio was the highest in ten years. A year later, we number 10, the lowest since 1952, when the Ohio Dept. of Natural Resources began staffing its soil survey program.

Staffing levels have varied in other states, too. NACD has conducted surveys in Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin, the association's North Central Region, over the past 30 years. In 1973, three of the states appropriated $750,000 for "accelerated soil survey" in 1973. Total appropriations doubled by 1976 and again by 1979. All of the states except Wisconsin appropriated a total of $4 million in 1980. Appropriations peaked at $5 million in 1986, before Indiana discontinued support when the "once-over" was completed in 1987. Minnesota discontinued support in the early 1990s, but has resumed support in recent years, to accelerate SSURGO. Michigan discontinued support a few years ago. Five of the eight states appropriated a total of $3 million in 2001.

Now that I've offered some background information about state conservation agencies and their partnerships in soil survey, I'll offer my perceptions of state and local user perspectives. I'll try to honor Maxine's request that I not concentrate on Ohio experiences. However, since I did not ask Executive Director Jim Cox to subject NASCA members to another survey, be forewarned that most perceptions originate from the Buckeye State. I believe that the soil survey partnership in Ohio is one of the strongest in the nation, and I would invite you to read an article State Soil Scientist Jon Gerken and I wrote recently in the spring edition of the NCSS Newsletter to see why I feel that way. Nevertheless, most of my observations identify challenges for funding NCSS efforts at the state and local levels.

First, I don't recall state or local users ever remarking about how promptly we deliver soils information. And, since we've reinforced the reputation of slow delivery over more than a generation, our customers have low expectations of us. Conservation district employees tend to be enablers, not protesting when they have received poor service. For elected officials, it's not so easy to excuse our tardiness when we don't deliver before their re-election campaign begins. And, since local officials such as county engineers or county auditors talk to their counterparts at statewide association meetings, poor service in one county can hinder our sales pitch in another county. Furthermore, local officials talk to members of their own political party in various elected or appointed positions, and some become legislators or state officials during their political careers. For Ohio and 18 other states with term limits in the legislature, old friends on key legislative committees are being replaced by less forgiving legislators.

Conservation districts can be excellent marketers of soils information locally. Although an article in a recent edition of the Soil & Water Conservation Journal acknowledges that some conservation districts have a narrow view of their role at the local level, Ohio has many conservation districts that are actively building partnerships locally. District boards whose members reflect soil and water resource interests in their county sell soil survey products to a variety of local officials and community groups, including the business community. Meeting their demands for soil survey products has been enough of a challenge – we probably shouldn't be greedy for more demand generated by the less active conservation districts.

I've been somewhat sloppy with the term "demand." If it is true demand, in a market sense, then our products will be valued. And, I'm concerned that at least below the federal level, the products may not be valued highly enough to pay for the soil scientists needed to develop them. As one District Conservationist observed in an interview, board members for his district would rather spend their money on a no-till seed drill than on an improved soil survey product. Perhaps it is because many staff members in conservation district offices are not comfortable with using soil survey information anymore. Fifteen years ago, one might have assumed that most District Conservationists had a strong soil science background – or that staff members spent time with the soil survey crew when the soil survey project was in progress. These assumptions don't appear to be valid today.

Personally, I have viewed our Soil Inventory and Evaluation's role as simply providers of soils information. It's sort of an "If we build it, they will come" approach. But, if they're not comfortable with using the information, perhaps we need to provide them with tools to use it – without necessarily understanding why the tools work. Otherwise, our information may lose the relevance and perceived value it once had.

Many of the Experiment Station faculty members here are acutely aware right now that state revenues are not growing anymore and that state and local budgets need to be balanced somehow every year or two. Governors, state legislators, and county officials are being forced to make tough decisions, eliminating funding for good investments for the sake of better investments. That puts soil survey in a competitive situation, and with many of us in the NCSS near retirement, I'm personally concerned that we may not have the energy to compete at the state and local level. It's so much easier to whine at this point in my career than it is to overcome obstacles to presenting soils information at its best in the public funding market!

Now, I want to switch to more positive perceptions. There are reasons for hope that we can restore the relevancy and use of soils information. SSURGO initiatives in a number of states have demonstrated that products that can be delivered in one or two years are marketable. And, while too many employees in conservation district offices may be unfamiliar with soil science, at least the younger employees do not appear to be hostile to soils information. They seem to be willing to apply any information that is helpful and easy to use, and professional biases that favored or hindered use of soils information in the past seem to be less prevalent. If using our information gives them a competitive advantage over other grant applicants, real market demand could result. Then, our challenge will be to deliver the information or enhancements quickly enough to meet demand.

I want to close with a list from the NASCA web site of member agencies' interests. They include land management, parks and natural areas, urban erosion/sediment control programs, agricultural nonpoint source control, agricultural cost-share programs, regulatory water quality programs, and assistance to conservation districts. Since the agencies and their interests are diverse and land-based, there's reason to believe that clever, energetic program managers can make soils information products marketable to the agencies and to districts in today's economy. I'm hopeful that NASCA's formal affiliation with NCSS will be helpful toward that end. I would ask that consideration be given to amend the NCSS Conference bylaws to allow NASCA representation on the Steering Committee. Thank you.

Two Perspectives of a Native American / NRCS Interface in Soil Survey & Soil Services

Neil Patterson, Head, Tuscarora Environment Program, Tuscarora Nation, Sanborn, New York and Steve Carlisle, Soil Scientist, USDA, NRCS, Seneca Falls, New York

Introduction

This discussion is of one relationship, which like most relationships is marked by the uniqueness of the individuals and circumstances. It will attempt to define the unique culture and viewpoints of the two governments, the United States and the Tuscarora Nation. We will detail what motivated the Tuscarora Nation into entering into the agreement to conduct a soil survey on the Nation, and how the agreement is being consummated. We will conclude with a list of some principles that may be helpful in guiding relationships between other Indian Nations and other representations of the US government.

The Tuscarora Nation

The Tuscarora Nation is located on the Niagara Escarpment about 10 miles north of Niagara Falls, New York on a 6000 acre reservation. A few miles to the north, in the Niagara gorge, the Niagara escarpment reveals one of the great Silurian rock exposures in North America. The Lockport Dolomite, the cap rock for Niagara Falls, underlies the soils of the reservation. These soils are principally fine loamy glacial tills and fine textured lacustrine soils. Elevations range from 400 feet above sea level to 660 feet above sea level.

While the Tuscarora People historically used their land for agriculture (grapes, corn, apples, dairy), now much of this agricultural land is reverting to forest. Within the Nation's territory, a majority of existing fields are rented to non-natives for corn and wheat, while Tuscarora farmers continue to grow traditional crops (Indian corn, squash, dry beans, strawberries).

The Government of the Haudenosaunee

The term, "Haudenosaunee Confederacy". is a more accurate nomenclature than the familiar term, Iroquois Confederacy. Some of the history explaining the origin of the Haudenosaunee Confederacy is popularized by Longfellow's poem. Thus, most US Citizens know of Hiawatha, and how through great effort he convinced 5 neighboring Iroquoisan speaking tribes in central New York to confederate and stop warring with each other. It is also common knowledge that many principles of this confederacy were later adopted into the Articles of Confederation and later the US Constitution. These five nations were the Seneca, Cayuga, Onondaga, Oneida and the Mohawk. The Tuscarora Nation was adopted into the Confederacy in 1715, after moving north from the Carolinas. The Haudenosaunee Confederacy encompassed nearly all of New York State, but influenced all other nations east of the Mississippi.

The Haudenosaunee are a matrilineal society, where lineage is traced through females within a clan that are rigid subsets of the nation as a whole. Clans are groupings of extended families.

One of the truly enlightened aspects of the Haudenosaunee form of government, is the balance of power inherent between the clanmothers and chiefs. Clanmothers have the responsibility and power to both install and remove chiefs from office. Not unlike the US Senate, diverse political interests between clans are accommodated as each clan has at least one representative on the council of chiefs. Together, the Councils of Chiefs from each of the Six Nations, make up the Grand Council of the Haudenosaunee, which convenes near Syracuse on the Onondaga Nation. The Onondaga Nation acts as a mediator between the two sides of the Longhouse, the Eastern Door of the Mohawks and the Western Door of the Senecas.

Decisions made by Haudenosaunee governments must conform with the principle of trans-generational responsibility, that is each decision is accountable to future generations, or as traditionally expressed the "faces yet to come from the ground." This translation is one of many Haudenosaunee references to the spiritual aspect of the soil. It is this regard for the soil, and the people and plants that grow from it that caused the Haudenosaunee to enact confederacy-wide and Nation-wide environmental programs.

Environmental Programs

Following the revolutionary war, expansion of the colonial frontiers confined Haudenosaunee communities to a restricted land base on federal Indian reservations. Internal pressures on this restricted land base and external problems associated with industrial pollution of waterways and burial of toxic chemicals, prompted a Confederacy wide environmental initiative called the Haudenosaunee Environmental Task Force. Eventually, individual environmental programs were instituted by the Nations with the assistance of the HETF. Each of the Six Nations are faced with diverse environmmental issues, many of them from outside their territories. The infamous Love Canal is a nearby neighbor to the Tuscarora Nation.

The Tuscarora Environment Program currently focuses on solid waste management, air and water quality assessments and environmental regulation and protection within the Nation's territory and local region. A few of the regional projects are a deep water aquifer study, Niagara River fisheries studies and hydropower relicensing. Other localized concerns include water and health issues relating to septic systems, open dumps and underground storage tanks. By far the biggest initiative taken by the TEP is the education of our youth to promote traditional agriculture, heirloom seed banks and healthy diets, and the overall cultural relationship between people and the soil and plants of the territory.

The Culture of the Haudenosaunee

The culture of the Haudenosaunee is inextricably associated with their agricultural heritage. The ceremonies of the longhouse are arranged on a lunar calendar divided by agricultural cycles of planting and harvesting. Strawberries, maple sap, and corn ceremonies are rituals that remind the people of the Creators gifts and the Natural World which supports them. The agricultural identity of the Haudenosaunee is evidenced by many examples in the Tuscarora language where words connote an ecological connectivity. For example the words for corn, beans and squash do not translate to “The Three Sisters,” but to “Our Sustainers,” much like the word for rice in some Eastern cultures translates as “life.” These plants, the strawberry, the maple, corn, beans and squash, all were placed on Earth for sustaining life as gifts from the Creator according to the Haudenosaunee Creation Myth. Contemporary Haudenosaunee agriculturists view these plants as a manifestation of the Creator. Consuming these gifts is analogous to the communion ceremony during Christian religion services.

Haudenosaunee Perspectives of the Land

The Creation story is more than a myth, it is a reality. It provides a template for understanding man’s place on the Earth. Whether taken literally or figuratively, the story promotes the wise use of all natural resources.

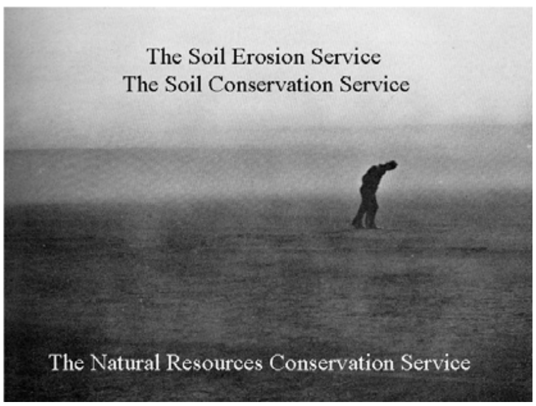
A principle of planning and decision making, reflective of this high regard for the welfare of future generations and the environment in which they will live, is the idea that plans and decisions must be made on the long term planning horizon. There is no provision in Tuscarora culture for a mass exodus by space ship from a bankrupt earth.

This idea that man must live in harmony with the environment over the long term is regarded as Natural Law. It is a law that describes the natural relationship of conformance with what we have come to regard as the human ecosystem. It is more than a general principle as it includes a great number of ceremonies, and specific plant and animal relationships. These components are carried forward through the generations via oral history.

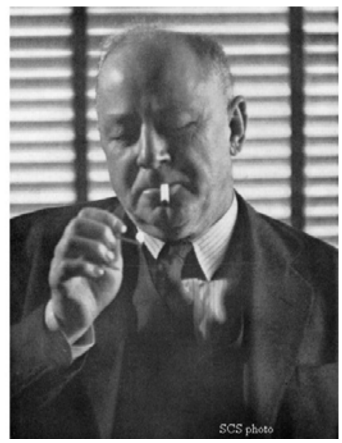
Today’s Haudenosaunee communities are struggling to conform with Natural Law because of the loss of some of this oral history over the last two centuries. Much of this broken chain of oral history is directly attributable to US government programs of assimilation, including boarding schools. However, the enduring power of this oral tradition is evidenced in ceremonies, medicines, and song and dance that still continue in Haudenosaunee longhouses.

The long-standing relationship that Tuscaroras have with the land has resulted in a large body of empirical based ecological knowledge that is being supported by a growing body of scientific evidence. This empirical knowledge coupled with the Haudenosaunee spiritual understanding of the human place in a dynamic ecosystem, offers strong parallels with many principles of pedology that regard soil as a living entity, and the foundation for most ecosystems.

The NRCS Culture—Historical, Evolution, Present



Interestingly it was from a spiritual perspective of the land that SCS is born in 1934 with a charismatic mission and a charismatic leader: Hugh Hammond Bennet. In 1936 the SCS wielded a labor army in the field of 140, 000 people through inter-personnel agreements with the Works Progress Administration and the Civilian Conservation Corps (Lord, 1938)



The organism has evolved, as evolve it must keeping pace with changing circumstances and people. Today, it has a much wider mandate. It is not so focused on a single very visible threat made palpable by harsh economic times. Today the NRCS is a government agency not much different than any other government agency. The esprit de corps and the sense of mission implanted by the "Coshocton Experience" is all but forgotten lore.

Like most government agencies the NRCS marches to an annual budget. Budgets for the year are rarely carried over into the next fiscal year. Promises and memoranda made one year can be rendered void by the budget of the next. The soul of every government employee is synchronized by this annual rhythm and what it means. Others, outside of the government rarely understand this tacit guidance.

Politics both internally and externally may shift priorities and resources, obliterating assumptions upon which longer term plans are based. Nevertheless, such planning goes on and most government employees are somewhat unsympathetic to goals and timelines not met.

Interestingly many government employees maintain somewhat of a corporate and extrospective view of clients that are serviced, which is to say if we provide a service we expect them to do something with it. Service is conditional on progress and results. Quick decision are valued.

Euro-American Perspectives of the Land. Persisting to this day, despite a brief hiatus during the Dust Bowl is the idea that land is an inexhaustible resource, to be bought, sold and expended at the discretion and pleasure of the owner. This perspective of the land is rooted in **history**. Using, abandonment and then moving on to something better. A pattern of use and abandonment traced from the stone fence lines in New England forests to the sad conditions prevalent in today's city downtowns and brown fields.

A penchant for classification causes Americans view land qualitatively as cells aggregated by various **taxonomic** schemes separated by crisp boundaries; political, red lining, districting farmland classifications, etc.

Land is viewed **quantitatively**, that is how many acres of this or that. The numerology of land counted in acres, hectares, chains links, etc. is central to the idea that land, as a resource is a commodity.

It is **aesthetically** based, as in view sheds, leaf tours, and shore property.

Finally, it is **vicariously** based, a second hand twice removed appreciation of abstract ethereal qualities of the land.

None of these perspectives are particularly spiritual, certainly not historical attitutudes that eventually brought on the Dust Bowl. Our penchant for classifying and quantifying things is not spiritual. Appreciation of aesthetics and vicarious relationships with the land are too superficial to be spiritual. A spiritual relationship is intimate and integrated. It seeks neither to preserve land or squander it, but to live with it harmoniously. Interestingly enough, this kind of relationship is articulated in the vision of the NRCS.

How the Interface Began For Us

Following and inquiry by Neil Patterson, Head, Tuscarora Environment Program in 1997, a series of meetings between the Tuscarora Nation and the NRCS began to deal with the specifics of a soil survey of the Nation, which was left out of the Soil Survey of Niagara County, New York . Aside from ironing out details that such a project would entail, the purpose of the meetings was to establish a level of trust that would permit this intrusive work to go on. The capstone of these meetings and talks was a brief non-signatory memomorandum of understanding.

What We Did

The soil survey was **designed** to fit the needs of the Tuscarora Nation. While this principle of designing the soil survey to fit the socio-economy of the area being surveyed is standard policy, in practice soil surveys are very conventional and the local tailoring usually consists of recognizing macro conditiions such as principally forested vs. largely agriculture or consulting local foresters or extension agents with respect to fine tuning interpretative tables. In the case of the Tuscarora soil survey, this tailoring resulted in a product and a service that deviated significantly from the conventional.

A **non-standard publication** will be developed that will be written in a way that that will resonate with the Haudensaunee culture. It will be a useful document that will attempt to capture that special relationship that the nation has with the land. Furtermore it will be a resource for education.

To promote the feeling that the soil survey was designed specifically for the Tuscarora People, Uwihreh, Yunenyeti and Nuhi- are words from the Tuscarora language that will name **new soil series** inititated during the soil survey.
Interpretations will be published for plants that are specifically important to the Tuscarora Culture. These include traditional food crops such as indian corn, beans, and squash, and als. Also the growth of selected medicine plants and plants such as sweet grass and black ash. The **field work** was begun and completed during the 2000 field season. Work is still ongoing gathering transect data and descriptions. An **advance digital soil map** was created using NRCS funds for digitizing.

Technical Assistance has been a key feature of the this relationship, is based on the principle that the relationship between the NRCS Soil Scientist is the same as the relationship between any NRCS Field Office and the the Soil Scientist: Examples of Technical Assistance include:
•Act in advisory capacity to TEP.
•Conceived and assisted in organizing Haudenosaunee GIS Conference.
•Arranged for GPR and EM surveys of cultural and possible chemical burial sites.
•Conduct educational and inormational presentations.
•Arranged for transfer of obsolete agency surveying equipment to the nation.

Principles of the Working Relationship

•Environmental Concerns cannot be contained within or without a political boundary
•Environment Programs within Indian Nations are allies, and to the extent of cooperation, the partners, of the NRCS
•Governmental agencies by themselves have little credibility.
•The credibility rests with individuals at the interface and it is built through trust.
•When these individuals leave, any credibility goes with them.
•Indian Nations and governmental agencies have extraordinarily different political and decision making systems and different perceptions of time.

•It is important to recognize that the vast majority of Native Americans are sincere and conscientious in their efforts to sustain their culture and observe practices and customs that make their tribal group unique.
•Because of this sincerity, the realities of tribal politics and the fact that environmental problems are everyone's problems, it is important that assistance be unconditional and tailored to the needs of the Indian Nation.
•Co-locate where possible.

Conclusion
•This relationship works very well but is based more on human relationships than on an agreement between governments.
•While there is commonality in a stated vision of our relationship to the environment, the spiritual regard that the Haudenosaunee have for the earth is not matched by the non-native government. Interestingly, as was pointed out it once was, and can still be.

For all of it's self-ascribed sophistication, humankind is a wayward child who strays from his mother except in times of peril he embraces her.
In ancient times when the child was never far from peril he worshipped his mother as a god. In his book, *Out of the Earth Civilization and the Life of the Soil*, Daniel Hillel points out that the Hebrew derivation of Adam and Eve are adama and hava or soil and life. Among other examples he points out the irony in our species classification: *Homo* is derived from the Greek word for humus, "the stuff of life in the soil" *Sapiens*, from Latin, means wisdom. Hillel suggests that the term should be extended to *Homo sapiens curans. Curans* denoting a stewardship relationship.

Homo sapiens curans gets one last chance.

Photo by Molly Carlisle, edited by Neil Patterson

Bibliography

Hillel, Daniel. 1991. *Out of the Earth, Civilization and the Life of the Soil*. University of California Press, Berkeley, CA.

Lord, Russell. 1938. *Behold our Land*. Houghton Mifflin Company, the Riverside Press, Cambridge, MA.

Parker, Arthur C. 1968. *Parker on the Iroquois*. Syracuse University Press. Syracuse, NY.

Morgan, Lewis H., as edited by Elisabeth Tooker. 1994. *Lewis H. Morgan on Iroquois Material Culture*. University of Arizona Press. Tuscon, Arizona

Whitney-Annunziata, Janice. 1995. *Haudenosaunee Environmental Restoration: An Indigenous Strategy for Human Sustainability*. University of Cambridge. Cambridge, England.

A Roundtable on Meeting the Needs of the Professional Soil Scientist

Co-Sponsored by

U.S. Consortium of Soil Science Associations(USCSSA)
and
Soil Science Society of America (SSSA)
Action Plan: Updated May 12, 2003

Purposes:

1. To conduct a roundtable meeting where the needs and interests of professional soil scientists will be shared and discussed.

2. To develop a coordinated effort between the USCSSA and the SSSA to provide improved services to professional soil scientists.

3. To strengthen the working relationships between the USCSSA and the SSSA in order to meet future needs of the members of both organizations.

Procedure and Responsible Individuals:

1. The roundtable is scheduled for Tuesday, November 4th at 7:30 p.m. The formal program will last one hour, but the room and "no-host, cash bar" will be available until 9:30 p.m. for those that wish to stay and talk.

2. The roundtable will be publicized by SSSA via the CSA News, the "Society News Flash", and by other means (e.g., our web site). The USCSSA will also publicize the roundtable by communicating directly to each of its member organizations by a direct mailing and by e-mail. Members of the planning committee are encouraged to communicate information about the roundtable to others as well, such as by division list-serves, state or regional newsletters and websites. (Responsible: Tom Sims and Sara Uttech, SSSA and Jim Culver, USCSSA).

3. SSSA will investigate the possibility of obtaining CEUs for those attending the roundtable. If possible, this will be included in all advertising. (Responsible: Luther Smith, SSSA).

4. There will be short welcoming and overview remarks by Mike Singer for SSSA and Jim Culver for USCSSA. These remarks will address the efforts of both organizations to provide greater support for practicing soil scientists and to develop a stronger working relationship between SSSA and USCSSA. (Responsible: Mike Singer, SSSA and Jim Culver, USCSSA).

5. After the opening remarks, there will be a panel discussion on specific ideas and options by which SSSA and USCSSA could meet the needs of practicing soil scientists. The panel will consist of several individuals with input from others on the planning committee. Panel topics and panel members include: (Responsible: Planning committee to identify topics and speakers, Tom Sims and Jim Culver to follow-up with contacting them).

a. *Needs and Opportunities for the Professional Soil Scientist:* Margie Faber, Society of Soil Scientists of Southern New England and Cliff Landers National Society of Consulting Soil Scientists.

b. *SSSA's Role in Meeting the Needs of the Professional Soil Scientist - Certification, Education, and Technology Transfer*: Tom Rice, SSSA S236.1 committee and Luther Smith, ASA-CSSA-SSSA

c. *Enhancing Recognition of Soil Science as a Professional Discipline*: Bob Kendall

d. *Role of Professional Soil Scientists in the the Smithsonian Soils Exhibit and the 18th World Congress of Soil Science*: Valerie Breunig, SSSA and John Kimble, SSSA

6. After the panel discussion, there will be roundtables set up to address each topic covered by the panel. The panel members will coordinate discussion at the roundtable for their topic. There will be additional roundtables provided for others that wish to share information and obtain input at this meeting. Some possibilities discussed to date are:

a. Council of Soil Science Examiners (Dawn Tracy)
b. S236.1 Membership, Identity, and Visibility (Tom Rice, Chair)
c. ARCPACS (Luther Smith will identify someone for this)
d. Certification (Myra Peak??)
e. Other ideas and potential contacts???

(Responsible: Tom Sims, SSSA, Jim Culver, USCSSA).

7. A reception will be held immediately after the roundtable discussion. (Responsible: Tom Sims and Keith Schlesinger, SSSA).

8. Follow-up: After the meeting in Denver, we will schedule a conference call to discuss options and plans for future activities. (Responsible: Tom Sims and Tom Rice, SSSA and Jim Culver, USCSSA).

Canada's New Initiatives in Soil Information Upgrade and Delivery

Scott Smith[1], Bill Harron[2] and Walter Fraser[3]

[1]Agriculture and Agri-Food Canada, Pacific Agri-Food Research Centre, Summerland, BC, V2A 8Y2;
[2] Agriculture and Agri-Food Canada, PRFA, Regina, SK ; [3]Agriculture and Agri-Food Canada, Manitoba Land Resource Unit, Winnipeg, MN

Presented to the USDA National Cooperative Soil Survey Conference, June 16-20, 2003

Abstract

After 10 years of reduced activity in soil survey in Canada, potential new investments into the upgrade and delivery of soils information are on the horizon. A five-year National Land and Water Information Service has received provisional funding that could led to a renewal of the soil survey effort in Canada. This initiative will concentrate on increasing the quality and accessability of detailed soil information through field sampling to update our existing soil inventory and activities that will expand the development of web-based viewers to interact with soil maps and databases. A second initiative is to better link available detailed soil information to the 1:1,000,000 scale Soil Landscapes of Canada map series which has been used extensively as a spatial framework for environmental monitoring and reporting.

Introduction

Since 1995 reductions in strength obtained largely through early retirements, have left an inconsistent capacity to delivery soil information across the country. In Alberta, Saskatchewan and Manitoba where the majority of agricultural land in Canada lies, relatively good coverage of soil mapping remains in place at both small and intermediate scales. Elsewhere, particularly in Ontario, British Columbia and the maritime provinces, staff cuts have greatly reduced the capacity to update or even maintain soil maps and related databases. Agriculture and Agri-Food Canada has recently reorganized much of its soil science activities. A new soils "theme" brings together scientists involved in soil process research with those conducting inventory in land resources and interpretations. The theme incorporates a little over 100 scientists and technicians from across Canada, with about half directly involved in activities related to soil survey, database development and interpretations.

The effort over the last 10 years has largely focused on small-scale map products derived from the Soil Landscapes of Canada (SLC) mapping series at 1:1,000,000 scale. This national coverage has provided the basis for a new set of relatively coarse interpretive products to act as agri-environmental indicators designed to track the environmental performance of agriculture at regional and national scales. While these have been relatively well received both domestically and internationally, this intensified use of, and demand placed on, the SLC product has highlighted the need to improve the quality and detail of the supporting databases.

Meanwhile, a new federal agriculture policy framework for Canada places a renewed emphasis on having environmental information about agricultural land readily available to planners, producers and the public in general. Information in the existing Canadian Soil Information System (www.agr.gov.ca/CanSIS) is simply inadequate or too inaccessible to meet these new needs. To meet these demands and to improve the quality, timeliness and extent of detailed land resource information for agricultural planning in Canada, a new five year initiative called the National Land and Water Information Service will begin implementation this fiscal year and is expected to run for an additional four years until early 2008. It is hoped that this initiative will substantially increase the land resource inventory capacity in Canada above present levels which are inadequate to provide the quantity and quality of soils information needed both inside and outside of the department.

In this paper we describe these two new initiatives in soil information upgrade and delivery - the development of the Soil Landscapes of Canada version 3 (SLCv3) and the implementation of the National Land and Water Information Service.

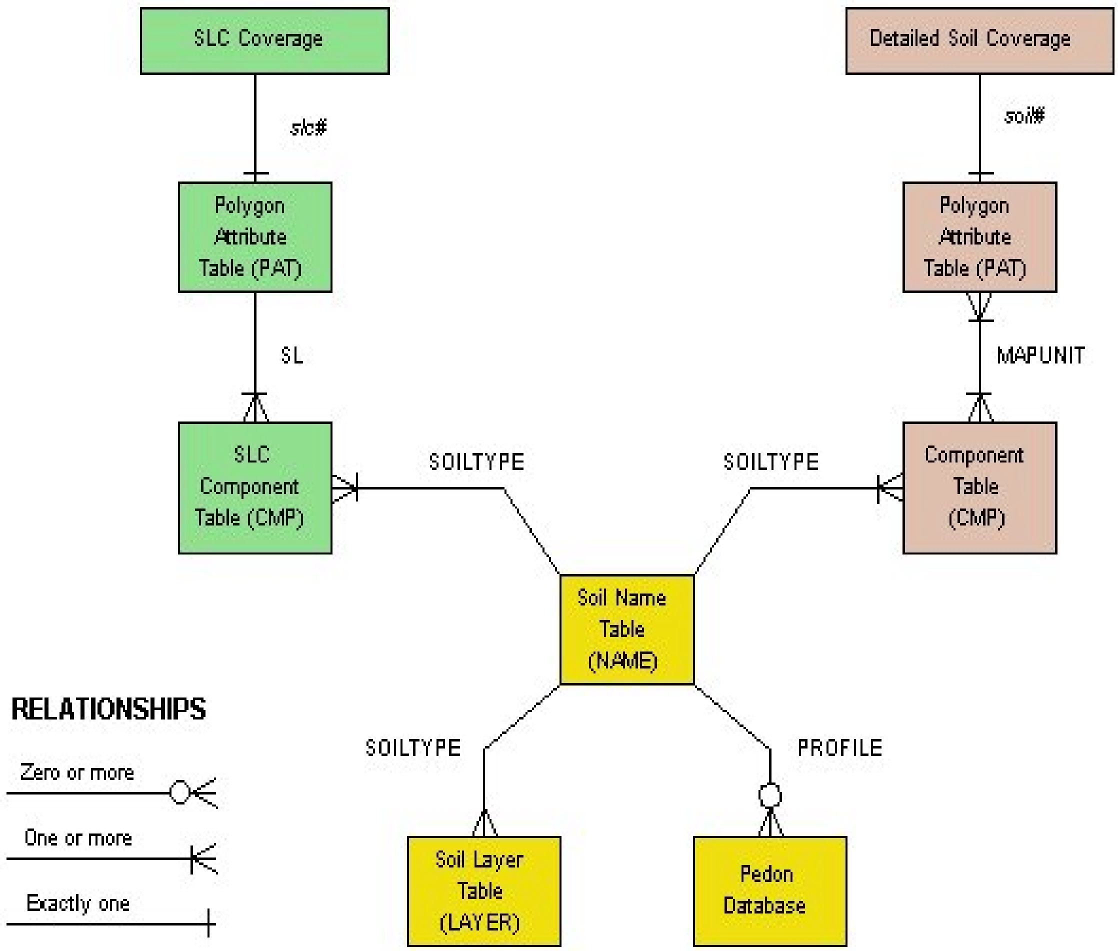
New Initiatives in Soil Upgrade and Delivery

Soil Landscapes of Canada v3.0

The Soil Landscapes of Canada 1:1,000,000 maps were first published in the 1980's as hard copy, manually-derived maps supported by generalized soil information organized according to dominant and subdominant landscape elements (Shields et al. 1991). Rather than soil-specific profile information these databases contained generalized attributes about soil properties, associated parent materials and regional landforms. Map polygons contained one or more distinct soil landscape components (dominant or subdominant) and sometimes contained small but highly contrasting inclusion components. Most of the soil properties were estimated by field pedologists with expert knowledge of the region.

A second version of the Soil Landscapes of Canada (SLCv2.0) was published in 1994 with upgrades in 1995 and 1996 (SLC v 2.1, 2.2) as digital products with national coverage. The SLC digital maps were produced in separate sheets, matching the original paper maps. SLC polygons were correlated along the map boundaries. National coverage consisted of 24 map sheets, and about 19,000 SLC polygons. In addition, several special projects derived from the SLC were produced to meet new interpretive needs including a Soil Carbon Map of Canada (Tarnocai and Lacelle 1996, Tarnocai 2000), a National Peatlands map (Tarnocai et al. 2000) and a nested series of ecological maps (Ecostratification Working Group 1995, Marshall et al. 1996). The Canadian portion of the soil carbon map of North America (Lacelle et al. 2000) was also produced from SLCv2. Each SLC version has a custom developed data base, and a different set of polygon numbers. These products are all available as downloads through the Canadian Soil Information System.

Version 3.0 is being developed from " a clean sheet of paper" to take advantage of new GIS methodologies. Four major changes are underway. The first major change was development of a new database model. SLCv3.0 will use a relational data base model (Figure 1) to link detailed soil name information to the landscape polygons. The SLCv3 map is directly linked to a Polygon Attribute Table (PAT). Each SLCv3 polygon can



have several Soil Component records (1 to 99), stored in a Component Table (CMP). The soils are identified by 3 character CanSIS soil codes. The soil attributes are stored in separate Soil Names Table and a Soil Layer Tables.

Figure 1. Relational database structure underlying the Soil Landscapes of Canada v3.0 map product.

Both map scales use the same Soil Name (contains attributes of the soil series as a whole, i.e. taxon, drainage, etc) and Soil Layer (contains attributes of individual soil horizons) tables. In this way, soil attributes only have to be changes in one file. The resulting changes will then be reflected in any identical soil components in either detailed soil maps or SLC map polygons (i.e. the Red River series, formerly a Gleyed Rego Black Chernozem, now a Gleyed Humic Vertisol). Interpretation programs and models developed for detailed maps can also be applied to SLC maps, since now for the first time they will share a common data structure.

The original SLC maps were drawn and compiled manually, usually from overlays on the original paper reconnaissance soil maps. Many of the detailed soil maps have been digitized in the past 10 years. SLCv3 will use these new digital map coverages to enhance the accuracy of the new polygon boundary placements. GIS analysis will also be used to refine the set of SLC soil components.

Two primary uses of the SLC are to provide a spatial framework for the presentation of agri-environmental indicators and the national greenhouse gas and carbon accounting system for agricultural land . Agri-environmental soil indicators are calculations based on the SLC soil database that express the risk of various soil degradation processes acting on agricultural land (McRae et al 2000). These include risk of soil water erosion, tillage erosion, wind erosion, compaction and salinization. They are calculated by integrating soil information with land management information as derived from the Statistics Canada Census of Agriculture. In a similar way, the soil landscape polygons are used to scale-up model-based results of CO_2, and NO_3 emissions/sinks from specific soil types from specific landscape positions (McConkey et al. 2003). Present plans are to complete the preparation of SLC v3.0 in early 2004.

National Land and Water Information Service

The intensification of agriculture including greater inputs, the concentration of livestock numbers in rearing and finishing facilities, the need to compete on international markets and public perceptions about agriculture's negative impacts on the environment have all generated the need for greater access to soils and related information (water, land use, biodiversity etc) for land use planning and decision making.

In response to this new demand, Agriculture and Agri-Food Canada has initiated the National Land and Water Information Service (Anon 2003). The initiative is a 5 year plan to enhance access to, and the quality of, detailed soils information for the agricultural regions of Canada. The National Land and Water Information Service (NLWIS) is expected to provide upgraded national data sets for land and water, and links to other data (land use, water quality and quantify, cadastral and biodiversity databases) held outside the department, and the tools and applications to assist with land use decision-making and environmental farm planning. These data will assist with the monitoring of soil quality and the calculations of agri-environmental indicators.

During the first year of the initiative (April 2003-March 2004), a "proof of concept" project will be developed using a limited database that will demonstrate data integration, decision support tools and the technology behind it to provide a land and water information service. The subsequent 4 years up to March 2008 will see the database and infrastructure components put into place nationally.

There are 5 components to NLWIS. Foremost is the effort to upgrade soil information. This effort will include developing and accessing spatially referenced soil data, developing appropriate interpretations and training users on the responsible use of this information. Existing information will be made digitally available (scanning of hard copy reports and maps, digitizing older maps) and soil databases will be updated through new field activities. This will require professionals skilled in: soil and land use surveys, interpretations, GIS and spatial data management.

In order to make information more readily available, there will be a large effort into the development of web-based viewers to query soil databases and maps as well as new interpretive tools to help with environmental planning in agriculture. One of the new tools in development is a tool that links soil, surficial geology and groundwater information together to direct the placements of intensive livestock production facilities (Eilers and Buckley 2001). The tool assesses the risk of contamination of ground water by animal manure. Finally, a new computing infrastructure will have to be developed within Agriculture and Agri-Food Canada to support interactive internet-based access to environmental information. This includes hardware, software and networking, adoption of appropriate Internet Server technologies that will provide access to GIS data, and interpretations through Internet browsers. Infrastructure will need to be developed that will permit the exchange of large amounts of data directly to clients through the Internet yet deliver information in a manner that maintains security of the information and the systems supporting it.

Building capacity to meet future information demands is a prime objective of NLWIS. New expertise will be needed in pedology to refurbish the depleted numbers of professionals and technicians within the department. New expertise will be needed in geographic information systems, information technology, and systems administration. Given the magnitude of the project ($15M Can per year for next 5 years), project management expertise will also need to be in place. Finally, because of the need to bring together disparate data from provincial and other federal agencies, a partnership office will be established to ensure that the appropriate and necessary agreements are in place to allow user access to a range of environmental databases through NLWIS.

Summary

Over the next five years two major initiatives will upgrade and update Canadian soil information - the development of the Soil Landscapes of Canada version 3 and the implementation of the National Land and Water Information Service.

Soil Landscapes of Canada maps are available in several versions (1.0 to 2.2) from AAFC. Version 3.0 will be available for the agricultural regions of Canada in early 2004. This new version will have enhanced spatial precision and soil attribute data. Many new applications are expected to use this spatial framework including a set of revised agri-environmental indicators and the national carbon and greenhouse gas accounting and verification system for agriculture.

The primary objective of the National Soil and Water Information Service is to make the information needed for environmental planning within the agricultural sector readily available interactively over the internet. Driven by increasing concern by the public about agriculture's environmental performance and the rapid changes in the make-up of the industry in Canada, an ambitious initiative has been launched to upgrade and update detailed soils (and related) information. The initiative incorporates new information management and technology as well as renewed investments into soil data collection, quality control and dissemination. These initiatives should provide the impetus for future collaborate with other agencies, particularly the USDA-NRCS in the development and application of information technologies in the delivery of soil information.

References

Anonymous 2003. National Land and Water Information Service: Project Plan. Draft #0.15. Agriculture and Agri-Food Canada, Ottawa. 95pp. (http://www.agr.gc.ca/nlwis/main_e.htm)

Ecological Stratification Working Group. 1995. A national ecological framework for Canada. Agriculture and Agri-Food Canada, Research Branch and Environment Canada, Ecozone Analysis Branch, Ottawa/Hull. Report and national map at 1:7,500,000 scale.

Eilers, R.G. and K.E. Buckley (eds) 2001. A methodology for evaluating soils, landscapes and geology for nutrient management planning in the prairie landscape. AAFC Tech. Bull. 2001-1E Land Resource Group, Research Branch, Agriculture and Agri-Food Canada, Winnipeg, Manitoba 124 pp.

Lacelle, B., C. Tarnocai, S. Waltman, J. Kimble, N. Bliss,B. Worstell, F. Orozco-Chavez and B. Jakobsen. 2000. North American Soil Organic Carbon. Agriculture and Agri-Food Canada, USDA, USGS, INEGI, and Institute of Geography, University of Copenhagen. USDA, Lincoln, Nebraska, USA (map only)

Marshall, I.B., C.A.S. Smith and C.J. Selby. 1996. A national framework for monitoring and reporting on environmental sustainability in Canada. Environmental Monitoring and Assessment 39:25-38

McConkey, B.G., C.M. Monreal, T. Huffman, G.T. Patterson, J.A. Brierley, R.L. Desjardins, P. Rochette, M.R. Carter, M. Bentham and S. Gameda 2003. National carbon and greenhouse emission accounting verification system for agriculture (NCGAVS). **In** C.A.S. Smith (ed) Soil Organic Carbon and Agriculture: Developing Indicators For Policy Analyses. Agriculture and Agri-Food Canada, Ottawa and Organisation for Economic Development and Cooperation. Paris. 325 pp.

McRae, T, C.A.S. Smith and L.J. Gregorich (eds) 2000. Environmental Sustainability of Canadian Agriculture: Report of the Agri-Environmental Indicator Project. Strategic Policy Branch, Agriculture and Agri-Food Canada, Ottawa 224 pp.

Shields, J.A., C. Tarnocai, K.W.G. Valentine and K.B. MacDonald 1991. Soil Landscapes of Canada: Procedures manual and user's handbook. Agriculture Canada. Publication 1868/E. Ottawa, 74pp.

Tarnocai, C. 2000. Carbon pools in soils of the Arctic, Subarctic and Boreal regions of Canada. **In**: R. Lal, J.M. Kimble and B.A. Stewart (eds.) Global Climate Change and Cold Regions Ecosystems. Advances in Soil Science, Lewis Publishers, Boca Raton, Fla., pp. 91–103.

Tarnocai, C. and B. Lacelle. 1996. Soil Organic Carbon Map of Canada. Eastern Cereal and Oilseed Research Centre, Agriculture and Agri-Food Canada, Research Branch, Ottawa, Ontario, Canada (map only).

Tarnocai C., I.M. Kettles, and B. Lacelle. 2000. Peatlands of Canada. Geological Survey of Canada, Open File 3834. Geological Survey of Canada, Ottawa (Map at 1:6 500 000 scale) .

NCSS Special Reports

Soil Change and Natural Resources Decision Making: A Blueprint for Soil Survey

Arlene J. Tugel, Soil Scientist, NRCS Soil Quality Institute, Las Cruces, NM
atugel@nmsu.edu

Abstract

This paper presents objectives, goals and an iterative strategy as a blueprint for enhancing soil survey with information on soil change. Decision making for soil and resource management requires information about the nature of soil change. There is increasing demand for information on the management time scale about resource condition and changes in the capacity of the soil to function resulting from natural disturbances and human impacts. Congress wants to know about the condition of our resources and land managers are being asked to consider resource condition in their management strategies. Knowledge of how soils change is needed to quantify soil function, detect change in function after a disturbance, to interpret results of assessment and monitoring, and to make predictions of soil response to management and climate change. However, necessary information is not available in soil surveys. Ecologically based soil change information should be included in soils surveys to meet current resource and environmental management requirements. Specific information includes reference or potential values (state variables), rates of change, drivers of change, and resistance and resilience to change in function. Key concepts for soil change, objectives and goals to meet this challenge are presented.

History of soil survey

A brief review of some major events in 19th and 20th century history of the US will give contextual understanding of soil survey advancements related to society's needs (Fig 1). The first soil surveys were begun in the late 1890's and the National Cooperative Soil Survey was established in 1899 (Durana, 2002). Early soil maps were made for agricultural purposes to meet the settlement needs of a nation. In 1935, Charles E. Kellogg, Chief, Soil Survey Divison, Bureau of Plant Industry, Soils, and Agricultural Engineering established policy for the inclusion of productivity ratings in all soil surveys (Durana and Helms, 2002).

World War II had a significant impact on soil survey in the US because of the drain on research scientists and mappers as they were called to war. After WWII, soil survey rose to the challenge and met the demands of a nation seeking 1) post-war stability and 2) increased productivity and agricultural and industrial expansion to meet world food demands. During the period from 1950 to 1974, Soil Taxonomy was developed to facilitate a uniform survey and data extension (Arnold, 1994). Legislation was passed that expanded the authorities of soil survey to meet needs for a developing nation (Durana and Helms, 2002). Most of today's standard soil interpretations for rangelands, forestlands, wildlife and non-agricultural uses of soil were developed during this same time frame.

The passage of the National Environmental Protection Act in 1969 had dramatic effects on the every day business of federal land management agencies (Muhn, 2002) and during succeeding years, raised the awareness and the concern of the American public for the condition of our nation's resources. However, soil survey advancements tailored to meet these environmental needs were not forthcoming for a number of years and are still limited to soil erosion parameters, nutrient and pesticide interpretations and hydric soil identification.

The completion of Soil Taxonomy and soil interpretations for non-agricultural uses were followed by the information age. Automated processing technologies were put to use in the early 1970's as soil databases were developed. During the 1980's, geographic information systems were adapted for soil survey map products. Both digital map products and electronic copies of soil surveys were made available to the public in the late 1990's. Landscape analysis procedures became available and testing of these operational tools for soil survey began in 2000.

The Government Performance and Results Act of 1993 had an impact on soil survey customer needs. Congress asked for accountability of government expenditures and expected to see results in terms of resource or society-based outcomes. Agency strategic plans developed in response to GPRA included quantifiable performance goals for healthy lands in the US. Measures that reflect soil condition are intrinsic in performance goals for all types of land uses (e.g. cropland, rangeland, forestland, urban land). The only soil-based property related to resource condition that is provided in soil survey is T factor. However, T factor defines tolerable soil loss, not resource condition.

After reviewing this timeline, an obvious question is "what major user need will soil survey meet in the 21st century?" The answer is "soil change" and the driving force is the awareness and concern of the American public for human impacts on and the condition of our nation's resources. A blueprint to meet this challenge is presented in this paper.

Soil survey of the 21st century: The challenge

Today's land managers and policy makers need soil information which is currently lacking in soil surveys. They are challenged to compare alternatives and make decisions that balance short- and long-term productivity, economic sustainability and environmental goals. Soil surveys do not include information on the dynamic nature of soil. Soil interpretations are not designed to address resource condition as affected by natural disturbances or human activities. Managers need information about the nature of soil change to prevent soil and land degradation, to support restoration and remediation activities, to establish and interpret assessment and monitoring programs, and to predict management effects on resource condition. All of these needs rely upon an understanding of use-neutral genetically derived soil properties as well as ecological processes, functions and the dynamic nature of soil.

The blueprint

This blueprint to meet this challenge includes objectives, goals and strategies for the development of soil survey enhancements that emphasize cause and effect on soil function. An example is the absence of fire in the mid-grasss prairie causing a decline in soil organic matter and resulting in decreased forage production.

A. Objective. Enhance soil survey of the 21st century to meet customer needs for decision making related to resource condition and sustainability. Include information about
soil and ecosystem change,
on the human time scale,
resulting from natural and human disturbances, and
related to soil function.
The human time scale includes both decades and centuries (Richter and Markowitz, 2001). Three primary goals should be addressed.

Goal 1. Include soil change data and information in soil surveys. Selection of items to include should be based on an evaluation of customer needs and cost effectiveness of data development. Possible items to include are: state variables (use-dependant properties), threshold values, drivers of change, rates of change, reversibility, resistance and resilience, and interpretations.

Goal 2. Develop a process-based relational framework to organize soil change data and interpretations. State and transition models (Westoby et al., 1989; Stringham et al., 2001) are process based and provide the necessary elements for the framework, including state variables, thresholds, resilience and drivers of change. Other frameworks may exist and should be evaluated.

Goal 3. Conduct interdisciplinary research on soil change. The research should meet NCSS needs for enhancing soil survey with soil change data and information.

B. Strategies. Developing the science and technologies of soil change for soil survey is an iterative process. Five steps, which can also be considered benchmarks of progress, are in this blueprint (Fig 2).

Step 1. Identify customer needs.
Step 2. Develop simple concepts and clearly defined terms.
Step 3. Conduct integrated research and long term studies on soil change.
Step 4. Develop decision-aid applications and simple conceptual models to organize soil change data.
Step 5. Develop data collection and modeling procedures, interpretations and information systems.

Key concepts for soil change

Soil scientists working together with scientists and specialists from other disciplines need to follow some key concepts in order to develop, understand and interpret dynamic interactions of soil related to functional capacity and resource condition. These concepts are function, soil change, dynamic soil properties, processes, disturbances and attributes of change.

Function. For the purposes of this paper, only a few examples of soil and ecosystem functions are presented. Rangeland health (Pellent et.al., 2000) assessments evaluate three attributes on the basis of their capacity to function. The attributes are soil and site stability, hydrologic function and biotic integrity. Soil quality assessments identify five functions (Karlen et. al., 1997): productivity and biodiversity, regulating water, cycling nutrients, filtering and buffering contaminants and providing structural support. The literature includes numerous other similar concepts for function.

Soil change. Soil change through time can be summarized as follows: soil is formed by pedogenesis, affected by historical land-use, and is currently changing in modern ecosystems that have increasing human influence (Richter and Markowitz, 2001). Jenny's (1941) factorial model states that soil is a function of climate, organisms, topography, parent material and time. It is important to remember that change is not caused by time. Every change in a system requires time, but change is not caused by the mere passing of time (Nikiforoff, 1959). Change results from variation in physical force or energy, whether the force is climate change on a geologic time scale, absence of fire on a centurial time scale or a plow on the seasonal time scale. Changes from human impacts on soil are more predictable if our thoughts include an appreciation of energy fluxes or processes (Smeck et al., 1983). Changes in soil function depend on an understanding of processes.

Dynamic soil properties. Dynamic soil properties are soil properties that change over a specified time scale in response to management, land use, natural disturbances and natural cycles. The human time scale includes both decades and centuries (Richter and Markowitz, 2001). Changes in soil properties can be measured over time through long-term studies or monitoring or by the careful substitution of space for time. Grossman (2001) defines use-dependent properties as properties that change with land use.

Processes. Changes in soil properties result from and produce variation in processes. The primary ecological processes are energy flow, the hydrologic cycle, and nutrient cycling. Processes are the thread that link soil and the other components of an ecosystem to each other. The functional capacity of soil is based on soil processes (Herrick et al., 1999) and synergistic or degradational interactions among soils, plants, animals, climate and management. Changes that can be measured, i.e., temporally variable or "dynamic soil properties," actually reflect the change in process. For example, decreased soil organic matter results in decreased resistance to erosion and reduced infiltration.

Disturbances. A disturbance is a change in force or energy that can modify soil morphology and composition, processes and the capacity to function. Disturbances include human actions as well as natural phenomena, e.g. cultivation, management inputs, irrigation, drought, fire, absence of fire, grazing, invasive weeds, floods, etc. A disturbance in the forest ecosystem such as catastrophic fire produces a hydrophobic soil layer that restricts infiltration, increases runoff and can increase erosion. Among other things, the fire changed the capacity of the soil function, e.g., to regulate the flow of water in the system (Fig 3).

Attributes of soil change. The book "Global Soil Change" (Arnold et al., eds., 1990) presents a number of terms to describe the nature of soil change. Terms included are: changeability, trends, reversibility, rates, pathways and feedbacks. Other important concepts include soil-plant/animal interactions as well as resistance and resilience (Herrick and Wander, 1998; Seybold et al, 1999). Interpreting the effect of soil change on function depends upon an understanding of these attributes of soil change.

How will the data be used?

Soil change information can be used to support practice designs, quantify amounts, trouble shoot problem areas, interpret assessments and predict soil behavior and response. Examples of using dynamic soil properties for 1) improving engineering calculations, predicting carbon sequestration potential and 3) soil assessment to support management decisions are described in Tugel et al. (2002).

Landowner information requirements in the example below illustrate some possible uses of soil change attributes. When considering resource condition and attaining management goals, managers are seeking answers to one or more of the following questions about the capacity of the soil to function: 1) What is it? 2) What should it be (for intended or sustained use)? 3) If degraded, can it be restored or improved? 4) What will it take to restore or improve it? 5) How long will it take? The answers to these inquiries require information about soil change and the dynamic nature of soil. In this example (Fig 4), a rancher makes a rangeland health assessment (Pellant et al, 2000) and detects a root-limiting compaction problem. Once the rancher determines the bulk density of the problem soil, data for interpretation and prediction are needed. Data that could be provided by soil survey includes: 1) reference values that specify the desired bulk density for the plant community, 2) drivers of change that can be used to restore the soil to the desired condition, and 3) information on thresholds of change, resistance, resilience and rates of change to anticipate the probability and timeframe for recovery.

Summary and conclusions

Proper soil management and the assessment, prevention and mitigation of undesirable management impacts on soil and ecosystems require information about attributes of soil change. The NCSS can provide leadership to advance the science of soil change and develop soil change technologies for soil survey. Soil Survey should include information about soil and ecosystem change on the human time scale resulting from natural and human disturbances that affect function. The human time scale includes both decades and centuries. The emphasis should be on soil function.

References

Arnold, R.W. 1994. Soil geography and factor functionality: Interacting concepts. p. 99-109. In R. Amundson et al. (ed.) Factors of soil formation: A fiftieth anniversary retrospective. SSSA Spec. Publ.33. ASA, CSSA, and SSSA, Madison, WI.

Arnold, R.W., I. Szabolcs and V.O. Targulian (eds.). 1990. Global Soil Change. Report of an IIASA-ISSS-UNEP Task Force on the Role of Soil in Global Change. International Institute for Applied System Analysis, Laxenburg, Austria.

Durana, P.J. 2002. Appendix A: Chronology of the U.S. Soil Survey. p 315-320. *In* D. Helms, A.B.W. Effland and P.J. Durana (eds.) Profiles in the History of the U.S. Soil Survey, Iowa State Press, Ames, IA.

Durana, P.J. and D. Helms. 2002. Soil survey interpretations: Past, present, and looking to the future. p 275-302. *In* D. Helms, A.B.W. Effland and P.J. Durana (eds.) Profiles in the History of the U.S. Soil Survey, Iowa State Press, Ames, IA.

Herrick, J.E. and W.G. Whitford. 1999. Integrating soil processes into management: from microaggregates to macrocatchments. In: Eldridge, D, and Freudenberger, D. (Eds.), *People and Rangelands: Building the Future.* Proceedings of the Fifth International Rangeland Congress, vol 1. Townsville, July 19-23. International Rangeland Congress, Inc. Townsville, Australia, pp. 91-95.

Grossman, R.B. D.S. Harms, C.A. Seybold, and J.E. Herrick. 2001. Coupling use-dependent and use-invariant data for soil quality evaluation in the United States. J. of Soil and Water Conserv. 56:63-68.

Jenny, 1941.Factors of soil formation. A system of quantitative pedology. 1st ed. McGraw-Hill Book Co., New York.

Grossman, R.B., D.S. Harms, C.A. Seybold, and M.T. Sucik. 2001. A morphology index for soil quality evaluation of near-surface mineral horizons. p.637-640. In: D.E. Stott, R.H. Mohtar and G.C. Steinhardt (eds.) Sustaining the Global Farm. Selected papers from the 10th International Soil Conservation Organization Meeting held May 24-29, 1999 at Purdue University and the USDA-ARS National Soil Erosion Research Laboratory. Purdue University, West Lafayette, Indiana.

Karlen, D.L., M.J. Mausbach, J.W. Doran, R.G. Cline, R.F. Harris, and G.E. Schuman. 1997. Soil quality: A concept, definition, and framework for evaluation. Soil Sci. Soc. Am. J. 61:

Muhn, J. 2002. Soil science in the Bureau of Land Management. P 215-231. In R. Amundson et al. (ed.) Factors of soil formation: A fiftieth anniversary retrospective. SSSA Spec. Publ.33. ASA, CSSA, and SSSA, Madison, WI.

Nikiforoff, C.C. 1959. Reappraisal of the soil. Science. 129:186-196.

Pellant, M., P. Shaver, D. A. Pyke and J.E. Herrick. 2000. Interpreting Indicators of Rangeland Health, ver 3. Technical Reference 1734-6. USDI-BLM, Denver, CO.

Richter Jr., D.D. and D. Markewitz. 2001. Understanding Soil Change: Soil sustainability over millennia, centuries, and decades. Cambridge University Press, Cambridge, UK.

Seybold, C.A., J.E. Herrick, and J.J. Brejda. 1999. Soil resilience: a fundamental component of soil quality. Soil Science 164: 224-234.

Smeck, N.E., E.C.A.Runge, and E.E. MacKintosh. 1983. Dynamics and genetic modeling of soil systems. p. 51-81. In Wilding, L.P., N.E. Smeck and G.F. Hall (eds.). Pedogenesis and Soil Taxonomy. I. Concepts and Interactions. Elsevier Science Publishers B.V. Amsterdam, The Netherlands.

Stringham, T.K., W.C. Krueger, and P.L. Shaver. 2001. States, transitions and thresholds: Further refinement for rangeland applications. Special Report 1024. Agricultural Experiment Station, Oregon State University, Corvallis OR, USA. (Order copies from: Dept. of Rangeland Resources, Oregon State University, 202 Strand Hall Corvallis, OR 97331-2218), or download pdf at http://www.ftw.nrcs.usda.gov/glti/pubs.html

Tugel, A. , A. Lewandowski, R. Bigler, J. Scheyer, L. Steffen and C. Talbot. 2002. Needs and Availability of Use-dependent/Dynamic soil properties Data and Problem Statement: An Initial Problem Statement. USDA, NRCS Issue Paper presented to Soil Survey Division Leadership, National Soil Survey Center, Lincoln, NE. April 2002.

Westoby, M., B. Walker, and I. Noy-Meir. 1989. Opportunistic management for rangelands not at equilibrium. Journal of Range Management 42:266-274.

Figure 1

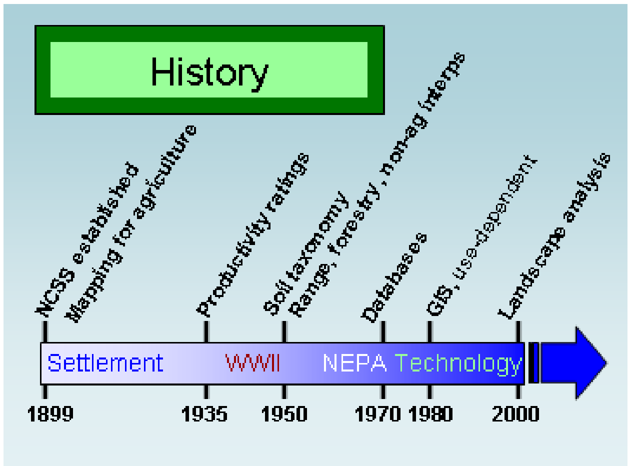


Figure 2

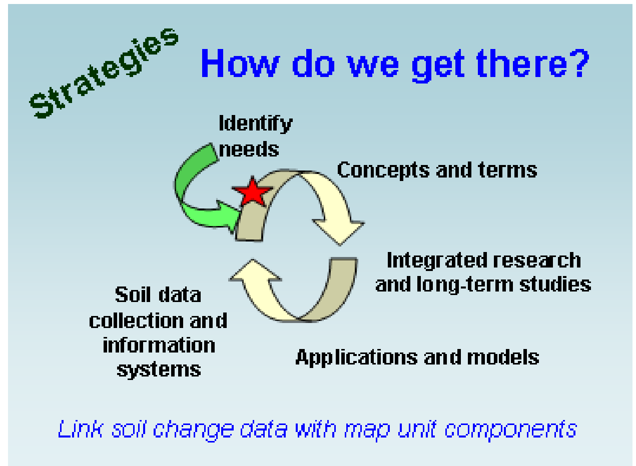


Figure 3

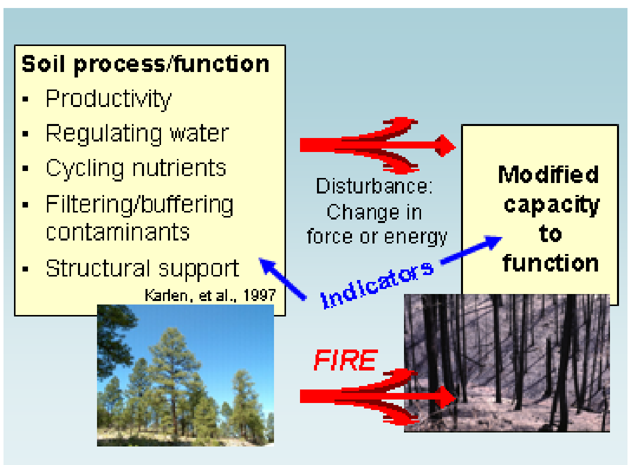
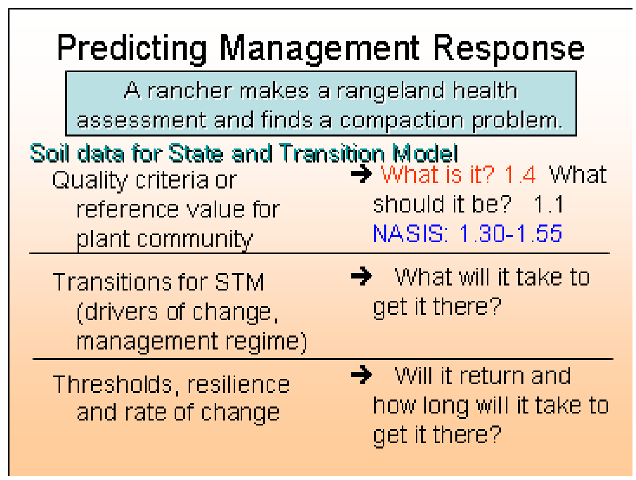


Figure 4



Soil Indicators of Rangeland Health Evaluation Systems: Potentials for Assessing and Monitoring Change in Soils

Jeffrey E. Herrick
USDA-ARS Jornada Experimental Range
Las Cruces, NM 88003-8003
Tel: 505-646-5194 – Internet: jherrick@nmsu.edu

Introduction. Soon after releasing "Soil and Water Quality: an Agenda for Agriculture" (NRC, 1993), the National Research Council published the book "Rangeland Health: New Methods to Classify, Inventory and Monitor Rangelands" (NRC, 1994). The book recommended a significant expansion of traditional rangeland assessment and monitoring from plant community composition, cover and production. The new approaches were to include the processes and properties that determine site productivity, water infiltration, soil erosion and resistance and resilience to degradation. In response to these recommendations, a quantitative assessment protocol (Pellant et al., 2000 and 2003) and a quantitative monitoring protocol (Herrick et al., *In Press*) were developed. Rather than focusing on a particular land use, indicators were selected that reflect relatively dynamic processes and properties that determine the *capacity of the land to function* today and in the future. As a result, both protocols include a much stronger emphasis on soils and on both soil and vegetation indicators that reflect both soil and ecosystem function.

The two protocols are designed to provide information on three attributes: soil and site stability, hydrologic function and biotic integrity. Biotic integrity reflects the current status of the biotic community, and its resistance and resilience to change (Seybold et al., 1999), which is a function of both soil and vegetation properties and processes.

Qualitative assessment protocol. "Interpreting Indicators of Rangeland Health" (Pellant et al., 2000 and 2003) is based on 17 soil and vegetation indicators, including bare ground, plant functional and structural groups, pedestals and terracettes, soil surface loss or degradation and compaction. Each indicator is rated as "departure from expected" for the ecological site (as defined by climate and relatively static soil properties). The "preponderance of evidence" of different indicator combinations is used to evaluate each of the three attributes. This qualitative, subjective protocol provides surprisingly consistent assessments when applied by qualified personnel who have a clear understanding of ecological site potential. NRCS and other organizations are in the process of defining the expected potential for each ecological site (group of soils that have a similar potential to conserve soil, capture and release water, and support plant communities that are resistant and resilient to degradation). This potential is recorded in an Ecological Reference Sheet (Pyke et al., 2002; Pellant et al., 2003) that will become part of Ecological Site Description. This protocol is not recommended for use as a monitoring tool because it is qualitative.

Quantitative monitoring protocol**. The "Monitoring Manual for Grassland, Shrubland and Savanna Ecosystems" (Herrick et al., *In Press*) includes a suite of complementary quantitative soil and vegetation measurements. Indicators calculated from three of the four core measurements (line-point intercept,**

vegetation gap intercept and belt transect) together provide a relatively comprehensive description of the composition and structure of the plant community as it relates to soil and ecosystem function. A fourth measurement, the soil stability kit (Herrick et al., 2000), provides a rapid, relative estimate of soil surface resistance to detachment through a 6-class rating system. Additional measurements (including penetration resistance and relative soil water infiltration capacity) are included to address more specific monitoring objectives. The measurements were selected based on the criteria listed below (#7 in "Summary and Conclusions", including cost (e.g. Table 1)). In some cases (e.g. bare ground) the ecological site description provides an absolute reference, while in others baseline data are used as a relative reference until reference databases are developed. Because it is not based on any particular management system, it can be easily adapted to address multiple management objectives.

One unique characteristic of both protocols is that they implicitly recognize the importance of *ecological thresholds* (Bestelmeyer et al., 2003; Stringham et al., 2003). The ecological threshold concept is another useful tool for soil change because it increases cost-effectiveness by focus on assessing, monitoring and managing relatively irreversible changes (Tugel, this volume; Herrick et al., 2002).

Table 1. Average number of replications total costs required to generate reference data for defined level of detectable change for four ecological sites ($p = 0.2$; power = 0.8) (Herrick et al., unpublished data). The study demonstrated that the costs of including different soil properties in a reference database varied widely as a function of both individual measurement costs and the number of measurements required.

Method	**Detectable Change**	**Replication Required**	**Cost/ Replication**	**Total Cost**
			--- minutes ---	
Infiltration (single ring)	30%	29	15	435
Bulk density (cylinder, 1-5 cm)	0.1 g/cc	14	21	294
Soil stability (field kit)	1 class	21	1.6	33

Summary and conclusions. In addition to specific measurements and indicators, the work completed to develop these two protocols resulted in seven conclusions that are relevant to assessing and monitoring soil change.

(1) Emphasize properties that are important for ecosystem function and are sensitive to a wide variety of uses, rather than those that are most sensitive to a particular land use. Individual land uses may no longer exist 100 or even 20 years from now and new ones will be developed.
(2) Emphasize qualitative indicators for assessment qualitative indicators for monitoring.
(3) Include both indicators of current status and early warning indicators that reflect a change in the capacity of the system to resist (resistance) and recover from (resilience) degradation.
(4) Use the cover, composition, condition and spatial distribution of vegetation to generate indicators that are more cost-effective and potentially correlated with remote sensing indicators.

(5) Generate reference data for a group of soils (ecological site) that have a similar potential to conserve soil, capture and release water, and support plant communities that are resistant and resilient to degradation.
(6) Use the threshold concept to help focus limited resources on those areas with the highest probability of relatively irreversible change.
(7) Apply the following criteria to measurement and indicator selection:
    a. Clearly related to the properties and processes they are intended to reflect.
    b. Easy to measure repeatedly, ideally in the field.
    c. The time needed to complete the number of measurements required to detect a functionally significant difference at a specified level of statistical precision should be minimized (Table 1).

Research and applied trials are clearly needed to address all three criteria. Additionally, because ecological site potential is defined as a function of climate and (relatively) static soil properties, we need to develop a better understanding of (1) the effects of spatial variability in relatively static soil properties on relatively dynamic soil properties, (2) the effects of interactions between different soil properties (static/dynamic) and climate on ecological processes. This requires reference data for both relatively static and dynamic soil properties.

Literature Cited

Bestelmeyer, B.T., J.R. Brown, K.M. Havstad, R. Alexander, G. Chavez and J.E. Herrick. 2003. Development and use of state and transition models for rangeland management. Journal of Range Management 56:114-126.

Herrick, J. E., J. R. Brown, A. J. Tugel, P. L. Shaver, and K. M. Havstad. 2002. Application of Soil Quality to Monitoring and Management: Paradigms From Rangeland Ecology. Agronomy Journal 94, no. 1:3-11.

Herrick, J.E., J.W. Van Zee, K.M. Havstad and W.G. Whitford. In Press. Monitoring Manual for Grassland, Shrubland and Savanna Ecosystems. USDA-ARS Jornada Experimental Range, Las Cruces, NM http://usda-ars.nmsu.edu/JER/monitoring.htm.

Herrick, J.E., W.G. Whitford, A.G. de Soyza, J.W. Van Zee, K.M. Havstad, C.A. Seybold, M. Walton. 2001. Soil aggregate stability kit for field-based soil quality and rangeland health evaluations. CATENA 44: 27-35. http://usda-ars.nmsu.edu/JER/monitoring.htm

National Research Council. 1993. Soil and Water Quality: an agenda for agriculture. Washington, D.C.: National Academy Press.

National Research Council. 1994. Rangeland health: new methods to classsify, inventory, and monitor rangelands. Washington, D. C., National Academy Press.

Pellant, M., P. Shaver, D. Pyke, and J. Herrick. 2000 and 2003. Interpreting Indicators of Rangeland Health, Version 3.0 and 4.0. Denver, Colorado: Bureau of Land Management http://www.ftw.nrcs.usda.gov/glti/pubs.html.

Pyke, D.A., J.E. Herrick, P. Shaver, M. Pellant. 2002. Rangeland health attributes and indicators for qualitative assessment. Journal of Range Management 55:584-597.

Seybold, C.A., J.E. Herrick and J.J. Brejda. 1999. Soil resilience: a fundamental component of soil quality. Soil Science 164: 224-234.

Stringham, T. K., W. G. Krueger, and P. L. Shaver. 2003. States and transition modeling: an ecological process approach. Journal of Range Management 56:106-113.

National Soil Information System (NASIS) – Connecting the Partnership through the WEB and New Technology
Jim Fortner

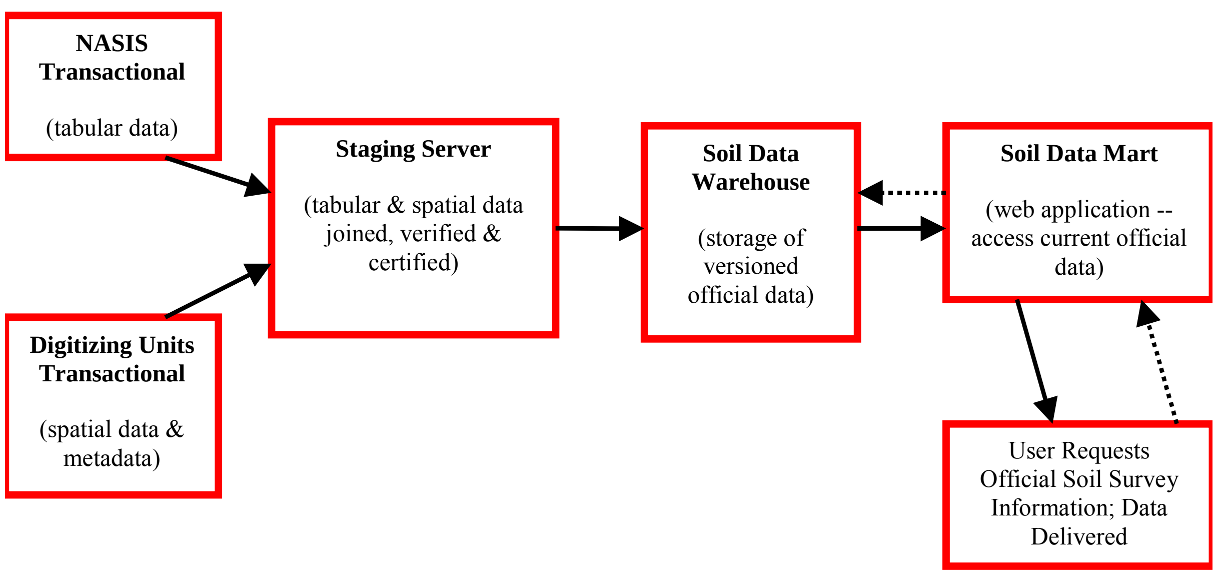
Soil Data Warehouse

- The Soil Data Warehouse (SDW) and Soil Data Mart (SDM) are soon to become reality. The exact release date is unknown at this time, but we will be initiating the beta test phase in the next few weeks. Timeline is presented below.

- The purpose of the SDW/SDM is to provide a single source for delivery of a national coverage of official soil survey data & information – digital maps, tabular attribute data, and metadata.

- Products and data delivery points include:
  - FOTG/eFOTG
  - SSURGO
  - Customer Service Toolkit/Soil Data Viewer
  - Technical Service Providers
  - General public
  - Computer models

- A new release of NASIS, version 5.2, will implement this change. Along with this release three new entities will be established – the Staging Server, the Soil Data Warehouse, and a Soil Data Mart. The following diagram illustrates the relationships between the entities.



- In this environment, a copy of the soil survey data that represents the "official" tabular data for each soil survey area is exported from NASIS and loaded onto the Staging Server. At the time of export from NASIS, various validations are run on the data to ensure completeness and integrity. If there is digital spatial data for a particular survey area, it is exported from the appropriate digitizing unit and loaded onto the Staging Server.

- At the staging server, validations are run on the data (tabular only, or tabular and spatial). If both tabular and spatial data exist, the joining of the two datasets occurs at this point. The two datasets are checked to ensure that they contain the same list of map units. The appropriate *mu keys* are inserted into the spatial data tables.

- A metadata file will accompany data for each soil survey area, even if only tabular data are available, using the current SSURGO Metadata template. If only tabular data exists, only appropriate metadata fields are populated.

- The Staging Server is accessible only by the State Soil Scientist or his/her designee. When the data are on the staging server, they can be reviewed. One method of review is to export the data in the format that can be loaded into Soil Data Viewer.

- After the State Soil Scientist has reviewed and verified the data, he/she can commit the data to the Soil Data Warehouse (SDW). The action of committing data to the SDW will be the certification by the State Soil Scientist, and the state Field Office Technical Guide (FOTG) committee, that this is in fact the "official" data for the soil survey area.

- Soil Data Warehouse and Data Mart content includes
  - Tabular data, including interpretations
  - Digitized spatial data
    - soil polygons, as well as point and line features, where available
    - soil survey area boundaries (map maintained by NCGC)
  - SSURGO style Metadata file
  - Data for a partial or whole soil survey area
  - SDW contains <u>archived</u> and <u>current</u> versions of official data
  - SDM contains only the <u>current</u> version of data

Soil Data Mart and Customer Access

- Soil Data Mart is a web application
- SDM can be accessed via an link to eFOTG or it can be accessed directly
- SDM allows the user to download tabular data, spatial data, or both, for the soil survey area of interest
  - Spatial data can be downloaded in ArcView shapefiles, ArcInfo coverages, or ArcInfo interchange formats.
  - Users can select which ACCESS template they wish to download – national or state specific.

- SDM allows users to print standard reports for the area of interest, and have the flexibility of indicating which map unit(s) to include in the report. The reports are patterned after the ACCESS template reports. State specific reports can also be made available.

SDW and SDM data population
- At the time of implementation, spatial data from existing SSURGO (version 1 and 2 formats) datasets will be preloaded into the SDW. No tabular data can be preloaded, as it is not in the proper data format. These datasets will be assigned SDW version 1.
- Spatial data from SSURGO 1 datasets will need some editing by the digitizing units before it can be merged with tabular data and moved to the SDM.
- Tabular data will need to be exported from NASIS for each of these SSURGO datasets, merged with corresponding spatial datasets in the staging server, then committed to the SDW. These updated datasets will be assigned SDW version 2.
- Tabular data can exist in the SDM without spatial data, but not vice versa.
- Tabular datasets for all non-SSURGO survey areas should be exported from NASIS to the SDW/SM as soon as possible.

SDW/SDM timeline
- Alpha test ongoing
- Beta test – July-August 2003
- Release NASIS 5.2, SDW – Sept/Oct 2003
- Pre-load data – Sept/Oct 2003
- Re-certify existing SSURGO – Jan 2004 ? (date not firm)
- Export remaining SSA data from NASIS to SDW/SDM – 12/31/04 ? (date not firm)

Electronic Field Office Technical Guide & SDM
- The SDM can be accessed via a link from the eFOTG at http://www.nrcs.usda.gov/technical/efotg/
- Linkage of eFOTG to Soil Data Mart should reduce or eliminate the need for states to separately maintain reports and/or data on the eFOTG. The link can be made between Section II, Soils Information, in the eFOTG and the SDM to provide official soil data and information. However, some data needed for Section II is not in NASIS and therefore will not be available in SDM.

Soil Characterization Data Mart
- The Soil Characterization Data Mart was recently implemented and can be accessed at http://ssldata.nrcs.usda.gov/
- This data mart provides access to soil characterization data in the National Soil Survey Laboratory either for download or by standard reports.
- The interface provides flexibility to query to the database by soil name, state and/or county of sampled site, or lab pedon number.

National Soil Information System (NASIS) – Connecting the Partnership through the WEB and New Technology

Portion Presented by Terry Aho

Soil Data Viewer Objectives

- Create mapunit level thematic soil maps and tabular reports
  Soil Data Viewer connects the soil spatial data in ArcView with the tabular data in MS Access. Provides user the capability to select interpretation or physical and chemical soil properties to process and create mapunit level thematic soil maps or reports.
- Shield user and applications from the complexity of the soil database
  Soil Data Viewer shields users and applications from the complexity of the soil database by incorporating the attribute and table structure in an internal query.
- Encapsulate business rules for appropriate processing of soil data
  The Soil Data Viewer business rules database provides for appropriate choices for processing the soil data. Allowing the user to focus on what data they need and not on how to find or process the data.
- Insulate users and applications from future structural changes to the soil database
  Soil Data Viewer insulates the user from the structure of the soil database providing for future adjustments in the soil database structure with impacting the user.

Soil Data Viewer Ugrade

- FY03 Funding to Upgrade SDV
  We received FY03 funding to upgrade SDV 3. Work will begin soon and potentially carry-over through FY04.
- SDV 4 in-sync with soil database
  Currently SDV 3 interface is controlled by a separate rules database that provides the available choices of interpretations, soil physical and chemical properties, and valid processing options. While the rules database can be customized for local interpretations and valid processing options, it’s not easy for users that have several soil survey datasets to switch rules database appropriate for their soil survey.

  The next release will integrate the business rules into the soil survey database delivered from the Soil Data Mart. SDV 4 will get its instructions when the user attaches to a specific soil survey database. This will provide users with a seamless interface to the available interpretations for a specific soil survey.
- Portable: ArcView 3, ArcGIS 8, Web
  The current Soil Data Viewer works only as an extension to ArcView 3.x. It is expected that Field Service Centers will begin migrating from ArcView to ArcGIS over the next couple of years. Many state offices and partners already have begun utilizing ArcGIS. The redesign and upgrade of SDV will focus on the portability of the application to work with ArcView 3, ArcGIS and over the Web. At this point we don’t know what technical issues may surface when we try to support multiple applications with a single source of core business processing code.
- Improved report capabilities

We've heard from many users of SDV 3 and they have requested a number of enhancements to the report functions currently in SDV. Some of these are including units of measure, spatial and tabular version information, reporting multiple attributes in a single report, and linking to available reports in the soil access database. These and other enhancements will be included in the upgrade.

- Provide processed metadata
  Currently SDV 3 when a soil theme is create the processed attribute value is added to the soil shapefile-dbf, with no information about the version of the tabular data used, units of measure, or the details about the processing.

  For example if SDV is used to process weighted average of the 0 to 25 cm for available water capacity, percent clay and percent organic matter, etc. The processed value is added to the dbf, but the depths used, components included and the units of measure are not captured. If the user then converts the process data to a shapefile and later comes back there is no information about what the data represent.
- Improved processing options
  Currently when processing interpretations SDV 3 returns the rating class for the overall interpretation. Enhancements to provide user selections to return the fuzzy value, the rating class of specific criteria making up the overall interpretation, or return the percent composition the rating makes up for the mapunit.

Web Soil Data Viewer

- Funding to bring back Web Soil Data Viewer
  More than a year or two ago a prototype Web Soil Data Viewer was piloted as part of the Lighthouse-Resource Data Gateway project. That project explored and uncovered many of the technical archecture issues related to an integrated Web access to geospatial data, as well as the Web application functions of Soil Data Viewer. After the pilot, funding was limited to support the continuation of Web Soil Data Viewer and it was brought off-line.

  Recent agency efforts to implement a Geospatial Data Warehouse and our part the Soil Data Warehouse and Soil Data Mart we now have the infrastructure to support Web applications to soil survey data. With FY03 funding we will be bring back the functionality of the Web Soil Data Viewer.
- Same basic functionality as SDV
  The Web version will have basically the same functionality as the client version of Soil Data Viewer 4.0 running on your desktop. Our development goal is to try to create a single core source code that can be utilized in several applications thus reducing the cost of supporting separate code bases for each application.
- Provide Web Service Connections
  As the agency moves forward with additional and improved customer delivery of services over the Web we will be looking at providing Web Services to Web Soil Data Viewer and the Soil Data Mart. Web Services is a term used to describe a service you provide and maintain for other application. Other Web application

such as a model like RUSLE or Runoff Curve Number would send a set of instructions across the Web to Web Soil Data Viewer (WSDV) or Soil Data Mart (SDM). From these instructions WSDV or SDM would return such things as a process soil thematic map or specific soil report.

- Integrate with other resource data layers
  The Web Soil Data Viewer prototype displayed the soil spatial data over an ortho-photo back drop. We want to take a close look at the ability to add or integrate other resource data into the Web Soil Data View, such as, hydro, transportation, climate, etc. for viewing with the soil map.

NASIS Re-Tooling

- Funding to move from X-Windows to a more main stream interface technology
  The farm service agencies have been moving towards a common computing environment (CCE) as well as the IT development looking at standardizing where possible the development environment. With funding we've received we are taking a serious look at re-doing NASIS from X-Windows to a more standard development technology. There are some outstanding questions whether this will help in NASIS user drop connections. The change from X-Windows will have minimal impact on the NASIS user.
- Move from Informix to SQL Server dB
  Part of the re-tooling effort we will be looking at migrating from Informix to the agency enterprise licensed Microsoft SQL server. This will have minimal impact on the NASIS user.
- NASIS user survey
  The Soil Business Area Analysis Group (SBAAG) conducted a survey of NASIS users across the country. The survey's intent was to discover what functional areas of the NASIS application are difficult to use and could be improved.

  188 people across 40 plus states responded to the survey. SBAAG is currently analyzing the results. There are some early indications that the NASIS report and interpretation functions appear the most cumbersome and difficult to use.

  ITC and NCSS are looking at establishing a NASIS user group to assist in identifying specific interface issues that affect usability.
- Target NASIS interface re-design
  During the NASIS re-tooling effort of the X-Windows and SQL server database, we will take a seriously look at the potential to re-design portions of interface and functions. The NASIS user survey and user group will aid this effort.
- Other Activities
  - Spatial Analysis
    NCSS is gearing up to re-establish the spatial analysis group. This group will be gathering our business requirements for the spatial portion of what we do. We need to have the analysis complete before we can continue towards the fully integrated information system to manage the maps and tabular data.
  - Database structural changes to support new join policy

Recently the Soil Survey Division published new guidance on the issue of joining mapunits between soil surveys. The current NASIS structure makes it difficult to fully implement this new policy. ITC and NCSS will be looking at what approaches are needed to facilitate the join policy such as, database structural changes, validations, or data compare reports.

Web Soil Survey

- West Texas Pilot FY03
  Last year the west Texas telecommunication project was initiated to improve and modernize Field Service Centers connectivity and program delivery (eGOV) in West Texas. This FY year additional funding was received to pilot an effective soil survey delivery system in light of eGOV initiative.
- Pilot a Web delivery system for custom Soil Survey Report
  The pilot will be looking at prototyping a Web Soil Survey delivery system, which provides a user interface to customize the delivery of parts of the soil survey to meet their needs. Using navigational services a user finds their area of interest, and then selects which data to use in the assembly of their custom soil survey report.
- Integrate with Web Services to Soil Data Mart and Web Soil Data Viewer
  Part of the Web Soil Survey will be the integration of dynamic up-to-date soil survey tables from the Soil Data Mart as well as soil interpretation maps using the web services of Web Soil Data Viewer.
- Provide customer packaging options
  The user will be provided with several options of the delivery of their requested data. They can view and print from their web browser, download over the internet, request data sent on CD, or request hard-copy printout send via surface mail.

Introduction to Interpretation Modules and Fuzzy Logic.
Summary of Remarks made by Russ Kelsea at the NCSS Conference, Plymouth Massachusetts on Friday, June 20, 2003 as part of Optional Seminar

Mays, Bogardi, Mausbach and others explored the application of fuzzy logic to soil survey interpretations in the late 1980s and early 1990s, but the catalyst for development of a fuzzy logic interpretation engine in NASIS occurred in 1995 when a group from Pennsylvania State University demonstrated a software application to NASIS developers in Fort Collins. The Penn State application used a branch of mathematics known as fuzzy set theory to rate the relative quality of specific reaches of the Columbia River for the production of Coho Salmon. The application produced an index value that could be regarded as similar to a soil potential index or any other index value used in pedology, i.e. it was an intuitive value for rating a particular quality. The concept was reinforced later that year during the at the SSSA meetings in St. Louis, where Tang and Groenemans illustrated the practical applications and mathematical basis of fuzzy set theory in land evaluation. Based on this inspiration, Bob Nielsen and others created, and NRCS adopted a whole new approach to making soil interpretations.

The fuzzy set approach offers many advantages. We now have the ability to create a continuous interpretive result that reflects the gradation of properties across the landscape, which means that we can consider presenting interpretive results on maps in new ways. For example, when rating soils for land application of municipal sewage sludge, we created a nearly continuous gradation of one color in which darker shades represented increasing limitations. This map looked very much like a shaded relief map. A continuous interpretive result also means that we can use the fuzzy values directly in cartographic models using map algebra in geographic information systems. This gives us the ability to create decision making tools (tax assessment, track-vehicle route examples) rather than simple thematic maps that must be used with other information before a decision can be made.

Our experience indicates that a critical part of making and understanding fuzzy interpretations is the ability to articulate an interpretive statement in ordinary language. Such a statement might be “A soil is good for agriculture if it is productive, manageable, and sustainable.” This statement includes the interpretive use (agriculture), the features affecting the use (production, management, sustainability), and the relationship between the features (productive AND manageable AND sustainable). A feature such as “sustainable” is recursively an interpretive use which might be articulated as “A soil is sustainable if it maintains tilth, nutrients, and soil moisture.” Thus, ordinary language explains the interpretation, and the fuzzy math (AND means minimum of the set) is included in the statement.

Given the new capabilities, we can now deal with interactions more easily. For example, we typically think that soils have more limitations for dwellings with basements as slope increases. We also think that soils have more limitations as water table is closer to the soil surface. But we also think that a sloping soil with water at 3 feet would be better than a nearly level soil with water at 3 feet because the sloping soil could be drained.

This scenario illustrates an interaction between slope and water which might be articulated as "A soil has limitations for dwellings with basements if it is steep, or wet and not drainable." We need to define steep, wet, and drainable, but the fuzzy math is clear and slope is probably considered in two contexts – steepness and drainability.

The fuzzy set approach also offers us new opportunities (Mays, et.al.) in which individual fuzzy factors can be considered in terms of cost and relative limitation in order to determine the most effective (least cost, most impact) methods to overcome limitations. We have not yet begun to explore this application of fuzzy set interpretations.

The new fuzzy set approach, however, requires a change in the way we think about interpretation criteria and the way we present and explain soil survey interpretations. As currently implemented by NRCS, the fuzzy set approach suffers from two main limitations.

First, many of our interpretations are constrained by Boolean set thinking. We have written many of our fuzzy set interpretive criteria in the old familiar style with crisp breaks between classes in order to create Boolean-style slight, moderate, and severe ratings. This approach limits the natural gradation of interpretive results which would be more representative of actual conditions. The example, given earlier in this session, is a fuzzy curve in which slope is constrained between 6 and 15 percent to represent the old "moderate" rating. A more representative fuzzy approach would not constrain the slope, thus producing fuzzy values for the entire range of possible slopes.

Second, although we can apply fuzzy set theory and can demonstrate how the math works (true = 1, false = 0, AND is the minimum of any set of fuzzy values, etc.), we do not understand well enough the mathematical basis, nor do we make use of many of the functions (hedges, etc.) and capabilities (alpha cutoffs, etc.) in fuzzy set mathematics. We could, for example, make better use of hedges such as "very", "extremely", or "somewhat" to modify fuzzy set values. These hedges might be mathematical functions such as squares, cubes, or logarithms. We are familiar with using mathematical functions to transform data for statistical analysis, but we are not familiar with using mathematical functions in fuzzy sets.

It seems clear that we have many new opportunities with fuzzy set interpretations. It also seems clear that we could use some help from our academic partners in understanding and applying fuzzy set theory to soil interpretations. The help we require is not the traditional help with pedological or taxonomic problems. Rather, we need help with understanding and applying mathematical principles and help with learning and explaining new ways of thinking about soil interpretations.

Arid Soils Study in South Africa and Namibia --Slides and discussion on the Arid Soil Study and Field Tour

Bob Engel, Soil Classification and Standards Staff, National Soil Survey Center, Lincoln, NE

Bob Engel reported on the Arid Soils Study in South Africa and Namibia January 22 through February 4, 2003. The study was organized by the Soil Science Society of South Africa (SSSSA) and the International Union of Soil Science (IUSS) Working Group on the World Reference Base for Soil Resources (WRB). The WRB is an international soil classification system similar to our Soil Taxonomy. The study included a field tour through the semi-arid and arid parts of western South Africa and the arid coastal zone of Namibia. About thirty other participants from Australia, Belgium, Burkina Faso, Germany, Hungary, Italy, Namibia, the Netherlands, Republic of South Africa, Russia, Tanzania, and the United States participated. The purpose of the study and tour was (1) to get better insight in the diversity of soils in (semi-) arid regions, (2) to study land use practices on these soils (irrigation, water harvesting, ripping), (3) to test the application of WRB on desert soils, and (4) to compare criteria between WRB and Soil Taxonomy and identify opportunities to better coordinate the two classification systems.

Contact: Bob Engel at bob.engel@nssc.nrcs.usda.gov

Appendix 1—Workshops

Correlation and Management of MLRA Soil Surveys
Presented by Earl Lockridge and Dennis Potter

8:00 – 8:40 AM	Introductions and Course Objectives	Lockridge
8:40 – 9:20 AM	Roles and Responsibilities	Potter
9:20 – 9:35 AM	BREAK	
9:35 - 11:20 AM	Management Issues	Lockridge/Potter
A.	Philosophy of MLRA Approach	
B.	Evaluations	
C.	Working with Partners	
D.	Communication	
E.	Managing the Workforce	
F.	Priority Setting/Flexibility	
G.	Staffing Structure	
H.	Time Management	
I.	MOUs and Work Plans	
J.	Work Load Analysis	
11:20 – 11:30 AM	Course Evaluation Summary	Lockridge
11:30 – 11:40 AM	Technical Presentations – Overview	Potter
11:40 – 11:50 AM	Exercise Overview	Lockridge
1:50 – 12:00 PM	Questions	

This special session was to introduce a portion of our training given during the NEDC course called Correlation and Management of MLRA Soil Surveys. The purpose was to make participants aware of our agenda and what information we present in the course.

We provided a copy of our official course agenda (See below), and presented selected pieces of many of the presentations given during the training. We did not touch all of the topics but tried to focus on the management aspects of the training as well as the "new technologies" portion of the course. The "objectives of the training" was presented as well as the history of the development, design, and presentation of the training.

In the training we have a comprehensive correlation exercise the students work on during the week and on Friday morning each group presents the results of their "correlation conference." The instructors role-play the setup of the correlation problem to get the students involved more completely.

Agenda

Correlation and Management of MLRA Soil Surveys

07/14-18, 2003
Lincoln, NE

Monday, July 14	Agenda topics	
1:00	Welcome and Introductions	Earl Lockridge
	Pre-test	Earl Lockridge
	Course Objectives and Overview	Earl Lockridge
	BREAK	
	Roles and Responsibilities in MLRA Soil Surveys	Tom Calhoun
	MLRA Project Management Issues	Dennis Potter

Tuesday, July 15	Agenda topics	
8:00	Exercise Introduction and Scenerio	Earl Lockridge
	Role Play	Instructors
	BREAK	
	Determining Information Needs	Jeff Olson
	Analysis and Evaluation of Existing Soil Surveys	Jeff Olson
	LUNCH	
	Developing MOUs and Work Plans	Tom Calhoun
	Developing a Workload Analysis for MLRA Project Offices	Jeff Olson
	BREAK	
	Staffing Structure for MLRA Project Office	Tom Calhoun
	Group Interaction	

Wednesday, July 16	Agenda topics	
8:00	Exercise Questions and Answers	Instructors
	Consistent Documentation	Earl Lockridge
	BREAK	
	Special Studies – Writing Proposals	Jeff Olson
	SSURGO – Development and Certification	Mike Hansen
	LUNCH	
	Progressive Correlation – Procedures MLRA Boundaries Joining	Dennis Potter
	NASIS -Entering Text Notes	Dave Kingsbury
	BREAK	
	Utilizing New Technology and Tools	Dennis Potter
	Group Interaction	

Thursday, July 17	Agenda topics	
7:30	OSED – Maintenance, Updating, and Routing	Dave Kingsbury
	NASIS – Managing Multiple Legends	Mike Hansen
	Reports	
	Site Data	
	Data Sharing/Population/Validation	
	Scheduler	
	Break	
	Manuscript Review and Editing	Dave Kingsbury
	Group Interaction	

t

Friday, July 18	Agenda topics	
8:00	Group Reports	Participants
	Post-test and Evaluations	Earl Lockridge
	Wrapup	Earl Lockridge
10:00 AM	Adjourn	

NASIS Database – Intro to Interpretations Modules and Fuzzy Logic
Rick Bigler, Jim Fortner, Russ Kelsea, NSSC

This four hour session gives an overview of the interpretation modules in NASIS, how we currently use fuzzy logic, and then discusses how fuzzy logic could possibly be used for improved interpretations in the future.

A presentation entitled "NASIS Soil Survey Interpretations – A New Perspective" describes:

- The objectives of NASIS interpretations
- The difference between crisp and fuzzy
- NASIS interpretation approach (rules, evaluations, and properties)
- Current constraints regarding NASIS interpretations
- Examples of local applications
- Examples of how the interpretations can be used within GIS

A second presentation entitled "An Introduction to Interpretations" is based on Chapter 14 of the NASIS Getting Started manual. It describes:

- How to develop interpretive statements
- Introduces fuzzy logic, particularly fuzzy math and the use of the OR and AND operators
- Converting the fuzzy result to rating classes
- An example of a NASIS interpretation report

A third presentation is based on the material found in Chapters 15 and 16 in the NASIS Getting Started manual. It includes the following:

- A walk through of the interpretation module in NASIS and a demonstration to class participants how interpretations are created in NASIS.

- Rules (both primary and base), evaluations, and properties are displayed for an actual interpretation (Picnic Areas)
- Among other things participants are able to observe how a particular interpretation criteria is evaluated in the evaluation table
- It demonstrates the options NASIS users have in generating an interpretation report.

Appendix 2—Agenda

NATIONAL COOPERATIVE SOIL SURVEY

Conference 2003
Soil Information for a Changing World

June 16-20, 2003
Plymouth, Massachusetts

Sunday June 15, 2003
Registration - Lobby of Radisson Plymouth Massachusetts
3:00 PM- 8:00 PM

Monday June 16, 2003

Registration - Lobby of Radisson Plymouth Massachusetts
7:30AM-1 PM

Optional Seminars 8:00AM-12 Noon (Must register in advance)Mayflower Ballroom

Option 1:	**Major Land Resource Area Correlation and Mapping in Soil Survey**—Earle Lockridge, NRCS, Dennis Potter, NRCS
Option 2:	**Building Inference Models in GIS to Map Soils (the SOILIM Concept)—**Bill Effland, NRCS**,** Axing Zhu & Jim Burt, University of WI

Soil Quality Institute Staff Meeting—Work group 8 AM-12 noon **(Manomet 3rd floor)**

General Session
Convene in Mayflower Ballroom, Radisson Inn, Plymouth, MA

Moderators	Peter Veneman, University of Massachusetts, Amherst
	Bruce Thompson, Natural Resources Conservation Service

1:05 PM - 1:15 PM	**Introduction & Welcome**	**NRCS MA State Conservationist, Cecil Currin**
1:15 PM – 1:30 PM	**Welcome to MA-- "Value of National Cooperative Soil Survey Effort to the US"**	**Dean, College of Agriculture, University of Massachusetts**

1:30 PM – 2:15 PM	**"The Importance of Statistical Documentation Keeping Soil Information Relevant in the 21st Century"**	**Maurice Mausbach, Deputy Chief, Soil Survey and Resource Assessment, NRCS**
2:15 PM—3:00 PM	**"The NCSS-New Technology Building for the Future With a Changing World"**	**Wayne Maresch, Acting Director Soil Survey Division, NRCS**
3:00 PM- 3:30 PM	**Break**	
3:30 PM – 4:15 PM	**Key Note Speaker—Craig Cox, Executive Director, Soil and Water Conservation Society—"Challenges to the Soil Survey: Soil Information for a Changing World"**	
4:15 PM- 4:45 PM	**Panel- Regional Conferences Highlights & Recommendations, NE (Steve Carpenter (NRCS-WV)or John Sencindiver (UWV)), W ((William Ypsilantis)DOI-BLM), S(Mike Lilly(NRCS MS)or Bill Kingery(MSU)), NC(Travis Neely (NRCS IN))**	
4:45 -5:00 PM	**Conference Logistics for Committee Meetings & Field Trip**	
5:30 PM – 8:00 PM	**Social – Mayflower Ballroom Computer Demos & Poster Session**	

Tuesday June 17, 2003

8:00 AM- 10:00 AM	**Committee Meetings (Open Committees. There is an opportunity to participate in 2 of the committees with an optional rotation at 9:00 AM)**

Committee 1: Selling Soil Science to Society—Promoting Partnerships (Manomet 3rd floor)
This committee should consider issues concerning soil survey product identification, product delivery, marketing strategies, public access to expertise, product timeliness and education on product use with an emphasis on promoting partnerships. Emphasis on transitioning soil surveys to electronic media.
Co-Chairs: Ken Lubich, NRCS, Nathan McCaleb, NCGC, NRCS QIT Publications 2003 Co-Chairs; Gary Steinhardt, Purdue University; Gary Muckel, NRCS, NSSC

Committee 2: Ecological Interpretations & Principles (Mayflower Ballroom 1)
This Committee should review classical references and University curricula for ecological principles and associations with soil and natural resource inventories. The Committee should investigate new interpretations and management recommendations associated with state and transition models; ecological frameworks; ecological site inventories and ecological land use inventories and discuss how they may be incorporated into soil survey.
Co-Chairs: Randy Davis, USFS, Washington, DC; Curtis Talbot, NRCS, Lincoln, NE

Committee 3: New Inventory Techniques and New Delivery Systems in Production Soil Survey (Carver Room 1st floor)
This committee is to concern itself with development national and regional interpretations; and training of soil scientists and geographers in new inventory techniques, interpretation of soil survey data, data collection, use and application of interpretations, and information technology issues concerning the delivery of soil data and applications to the public and private sectors.
Co-Chairs: Henry Mount, NRCS; Axing Zhu & Jim Burt, University of WI

Committee 4: Recruitment and Retention of Soil Scientists in Soil Survey (Mayflower Ballroom 2)
This committee is to concern itself with recruitment and retention of Soil Scientists in soil survey and soil resource management.
Co-Chairs: Jon Gerken, NRCS, SSS, OH; Jason Parman, OPM

Committee 5: Water Movement and Water Table Monitoring in Soil Survey (Halifax 3rd floor)
This committee will explore and discuss how soil survey should address water movement and water tables for regional updates of the soil survey and database representation.
Co-Chairs: Henry Lin, PSU; Cathy Seybold, NRCS

Committee 6: Hydric Soils National Committee (Mayflower Ballroom 3)
Leadership from the National Hydric Soil Committee will discuss 2002 meeting reports and any further debate on the indicators or test indicators for Hydric Soils. This will also be an opportunity for the NE Hydric Soils Committee and the Mid-Atlantic Hydric Soils Committee to meet with the National Committee leadership for discussion of future testing for proposed indicators.
Chair: Karl Hipple, NSSC, NRCS

10:00AM- 10:30AM	**Break**
10:30AM —12 Noon	***Soil Survey on Public Lands—Special Needs and Opportunities*** **Moderator- Pete Biggam, NPS** Randy Davis, USFS, Washington, DC Pete Biggam, NPS, Denver CO Bill Ypsilantis for Tim Sullivan, Soil Scientist, USDI/BLM, Washington, DC George Teachman, Liaison to DOD, NRCS, Aberdeen, MD
12 Noon – 1:30 PM	**Conference Luncheon** **Moderator- Bruce Thompson** **Speakers-** Bob Engel-South Africa Soils Wayne Maresch-NCSS Award

Reconvene at the Mayflower Ballroom
Moderator-Steve Fischer, NRCS MA

1:30 PM – 2:15 PM	***Soil Change and Natural Resources Decision Making: A Blueprint for Soil Survey*** Arlene Tugel, SQI, NRCS
2:15PM—3:00 PM	***Soil Attributes of Rangeland Health Evaluation Systems (Potentials for Assessing and Monitoring Change in Soils)-*** Jeff Herrick, USDA-ARS Jornada Experimental Range
3:00 PM –- 3:30 PM	**Break**
3:30PM-4:00 PM	***Report from NCSS Standards Standing Committee*** Craig Ditzler/Tom Reedy, NRCS, NSSC
4:00PM—5:00 PM	**Special Reports-** Subaqueous Soil Mapping Report-**Marty Rabenhorst, University of Maryland, College Park, MD** **ICOMMOTR –**Wayne Hudnall, Louisiana State University, Baton Rouge, LA ICOMANTH Circular Letter Testing-**John Galbraith, VPI, Blacksburg, VA**
7:00 PM –9:00 PM	**a. *In Conference Committee Meetings-Continue to complete reports*** ***b. Standing Committee Meetings-Recommendations for Future*** **Research Needs—(Manomet 3rd floor)** **New Technology—(Carver 1st floor)** **NCSS Standards—(Halifax 3rd floor)**

Wednesday June 18, 2003

Coffee and pastries will be available at 6:30 AM at hotel meeting site for Tour. Participants will meet Vans at 6:45 AM. Lunch will be provided with the field trip.

7:00 AM – 5:00 PM
(Concurrently) Manomet Room 3rd floor
8:00AM-5:00PM NRCS QIT-- Publications

Thursday June 19, 2003

7:30 AM – 8:30 AM **Strategic Planning for the Future of NCSS-Mayflower Ballroom**
Break Out Sessions for:
University Representatives
Agency Representatives
Private Sector and Consulting Soil Scientists

Mayflower Ballroom
8:30 AM – 9:30 AM ***Report from New Technology Standing Committee (20 min.)***
Bill Effland, Landscape Analyst, NRCS; Pete Biggam, NPS
Special Reports- *"Into the Wild with Technology, The Making of the Soil Survey of Denali National Park, Alaska"-- Landscape Analysis/GIS* –Mark Clark, NRCS, Palmer AK

9:30 AM – 10:00 AM **Break**

10:00AM-10:45 AM ***Report from Research Needs Standing Committee (20 min.)***
Co-Chairs of Committee--Nancy Cavallaro, CSREES-USDA, NRI Soil and Water and Peter Veneman, UMA
Special Reports – Research in SE, Larry West, University of Georgia, Athens, GA

10:45AM-12 Noon
Two Perspectives of a Native American/NRCS Interface in Soil Survey—**Neil Patterson, Tuscarora Environment Program, Sanborn, NY and Steve Carlisle, NRCS Seneca Falls NY**

User Perspective - National Association of State Conservation Agencies (NASCA)-Partnership in Soil Survey with State Government—**Tim Gerber, NASCA Rep, Ohio DNR**

12:00 Noon – 1:00PM **Lunch**

Reconvene at Mayflower Ballroom
1:00 PM – 1:30PM **Special Reports- Canada's New Initiative in Soil Information Upgrade and Delivery, Scott Smith, National Study Leader-Soil Inventory, Agriculture and Agri-Food Canada**

1:30 PM-2:10 PM **Special Reports--National Soil Information System (NASIS)—Connecting the Partnership through the WEB & New Technology**
Terry Aho, ITC, NRCS & Jim Fortner, NSSC, NRCS

(The next 2 hrs will be presentations of Committee reports from Co-Chairs or representative)

2:10 PM –2:20 PM **Committee # 1 Report Recommendations**

2:20 PM –2:40 PM **Committee #2 Report Recommendations**

2:40 PM – 3:00PM **Committee #3 Report Recommendations**

3:00 PM-3:30 PM **Break**

3:30 – 3:50PM **Committee #4 Report Recommendations**

3:50 PM – 4:10PM **Committee # 5 Report Recommendations**

4:10 PM – 4:30PM **Committee # 6 Report Recommendations**

4:30 PM- 5:00 PM **Panel (leadership from University, Agency and Private Sector Breakout Sessions)--Strategic Planning for the Future of NCSS—** Presentations from Breakout Sessions; Review of Action Register; Where do we go from here?

5 PM **Adjourn**

Friday June 20, 2003
Optional Seminars 8:00AM-12 Noon (Must register in advance)(Mayflower 1&2)

Option 1: **NASIS Database—Intro to Interpretations Modules and Fuzzy Logic** Rick Bigler, NSSC; Jim Fortner, NRCS

Option 2: **Soil Quality—Field Methods and Applications—**Lee Norfleet, Bill Puckett, Mike Hubbs, SQI, NRCS

8:00 AM – 10:00 AM **Steering Team Meeting (Steering Team Committee Members only) (Manomet Rm 3rd floor)**

8:00 AM – 10:00 AM **Participants Complete & Submit Reports for Compilation of Proceedings**

NRCS Regional Reports
Committee Reports
Technical Speakers

Appendix 3—Participants

First Name	Last Name	Title	Organization	City	State	ZIP	Email
Terry	Aho	Soil Scientist	USDA-NRCS, Information Technology Center	Fort Collins	Co.	80526	taho@itc.nrcs.usda.gov
Robert	Ahrens	Director	National Soil Survey Center	Lincoln	NE	68508	bob.ahrens@nssc.nrcs.usda.gov
Stan	Anderson	Editor	USDA-NRCS	Lincoln	NE	68508	stan.anderson@nssc.nrcs.usda.gov
Susan	Andrews	Biologist	Soil Quality Institute	Ames	IA		andrews@nstl.gov
Pete	Biggam	Soil Scientist	NPS	Denver	CO		pete_biggam@nps.gov
Ricky	Bigler	Soil Scientist	USDA-NRCS	Lincoln	NE	68508	rick.bigler@nssc.nrcs.usda.gov
Brian	Bills	Professor	Pennsylvania State University	University Park	PA	16802	bbills@essc.psu.edu
Leander	Brown	Soil Scientist	USDQA-NRCS	Laurel	MD	20708	leander_brown@usgs.gov
James	Brown	State Soil Scientist	USDA-NRCS	Annapolis	MD	21401	James.brown@md.usda.gov
James	Burt	Professor	University of Wisconsin	Madison	WI		
Steven	Carlisle	Resource Soil Scientist	NRCS Soil Quality Institute	Seneca Falls	NY		scarlisle@ny.nrcs.usda.gov
Nancy	Cavallaro	Dr.	CSREES-USDA; NRI Soil & Water	Washington	DC		nancy.cavallaro@usda.gov
Edward	Ciolkosz	Dr.	Pennsylvania State University	University Park	PA	15802	f8i@psu.edu
Mark	Clark	Project Leader	USDA-NRCS	Palmer	Ak	99645	mclark@ak.usda.gov
Craig	Cox	Executive Director	Soil & Water Conservation Society	Ames	IA		craigcox@swcs.org
William	Craddock	State Soil Scientist/MRLA Team Leader	USDA-NRCS	Lexington	KY	40503	bill.craddock@ky.usda.gov
Cecil	Currin	State Conservationist	USDA-NRCS	Amherst	MA	01002	cecil.currin@ma.usda.gov
Alex	Dado	Soil Survey Project Leader	USDA-NRCS	New Castle	PA	16101	Alex.Dado@pafranklin.fsc.usda.gov

First Name	Last Name	Title	Organization	City	State	ZIP	Email
Thomas	D'Avello	GIS Specialist	USDA-NRCS	Champaign	IL	61821	tom.davello@il.usda.gov
Randy	Davis	Forester	USFS	Washington	DC	20250	
Craig	Ditzler	National Leader	USDA-NRCS Soil Classification & Standards	Lincoln	NE	58508	craig.ditzler@nssc.nrcs.usda.gov
William	Dollarhide	State Soil Scientist/MO-3 Team Leader	USDA-NRCS	Reno	NY	89511	bill.dollarhide@nv.usda.gov
Karen	Dudley	Soil Scientist	USDA-NRCS	Concord	NH	03301	Kdudley@nh.nrcs.usda.gov
Edward	Ealy	State Soil Scientist	USDA-NRCS	Athen	GA	30601	edward.ealy@ga.usda.gov
William	Effland	Soil Scientist	USDA-NRCS	Washington	DC	20250	william.effland@usda.gov
Bob	Engel	Soil Scientist	USDA-NRCS	Lincoln	NE	68508	bob.engel@nssc.nrcs.usda.gov
Margie	Faber	Ass't State Soil Scientist	USDA-NRCS	Windsor	CT	06095	Margie.Faber@CT.usda.gov
Steven	Fischer	Soil Data Quality Specialist	USDA-NRCS	Amherst	MA	01002	Steven.Fischer@ma.usda.gov
Jim	Fortner	Soil Scientist	USDA-NRCS	Lincoln	NE	68508	Jim.Fortner@nssc.nrcs.usda.gov
Carol	Franks	Soil Scientist	NSSC	Lincoln	NE	68508	carol.franks@nssc.nrcs.usda.gov
Bruce	Frazier	Associate Professor/ Soil Scientist	Washington State University	Pullman	WA	99164	bfrazier@wsu.edu
John	Galbraith	Associate Professor	UPI	Blacksburg	VA		ttcf@ut.edu
Timothy	Gerber	Administrator, Soil Inventory & Evaluation Section	Ohio Dept. of Natural Resources	Columbus	OH	43224	tim.gerber@dnr.state.oh.us
Jon	Gerken	State Soil Scientist	USDA-NRCS	Columbus	OH	43215	jon.gerken@oh.usda.gov

First Name	Last Name	Title	Organization	City	State	ZIP	Email
Mike	Golden	State Soil Scientist/MO-9 Team Leader	NRCS	Temple	TX	76501	michael.golden@tx.usda.gov
Steve	Gourley	State Soil Scientist	USDA-NRCS	Burlington	VT		
Warren	Henderson	State Soil Scientist	USDA-NRCS	Gainesville	FL	32614	warren.henderson@fl.usda.gov
Hangsheng	Henry Lin	Asst. Professoro f Hydropology/soil Hydrology	Dept. of Crop & Soil Science	University Park	PA	16802	henrylin@psu.edu
Luis	Hernandez	State Soil Scientist	NRCS	Lincoln	NE	68508	luis.hernandez@usda.gov
Jeff	Herrick	Professor	USDA-NRCS	Las Cruses	NM	88003	jherrick@nmsu.edu
Karl	Hipple	National Leader Soil Survey Interpretations	NSSC	Lincoln	NE	68508	karl.hipple@nssc.nrcs.usda.gov
Wayne	Hoar	State Soil Scientist	USDA-NRCS	Dover-Foxcroft	ME	04426	wayne.hoar@me.usda.gov
Ken	Howard	Application Project Manager	National Information Technology Center	Fort Collins	Co.	80526	kharward@itc.nrcs.usda.gov
Mike	Hubbs	Agronomist	NRCS Soil Quality Institute	Auburn	AL	36832	mhubbs@eng.auburn.edu
Wayne	Hudnall	Professor		Baton Rouge,	LA	70803	whundnall@agctr.lsu.edu
Steve	Hundley	State Soil Scientist	USDA-NRCS	Durham	NH	03824	steve.hundley@nh.usda.gov
Wade	Hurt	Soil Scientist	University of Florida	Gainsville	FL	32611	Wade_Hurt@mail.ifas.ufl.edu
Russell	Kelsea	National Leader, Soil Survey Technical Services	NSSC	Lincoln	NE	68508	russ.kelsea@nssc.nrcs.usda.gov
John	Kick	Soil Scientist/ICCS Leader	USDA-NRCS	Amherst	MA	01002	John.Kick@ma.usda.gov

First Name	Last Name	Title	Organization	City	State	ZIP	Email
William	Kingery	Professor	Plant & Soil Sciences	Mississippi State	MS	39762	wkingery@msstate.edu
David	Kingsbury	Soil Data Quality Specialist	USDA-NRCS	Morgantown	WV	26050	david.kingsbury@wv.usda.gov
Jim	Komar	Soil Scientist	USDA-NRCS	Red Bluff	CA		james.komar@ca.usda.gov
Michael	Kortum		National Cartographic & Geospatial Center	Fort Worth	TX	76115	mkortum@ftw.nrcs.usda.gov
Sheryl	Kunickis	National Agricultural Research Coordinator	USDA-NRCS/ARS	Beltsville	MD	20705	shk@ars.usda.gov
Duane	Lammers	Soil Scientist	USDA-Forest Service	Corvallis	OR		dlammers@fs.fed.us
Darrel	Leach	Ass't State Soil Scientist	USDA-NRCS	Gainesville	FL	32614	darrell.leach@fl.usda.gov
Maxine	Levin	Program Manager	USDA-NRCS	Washington	DC	20250	maxine.levin@usda.gov
Michael	Lilly	State Soil Scientist	USDA-NRCS	Jackson	MS	39269	mike.lilly@ms.usda.gov
Earl	Lockridge	Soil Scientist	USDA-NRCS,NSSC	Lincoln	NE	68508	earl.lockridge@nssc.nrcs.usda.gov
Charles	Love	SSS/MO-15 Team Leader	USDA-NRCS	Auburn			charles.love@al.usda.gov
Ken	Lubich	Coordinator	USDA-NRCS, National Soil Survey Digitizing	Madison	WI	53719	Ken.Lubich@wi.usda.gov
Wayne	Maresch	Acting Director	USDA-NRCS Soil Survey Division	Washington	DC	20250	wayne.maresch@usda.gov
Astrid	Martinez-Flores	Soil Scientist	USDA-NRCS	Greenfield	MA	01301	astrid.martinez@magreenfie.fsc.usda.gov
Maurice	Mausbach	Deputy Chief	USDA-NRCS Soil Survey & Resource Assessment	Washington	DC	20250	maurice.mausbach@usda.gov
Dewayne	Mays		USDA-NRCS-NSSC	Lincoln	NE	68508	dewayne.mays@nssc.nrcs.usda.gov
Nathan	McCaleb	Branch Leader, soil Support Center	National Cartographic & Geospatial Center	Fort Worth	TX	76115	nmccaleb@ftw.nrcs.usda.gov
Joseph	McCloskey	State Soil Scientist	USDA-NRCS	St. Paul	MN	55101	Joe.McCloskey@mn.usda.gov

First Name	Last Name	Title	Organization	City	State	ZIP	Email
Chad	McGrath	State Soil Scientist	USDA-NRCS	Portland	OR	97204	chad.mcgrath@or.usda.gov
Douglas	Miller	Soil Scientist	USDA-NRCS	St. Paul	MN		
Henry	Mount	Soil Scientist	national Soil Survey Center	Lincoln	NE	68508	henry.mount@nssc.nrcs.usda.gov
Brian	Needelman	Professor	University of Maryland	College Park	MD	20742	bneed@umd.edu
Travis	Neely	State Soil Scientist/MO-11	USDA-NRCS	Indianapolis	IN	46278	travis.neeley@in.usda.gov
Charles	Nelson	consultant	private	Christainsburg	VA	24073	soiltech@earthlink.net
Darwin	Newton	State Soil Scientist	USDA-NRCS	Nashville	TN	37203	dnewton@tn.nrcs.usda.gov
Martin	Norfleet	Soil Scientist	USDA-NRCS, Soil Quality Institute	Auburn	AL	36832	norfleet@eng.auburn.edu
Anthony	O'Geen	Asst. Soil Resource Scientist	Land, Air & Water Resources	Davis	CA	95616	atogreen@ucdavis.edu
Carolyn	Olson	National Leader	USDA-NRCS, Soil Survey Investigations	Lincoln	NE	68508	Carolyn.olson@nssc.nrcs.usda.gov
Laurie	Osher	Soil Scientist	University of Maine	Orono	ME	04469	laurie@maine.edu
Neil	Patterson		Tuscora Environment Program	Sanborn	NY		tuscenv@igc.org
Neil	Peterson	State Soil Scientist	USDA-NRCS	Spokane	WA	99201	neil.peterson@wa.usda.gov
Dennis	Potter	State Soil Scientist	USDA-NRCS	Columbia	MO	65203	dennis.potter@mo.usda.gov
Russell	Pringle	Soil Scientist	Wetland Science Institute	Baton Rouge,	LA	70803	rpringle@agctr.lsu.edu
Brian	Printup		Tuscora Environment Program	Sanborn	NY	14132	tuscenv@igc.org
Bill	Puckett	National Leader	National Soil Dynamics Labortory, USDA-NRCS	Auburn	AL	36832	bpuckett@eng.auburn.edu
Martin	Rabenhorst	Professor of Pedology	HSP-Dept. of Natural Resource Sciences	College Park	MD	20742	MR1@umail.umd.edu
Thomas	Reedy	Soil Scientist	USDA-NRCS	Lincoln	Ne	58508	tom.reedy@nssc.nrcs.usda.gov
Carmen	Santiago	Soil Scientist	USDA-NRCS	Hato Rey	PR	00918	carmen.santiago@pr.usda.gov

First Name	Last Name	Title	Organization	City	State	ZIP	Email
Kenneth	Scheffe	State Soil Scientist	USDA-NRCS	Albuquerque	MN	87109	kenneth.scheffe@nm.usda.gov
Philip	Schoeneberger	Resource Soil Scientist	USDA-NRCS,NSSC	Lincoln	NE	68508	philip.schoeneberger@nssc.nrcs.usda.gov
Darrell	Schroeder	State Soil Scientist	USDA-NRCS	Casper	WY	82601	darrel.schroeder@wy.usda.gov
Joseph	Schuster	Ecological Resource Consultant		Panama City Beach	FL	32408	dirtboy_fl@hotmail.com
Cathy	Seybold	Soil Scientist	USDA-NRCS,NSSC	Lincoln	NE	68508	cathy.seybold@nssc.nrcs.usda.gov
Scott	Smith	C.A. Soil Scientist/Chercheur Scientifique	Agriculture and Agri-Food Canada/Centre de Recherches Agrolimantaires du Pacifique	Canada	VOH	494-0755	smithcas@agr.gc.ca
Randy	Southard	Professor	University of California	Davis	CA		Southard@agdean.usdavis.edu
Gary	Steinhardt	Professor					gsteinhardt@purdue.edu
Mike	Sucik	State Soil Scientist	USDA-NRCS	DesMoines,	IA	50309	mike.sucik@ia.usda.gov
Katherine	Swain	MLRA Project Leader	USDA-NRCS Concord Center	Concord	NH	03301	kswain@nh.nrcs.usda.gov
Curtis	Talbot	Range Management Specialist	USDA-NRCS	Lincoln	NE	68508	curtis.talbot@nssc.nrcs.usda.gov
Ronnie	Taylor	State Soil Scientist	USDA-NRCS	Sommerset	NJ	08873	rtaylor@nj.nrcs.usda.gov
George	Teachman	Soil Scientist	USDA-NRCS	Annapolis	MD	21401	George.Teachman@aec.apgea.army.mil
Bruce	Thompson	State Soil Scientist MO-12 Team Leader	USDA-NRCS	Amherst	MA	01002	Bruce.Thompson@ma.usda.gov
Arlene	Tugel	Soil Scientist	USDA-NRCS Soil Quality Intitute, Jornada Experimental Range	Las Cruces	MN	88003	atugel@nmsu.edu
Robert	Tunstead	Soil Scientist	USDANRCS	W. Wareham	MA	02576	tunstead@mawestware.fsc.usda.gov

First Name	Last Name	Title	Organization	City	State	ZIP	Email
James	Turenne	Soil Scientist/GPR Specialist	USDA-NRCS	W. Wareham	MA	02576	James.Turenne@mawestware.fsc.usda.gov
Goro	Uehara	Professor	University of Hawaii	Honolulu	HI		goro@hawaii.edu
Lenore	Vasilas	Soil Scientist	U.S. Environmental Protection Agency	Philadelphia	PA	19103	vasilas.lenore@epamail.epa.gov
Bruce	Vasilas	Professor	Dept. of Plant and Soil Sciences	Newark	DE	19717	bvasilas@udel.edu
Peter	Veneman	Professor	Plant & Soil Sciences	Amherst	MA	01002	veneman@pssci.umass.edu
Roy	Vick	State Soil Scientist/MO-14 Team Leader	USDA-NRCS	Raleigh	NC	27609	roy.vick@nc.usda.gov
James	Ware	Soil Scientist	USDA-NRCS Soil Survey Division	Washington	DC	20250	Jim.ware@usda.gov
Cleveland	Watts	State Soil Scientist/MO-5 Team Leader	USDA-NRCS	Salina	KS	67401	cleveland.watts@ks.usda.gov
Larry	West	Professor	University of Georgia, Crop & Soil Sciences	Athens	GA	30602	Lwest@uga.edu
William	Ypsilantis	Soil Scientist	Bureau of Land Management	Denver	CO	80225	Bill_Ypsilantis@blm.gov
Monday	Mbila	Professor	AL & M University	Normal	AL	35762	mmbila@aamu.edu
Axing	Zhu	Professor	University of Wisconson	Madison	WI		

Appendix 4--Conference Recommendations to NCSS

Agency Meeting

Form a Task Force of 5-7 people (co-chaired by Jon Gerken, NRCS and rep from NCSS partnership) to look at NCSS Conference structure and function—Progress report in Nov and plan of action to Steering team ASA meetings; report to Regional Conferences June 2004

Special Reports

1. Canada recommends linkages with New Technology Committee; NASIS & CanSIS web linkages to share technology in soil information delivery web tools—Request Co-Chairs of New Technology Committee to contact Canada to join Committee
2. NASCA requests that the NCSS ByLaws include NASCA in Steering team for conferences and in amendment lists of cooperators; NRCS will draft changes and present team at Nov meeting
3. Encourage private sector participation; Investigate avenues to encourage consulting soil scientists to attend to regional conferences; Request that the regional conferences address this issue in their conferences and report back to the 2005 NCSS conference.
4. Accept invitation from Texas to host the next National Cooperative Soil Survey Conference May 22-25, 2005; Steering Team accepted Location and date

Standing Committees

1. Request meeting time at National Conferences; Refer to Jon Gerken for consideration on structure of NCSS conference
2. Request formal meeting time (face to face) during the alternate years; Refer to Jon Gerken for consideration on structure of NCSS conference
3. Formalize structure for New Technology and Research agenda Committees with alignment with Regional Conferences; Refer to Jon Gerken for consideration on structure of NCSS conference
4. In all cases Bylaws should be reviewed and possibly revised

Appendix 6—Steering Team Minutes

SUBJECT:	NCSS Steering Committee Meeting Minutes	June 20, 2003
TO:	Steering Committee (see attached list)	File Code: 430-14

The Steering Committee for the National Cooperative Soil Survey Conference met on June 20, 2003 at the Radisson. Members present were Wayne Marech (Acting Director-Chair), Gary Steinhardt, Travis Neely, Bill Kingery, Mike Lily, Darrel Schroeder, Randy Davis, Pete Biggam, Mike Golden, Bob Ahrens, Russell Kelsea, Karl Hipple, Craig Ditzler, Monday Mbila (1890's Universities), Tim Gerber (NASCA) and Maxine Levin.

Wayne Maresch, NRCS, Acting Soil Survey Division Director, chaired the meeting.

1. Action items from the Conference were briefly reviewed.

Action Items
6/19/03
Agency Meeting
Form a Task Force of 5-7 people (co-chaired by Jon Gerken, NRCS and rep from NCSS partnership) to look at NCSS Conference structure and function—Progress report in Nov and plan of action to Steering team ASA meetings; report to Regional Conferences June 2004

Special Reports

1. Canada recommends linkages with New Technology Committee; NASIS & CanSIS web linkages to share technology in soil information delivery web tools—Request Co-Chairs of New Technology Committee to contact Canada to join Committee
2. NASCA requests that the NCSS ByLaws include NASCA in Steering team for conferences and in amendment lists of cooperators; NRCS will draft changes and present team at Nov meeting
3. Encourage private sector participation; Investigate avenues to encourage consulting soil scientists to attend to regional conferences; Request that the regional conferences address this issue in their conferences and report back to the 2005 NCSS conference.
4. Accept invitation from Texas to host the next National Cooperative Soil Survey Conference May 22-25, 2005; Steering Team accepted Location and date

Standing Committees

1. Request meeting time at National Conferences; Refer to Jon Gerken for consideration on structure of NCSS conference
2. Request formal meeting time (face to face) during the alternate years; Refer to Jon Gerken for consideration on structure of NCSS conference
3. Formalize structure for New Technology and Research agenda Committees with alignment with Regional Conferences; Refer to Jon Gerken for consideration on structure of NCSS conference
4. In all cases Bylaws should be reviewed and possibly revised

2. ByLaws were briefly reviewed. The 2003 Conference has requests for changes in ByLaws. The 2003-4 Steering Team will reconvene at the ASA Meetings in Denver, CO in early November, 2003. The Committee requested that meeting be scheduled for Monday or Tuesday

at about 5 to 7 P.M. to follow the S-5 Business meeting. Maxine Levin will follow-up to make reservations with SSSA.

- Review ByLaws-Refer all recommendations to task force
    - Request by Research Agenda Standing Committee to adjust bylaws(amendments?) to formalize infrastructure and purpose.
    - Request by NASCA to be added to Bylaws as part of steering team
    - Proposal by National Association of Professional Soil Scientist Associations has requested NRCS to consider adding this National organization to NCSS conference with MOU—refer group to participate first regionally

3. Committees:
Request by In –Conference Committees to continue in 2005--
Selling Soil Science to Society—Conclude with report
Ecological Interpretations & Principles—Continue to 2005
New Inventory Techniques—Combine in New Technology
Recruitment & Retention—Conclude with report
Water Movement & Monitoring—Conclude with report, combine in Research Agenda Committee
National Hydric Soil Committee—Offer a report at regional conferences and 2005 conference

4. Regional Conferences for 2002 are tentatively scheduled as follows:

Northeast—Canaan Valley, WV	June 20-24, 2004
North Central- Indiannapolis	June 20-24, 2004
South—Biloxi, MS	May-June ??, 2004
West—Jackson, WY	June 14-18, 2004

The National Conference requests that the regional conferences follow a format that produces regional information and support to the 3 standing committees: Research Agenda, New Technology and Standards. Regional Conferences need to select representatives from their 2004 conferences to represent the regions for these standing committees. In addition, the regional conferences will designate representatives to serve on the Steering team for the 2005 National NCSS Conference (based on plans for conferences in 2006).

The Steering Committee meeting was adjourned at 930 AM.

Respectfully Submitted,

MAXINE J. LEVIN
Program Manager

cc:
Wayne Maresch, Acting Director, SSD, NRCS, Washington, D.C.
Maurice Mausbach, Deputy Chief, SSRA, NRCS, Washington, D.C.

Appendix 7-National Cooperative Soil Survey Conferences: Structure and Function Task Force

Chair: Jon Gerken, NRCS, OH

Purpose of Task Force: Form a Task Force of 5-7 people (co-chaired by Jon Gerken, NRCS and rep from NCSS partnership) to look at NCSS Conference structure and function and make recommendations for changes to Bylaws
Desired Outcome: Increased participation by all of NCSS Partnership; Improved coordination and planning of all soil survey activities in NCSS

Charges:

1. Bring together a task force of 5-7 persons with diverse NCSS background. Jon Gerken, assigned Chair of Task Force will recommend potential members to be confirmed by Director of Soil Survey Division, NRCS. Co-Chair is recommended to be non-federal NCSS cooperator. Meetings will be by teleconference and email communication.

2. Review By-Laws of NCSS Conference and proceedings of past conferences to evaluate structure and function of NCSS conferences. Progress report in Nov 2003 and plan of action to Steering team ASA meetings; report to Regional Conferences June 2004

3. Review 2003 NCSS University Conference Report with suggestions for improved communication with University NCSS participants.

3. Encourage private sector participation; Investigate avenues to encourage consulting soil scientists to attend to regional and National conferences; Request that the regional conferences address this issue in their conferences and report back to the 2005 NCSS conference.

4. Consider requests of Standing Committees from 2003 NCSS Conference, Plymouth MA:
Request meeting time at National Conferences
Request formal meeting time (face to face) during the alternate years between National Conferences
Formalize structure for New Technology and Research Agenda Committees with alignment with Regional Conferences
In all cases Bylaws should be reviewed and possibly revised

5. NASCA requests that the NCSS By Laws include NASCA in Steering team for conferences and in amendment lists of cooperators; Task Force will draft changes and present to Steering Team at Nov 3, 2003 meeting at ASA Meetings in Denver.