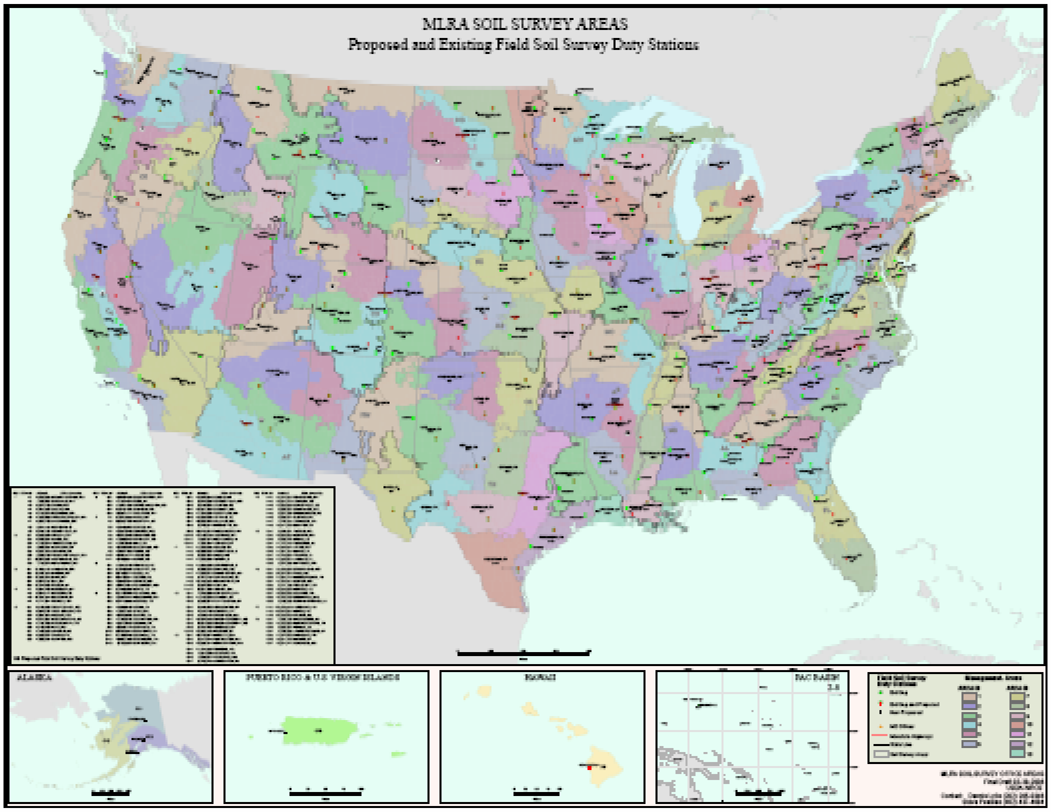



# MLRA Soil Survey

# Restructuring

# Plan

**APRIL 2006**
**(AMENDED OCTOBER 2006)**
**(AMENDED AUGUST 2007)**

10/2/2006

## FOREWORD

The Soil Survey Program is authorized under law and regulation, and guided by executive order and secretary's memoranda. The Agriculture Appropriation Act of 1896 established the soil survey, and subsequent laws (1903, 1928, and 1935) clarified the purpose. In 1966, Congress expanded the scope and further clarified the intent of the Soil Survey Program in Public Law 89-560, known as the Soil Survey for Resource Planning and Development Act. This law, now codified under the Public Health and Welfare 42 USC, provides detailed expectations for the soil survey program and is the principal basis for the soil survey mission.

The soil survey program of the United States is a cooperative effort conducted by Natural Resources Conservation Service (NRCS) and other Federal agencies in collaboration with states and other entities. Leadership for the Federal part of the National Cooperative Soil Survey is delegated to the Chief of the Natural Resources Conservation Service by the Under Secretary for Natural Resources and Environment (7 CFR 2.61).

### SOIL SURVEY MISSION

The authorities define the mission of the Soil Survey Program. Taken together, the authorities direct the Secretary of Agriculture to:

1. ***make an inventory of the soil resources of the United States;***
2. ***keep the soil survey relevant to ever-changing needs;***
3. ***interpret the information and make it available in a useful form; and***
4. ***promote the soil survey and provide technical assistance in its use for a wide range of community planning and resource development issues related to non-farm and farm uses.***

These four functions are the core mission of the soil survey program. In addition to these four core functions, the NRCS has a unique responsibility to lead the Federal part of the National Cooperative Soil Survey. Thus, the Soil Survey Division has a fifth mission function separate from, but related to the core functions of the Soil Survey Program.

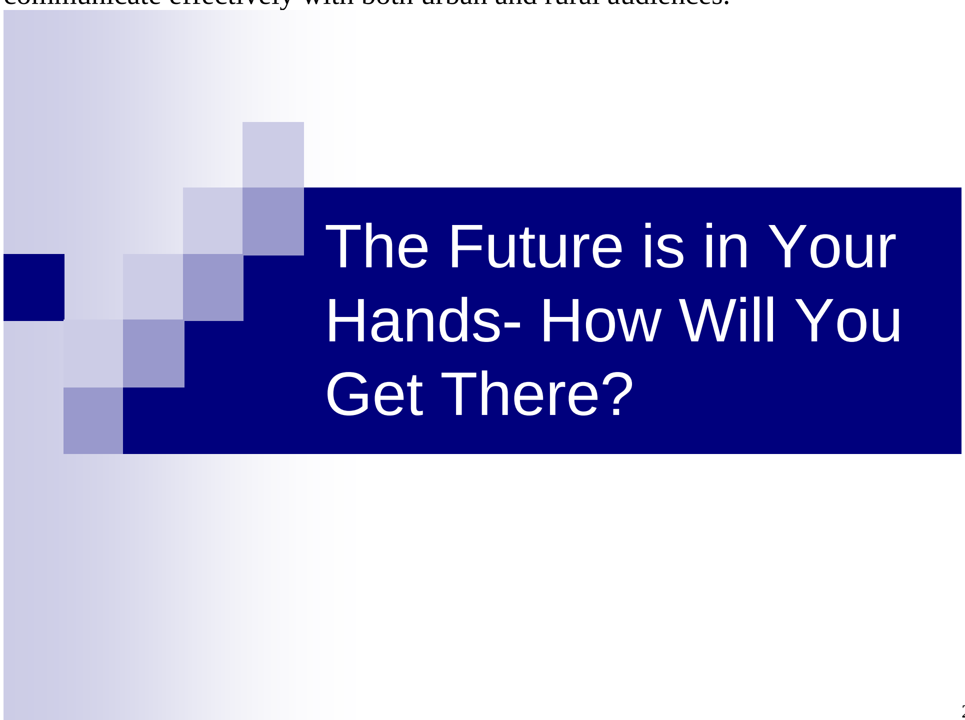
### SOIL SURVEY VISION

The Soil Survey Division's vision for the foreseeable future is a Soil Survey Program that provides complete coverage of first generation soil surveys for all lands in combination with more balance in the four core mission areas.

For several decades, the soil survey program focused mainly on making the initial soil survey – the first of the four core mission areas. The National Cooperative Soil Survey partnership is well skilled at this mission function. As the initial soil survey nears completion however, the Soil Survey Division will re-balance its focus toward the three remaining core mission functions. Efforts have already begun within the Soil Survey Division to redirect its focus toward continually improving soil survey information to meet ever-changing needs for new data and analysis, delivering soil survey analysis and data in more useful forms to a more diverse clientele, promoting soil survey, and providing technical assistance in its use.

The Soil Survey Division envisions that as users gain greater access to soil survey information, especially through the Web Soil Survey, they will use soil survey for a wider range of purposes, discover deficiencies in the data, and place demands on the soil survey that were not anticipated during the initial inventory. These evolving demands will lead to increased and continual emphasis on data quality and data completeness. The broader range of users will demand a wider range of analysis tailored to their specific needs. These analyses will require specialists from many disciplines to understand complex relationships required to develop effective interpretive criteria. Analysis of single soils will no longer be adequate, and predictions of behavior across entire soil landscapes integrated with other factors (climate, land-use, demographics) will be needed to address increasingly complex needs. ***Many of these new analyses will be developed by an increasingly well trained and diverse cadre of resource soil scientists in states.*** The Soil Survey Division will have difficulty meeting increasing demand for soil survey products and services and will make soil survey information available to third parties who will independently deliver products and services to their clients.

***All of these demands will drive the need for an organizational and technical infrastructure consisting of soil scientists, who have the tools they need such as geospatial technologies, are technically competent in their discipline and are proficient at relating soils to landscapes.*** These soil scientists must understand the role of soils in ecosystems and must also understand legal processes and public policy decision making, understand soil responses to human impacts, participate in a broader range of professional venues, and be able to communicate effectively with both urban and rural audiences.[1]



[2]

[1] Excerpts from Soil Survey Division draft strategic plan
[2] Graphic by Dana York, Associate Chief, from the 2005 State Soil Scientists Meeting, Laughlin, Nevada

## EXECUTIVE SUMMARY

The soil survey is a classic example of what economists call a public good. For every dollar spend each year the soil survey returns at least two dollars in benefits. The public funded soil survey information provides an unbiased level playing field for making nearly any decision involving the land. “The problem with a public good is that often we cannot observe what individuals are willing to give up in order to get the public good. How can we assess how urgently they really want more or less of it, given the other possible uses of their money? So any given public good will still most likely be either under-provided or over-provided under government stewardship”[3]. The MLRA Soil Survey implementation strikes a balance between what customers want, the detail that could be provided, and what makes economic sense.

In 1995, NRCS reorganized the National Cooperative Soil Survey (NCSS) mapping program to a Major Land Resource Area (MLRA) basis in order to develop a seamless, high quality digital soil survey of the U.S. The 1995 reorganization divided the nation into 18 MLRA Soil Survey Regions and transferred the quality assurance function from the National Soil Survey Center (NSSC) to the 18 MLRA offices (MOs) located in conjunction with State offices. Also at this time the quality control function was reassigned from the State Office to the Soil Survey Office. The MOs have responsibility for soil survey mapping and assuring quality and consistency across a broad geographic area that has similar soils with the goal of eliminating the mismatch in mapped soils at state and county boundaries. During the 1995 reorganization, Soil Correlator positions were moved from the NSSC and from Non-MO State Offices to MO offices and their titles were changed to Soil Data Quality Specialists to emphasize assurance of the quality of all soil survey data. The State Soil Scientists in the Non-MO States were directed to focus more on new soil applications and uses (technical soil services) to build demand and use of soil information. Some states have implemented MLRA Soil Survey Areas and some have not. This plan completes the MLRA Restructuring of the Soil Survey.

**Technical Advantages to Soil Survey by MLRA**
MLRA Soil Surveys will eliminate the 100 years of “by county” patchwork and improve the accuracy and consistency of soil survey information. MLRA soil survey’s increase productivity because soil scientist will map similar catenas of soils and become expert in those soils’ mapping and interpretation. Soil Surveys conducted by MLRA will not be completed in the same manner as the initial soil surveys. We will use new technology including GIS, Remote Sensing and landscape predictive models. We will travel to the field to check areas that, after analysis appear to be wrong.

Soil mapping is best done as a team. With 3 to 5 people, it allows some to specialize in certain areas such as geospatial technologies (GPS, GIS and remote sensing) for landscape analysis (topography, vegetation, climate, geology, and hydrology), soil data comparison, soil data analysis and population, soil classification, etc. This leads to improved team performance, job satisfaction, and improved quality of the soil survey. For the new soil

---

[3] A Glossary of Political Economy Terms copyright © 1994-2005 Paul M. Johnson
Department of Political Science, 7080 Haley Center, Auburn University, Auburn, AL 36849

scientist there is a trove of information about soils, soil landscapes, soil behavior, etc. that can not be gained except through on the job training with soil scientists experienced in an area.

**Organization Functions, Structure and Staffing**

MLRA Soil Survey offices (SSO)

The SSOs are responsible for conducting soil surveys for their assigned geographic areas. These areas range in size from about 2 million in Puerto Rico to 177 million in Alaska and from 4 million to 37 million in the conterminous U.S. The national average is 15 million acres. Additional functions include;

- Leading a technical team which includes state or multi-state staff, cooperators, NRCS field staff, resource soil scientists, and others to establish priorities and coordinate technical activities
- Periodically completing a review of new soil survey area data
- Publishing to the Web Soil Survey as areas are completed and reviewed

Current Soil Survey Office Structure including Reimbursable Funds

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Staff per Office | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Staff = 552 |
| Number of Offices | 104 | 71 | 46 | 18 | 5 | 8 | 1 | 2 | Offices= 255 |

New MLRA Soil Survey Office Structure including Reimbursable Funds

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Staff per Office | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Staff = 552 |
| Number of Offices | 5 | 24 | 40 | 38 | 22 | 9 | 9 | Offices = 147 |

MLRA Regional Offices (MO)

MO offices are responsible for quality assurance (the process of providing technical standards, review, and training to support soil survey quality control) for all phases of the soil survey in their multi-state region. This includes;

- Reviewing data before it is added to the soil data mart and published to the Web Soil Survey
- Developing and maintaining a seamless national soil geospatial database

Staffing in MO Offices is reduced to reflect the transfer of the quality control function to the MLRA Soil Survey Offices, completion of SSURGO initiative and increased staffing cost.

Current MO Regional Office Structure

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Staff per Office | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 13 | Staff = 122 |
| Number of Offices | 1 | 5 | 3 | 2 | 2 | 1 | 1 | 2 | Offices = 18 |

New MO Regional Office Structure

| | | | | |
|---|---|---|---|---|
| Staff per Office | 4 | 5 | 6 | Staff = 85 |
| Number of Offices | 7 | 9 | 2 | Offices = 18 |

Of the 41 positions being shifted from MO functions, 18 soil scientists and 10 secretaries are planned to be redirected to state activities. In addition, it is anticipated that 13 positions vacated by retirement or promotion will not be filled.

The redirection of staff currently at the MO represents a shift of emphasis for these staff members. These positions are planned to be shifted to soils activities that are a part of state functions, such as Technical Soil Services, rather than their pre-restructuring function as a part of the MO activities.

MO Staffing level projections by fiscal year are:

| FY 2007 | FY 2008 | FY 2009 | FY 2010 | FY 2011 |
|---|---|---|---|---|
| 126 | 116 | 105 | 95 | 85 |

Since no changes are planned in staffing numbers, budgetary impacts are as reflected in the Restructuring Plan.

SSURGO, Digitizing Unit and Map Finishing Unit Transition

With the completion of the Web Soil Survey, Digital Map Finishing Units will be phased out according to an established timeline. Soil Survey Digitizing Sites will be phased out over the following timeline as we complete the SSURGO initiative in FY 2007. Future soil survey information will be digitized by MLRA Soil Survey Offices as the work is completed. SSURGO funding will be refocused to complete SSURGO for the remaining unmapped areas of the U.S.

**Completing the Initial Soil Survey on all Lands by 2010**

In conjunction with the MLRA Implementation we will accelerate the completion of the 60 million acres of non-federal (private, state and Native American land) work with federal partners to complete 109 million acres of federal lands initial soil survey in order to complete the conterminous U.S. initial or first generations soil survey by December 2010. This acceleration will be made possible by;

1. Re-focusing some staff from update and maintenance activities to initial soil survey mapping.
2. Detailing some soil scientist from areas where the initial survey is complete
3. Hiring additional soil scientists
4. Contracting
5. Working with NCSS partners
6. Establishing Premapping Centers
7. Re-focusing SSURGO initiative funds

**Costs and Benefits**

The MLRA Implementation will have the following costs and benefits. The cost in the table below include increase salary, transfer, and travel costs. The benefits include increased productivity.

| Annual Cost | Annual Benefits | Net Benefits | Annual NPV of Net Benefits | Annual Benefit Cost Ratio | Annual ROI |
|---|---|---|---|---|---|
| $2,600,000 | $6,400,000 | $3,900,000 | $2,702,931 | $2 | 145 |

Standard SSO and MO Computer Configuration

A part of the cost of implementing the MLRA soil survey is the initial cost to upgrade the computer hardware and software so that staff can work across these large geographic areas. Soil Surveys conducted by MLRA will not be completed in the same manner as the initial soil surveys. Much of the soil survey update will be completed with computers, utilizing existing geospatial information as a template. These geospatial data include SSURGO, elevation, climate, vegetation, streams, land use and other layers. Geospatial technology will be used to analyze these data across the MLRA. SSO staff will travel to the field to verify the need for changes or to add more detail to existing mapping. In some instances they will be required to correct inaccurate mapping, but most map unit boundaries should not change. In order to complete these tasks and increase our productivity and quality, computers with large processing capacity and access to large amounts of disk storage are required. A separate but standard CCE configuration will be developed for these offices.

Elevation Data

Elevation data of the correct resolution are a critical to the successful use of landscape predictive models which are required in order to successfully implement the MLRA Soil Survey. The resolution required varies across the U.S. NRCS will partner with other federal and state agencies to acquire these data.

**Implementation Timeline**

MLRA Soil Survey Offices will be implemented according a plan developed by State Conservationists. This plan will be complete by July 31, 2006. Approximately 92 offices will be implemented in fiscal year 2007, 37 in 2008, and 16 in 2009.

**Placement Strategy**

Staff placements in the MLRA Soil Survey Offices and MO offices will be made by State Conservationists in FY 2006 though FY 2008 to allow for completion of initial mapping and contractual commitments. Each MO will develop a transition plan by July 31, 2006 that shows the transition of all staff. Staffs that are not placed by September 30, 2008 will be placed in the remaining offices according to a placement plan and be relocated by September 2009.

**Conclusions**

The demand for soil survey information is growing and requests for specific data and analysis are constantly evolving and continually changing. Demand is driven by change in agricultural program policy, new environmental resource models such as RUSLE2, land use changes, and evolving land-use law, regulation, policy, and environmental concerns. Soil surveys require continual improvement in order to assure an accurate and complete database that can satisfy evolving needs for data and analysis.

The Soil Survey Program must restructure in order to; adjust to the completion of the initial soil survey of the U.S., become more efficient, improve quality and consistency, and meet emerging customer needs. Soil Survey by MLRA will eventually replace the existing 100 years of county patch work soil surveys and increase the quality and consistency of soil survey information.

**Recommendations**

1. Determine "the appropriate number" of MLRA Soil Survey Areas and MLRA Soil Survey Offices by October 1, 2006, and implement offices before September 30, 2009, as initial soil survey's are completed, and funding and space become available
    - Reconsider and reduce the number of areas and offices to eliminate the remaining 1 and 2 person offices.
    - Reconsider office locations to make them more centralized if possible.
    - State Conservationists and MLRA BOD implement according to their plan between October 1, 2006 and September 30, 2008
    - Formal Placement for remaining staff October 1, 2008 to September 30, 2009
2. Reduce the MO offices from 126 staff to 84 staff to reflect function shift to field and less need for editors because of Web Soil Survey – Redirect gains to field
3. Complete the initial soil survey on private lands, including Native American Land, and priority federal lands by December 2010
4. Complete the development of a standard MLRA Soil Survey Office CCE configuration that provides the hardware and software to support full MLRA Implementation. Work with OCIO Information Technology Services (ITS), and provide national funding to purchase tablet computers for 501 field soil scientists at a cost of approximately $1.25 million and geospatial analysis computer for 147 MLRA Soil Survey Offices at a cost of $1.03 million and 18 MLRA Regional Offices at a cost of $126,000. Total cost is about $2.4 million.

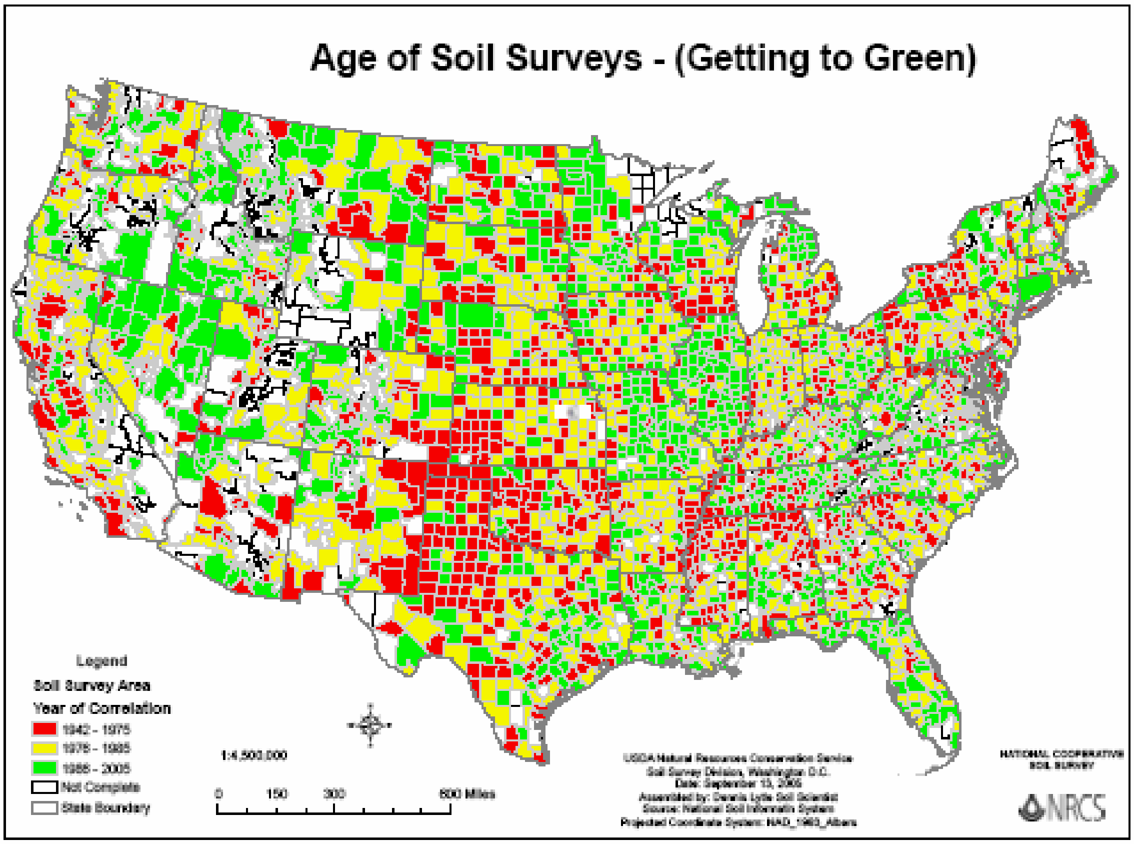
## TABLE OF CONTENTS

## INTRODUCTION

The National Cooperative Soil Survey (NCSS) has been completed on 2.12 billion acres. The replacement costs of these data averages about $3 dollars per acre or $6.4 billion dollars. The average annual benefit from the soil survey is $32.4 billion dollars. In order to protect the public's investment, and ensure that soil surveys remain useful and relevant the NRCS Soil Survey Program must change.

## BACKGROUND

The soil survey has evolved since 1899 from an emphasis on cropland to a soil survey that must meet many diverse uses. Approximately one third of the published soil surveys are more than 30 years old and another third are more than 20 years old. Soil surveys made 30 or more years ago do not meet today's needs and today's soil surveys will likely not meet the needs 20 or 30 years from now. Advances in technologies that customers use such as precision agriculture; economics reasons such as increasing fuel costs, changes in agricultural chemicals, and societal changes such as population increases and "Smart Growth" initiatives and Farm Bills such as the 1985 Farm Bill and the Swamp buster and Sod buster provisions are all factors that have added requirements for today's soil survey information.

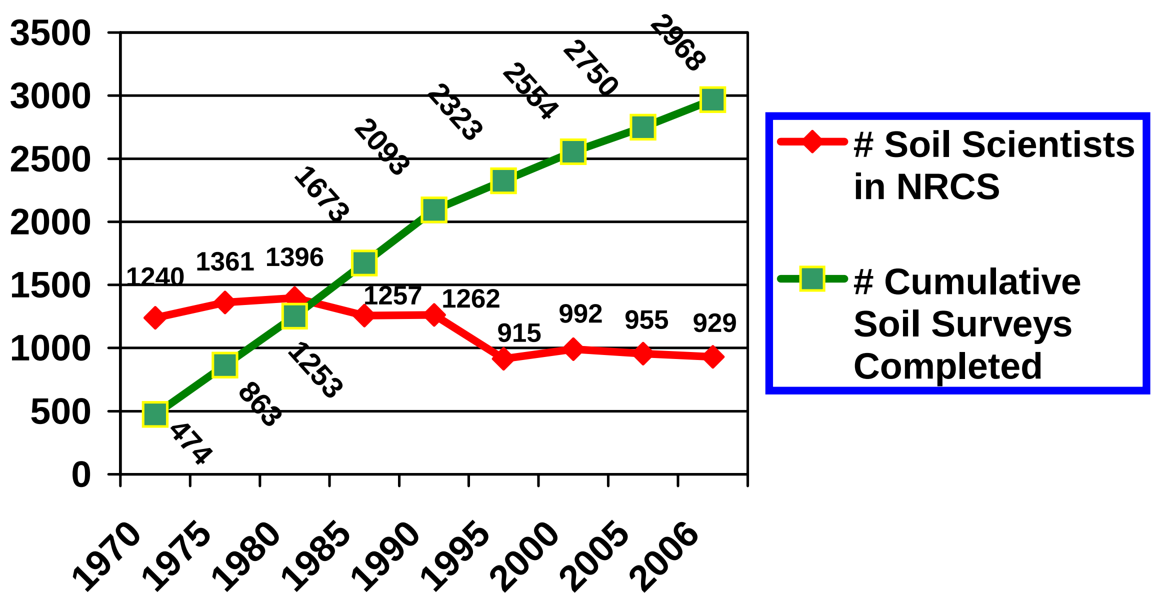



We must continually upgrade soil surveys to meet customer needs. Areas once given less attention such as coastal, rangeland and forestland areas are now critical resource concerns for many programs. About 60 million acres of non-federal and Native American land, and another 109 million acres of federal lands are not mapped. In addition about 10 million acres of coastal zone areas needs updating.

More than 90 percent of the United States has detailed soil survey, and more than 96% of non-Federal land and Native American land have a detailed soil survey. Most of the detailed soil survey information (maps, data, and analysis) is available on a county-by-county basis in published soil surveys. More than two-thirds of these surveys have digital maps, data and analysis available on the Soil Data Mart and are accessible through the Geospatial Data Gateway and Web Soil Survey. In most cases, the digital information is county-centric and does not join seamlessly from one county to the next. Unmapped areas, lack of digital information, and lack of seamless information impede the Agency and others' ability to efficiently conduct program activities.

The demand for soil survey information is growing and requests for specific data and analysis are constantly evolving and continually changing. Demand is driven by change in agricultural program policy, new environmental resource models such as RUSLE2, land use changes, and evolving land-use law, regulation, policy, and environmental concerns. Soil surveys require continual improvement in order to assure an accurate and complete database that can satisfy evolving needs for data and analysis. In some cases the original design of the survey has been exceeded and an intensive improvement is needed to meet the evolving needs. More than 20% of soil surveys are out-of-date and require extensive updating. An additional 22% require significant upgrading.

The graph below shows the number of NRCS soil scientists, and the number of soil surveys and the associated data bases that these scientists are maintaining. During the 70' and 80's there were few published soil surveys and efforts were concentrated on mapping and publishing more soil survey. We are now faced with the need to finish the initial or first generation soil surveys as well as maintain and update older surveys with fewer soil scientists. ***The workload today is more than twice the workload in 1985, and we have about 40 percent fewer field soil scientist that we had in 1985.***



Moreover, existing field techniques and technologies are not adequate to satisfy evolving needs for more precise soil data and analysis and description of soil properties that change across landscapes, over time, and under differing management practices. In order to keep soil survey data and analysis relevant, new field techniques, tools, and technologies are needed to make the update process more efficient.

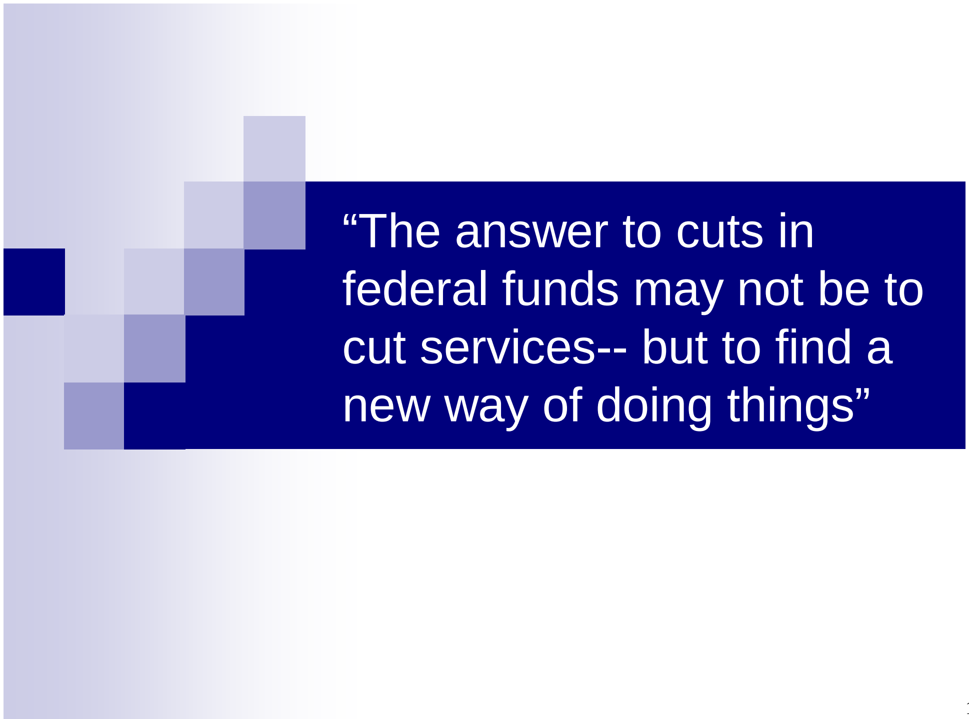
### THE PRESIDENT'S MANAGEMENT AGENDA

President's Management Agenda is a driving force in the restructuring of the Soil Survey Program. This agenda focuses on 5 areas.

1. Strategic Management of Human Capital - ***having processes in place to ensure the right person is in the right job, at the right time, and is not only performing, but performing well;***
2. Competitive Sourcing - regularly examining commercial activities performed by the government to determine whether it is more efficient to obtain such services from Federal employees or from the private sector;
3. Improved Financial Performance - accurately accounting for the taxpayers' money and giving managers timely and accurate program cost information to make informed management decisions and control costs;
4. Expanded Electronic Government - ensuring that the Federal Government's $60 billion annual investment in information technology (IT) significantly improves the government's ability to serve citizens, and that IT systems are secure, and delivered on time and on budget; and
5. Budget and Performance Integration - ensuring that performance is routinely considered in funding and management decisions, and those programs achieve expected results and work toward continual improvement.

> Each NRCS program receives a rating according to the Program Assessment Rating Tool (PART). The PART evaluation proceeds through four critical areas of assessment – purpose and design, strategic planning, management and results and accountability. The first set of questions gauges whether the program's design and purpose are clear and defensible. The second section involves strategic planning, and weighs whether the agency sets valid annual and long-term goals for programs, including financial oversight and program improvement efforts. The third section rates program's management, including financial oversight and program improvement efforts.
>
> The fourth set of questions focuses on results that programs can report with accuracy and consistency. The answers to the questions in each of the four sections result in a numeric score for each section from 0 to 100 (100 being the best). These scores are then combined to achieve an overall qualitative rating of Effective, Moderately Effective, Adequate, or Ineffective. In fiscal year 2003 the Soil Survey Program received a rating of "moderately effective" with a score of 71. Federal programs are expected to continue to increase their efficiency each year in order to maintain their rating.

In summary, those federal programs, including the Soil Survey Program that are not continually evolving and improving or demonstrating results are identified for reduction or elimination.



[1]

### THE NRCS CHIEF'S CHALLENGE

Bruce Knight, Chief of the NRCS, has challenged the leaders of the Soil Survey Program to "Find a better way to do Soil Survey". "Soil Survey is the foundation for most conservation activities. Soil Survey information enables conservation to thrive in both the public and private sectors."

### MLRA IMPLEMENTATION BACKGROUND

In 1995, NRCS reorganized the National Cooperative Soil Survey (NCSS) mapping program to a Major Land Resource Area (MLRA) basis in order to develop a seamless, high quality digital soil survey of the U.S. The 1995 reorganization divided the nation into 18 MLRA Soil Survey Regions and transferred the quality assurance function from the National Soil Survey Center (NSSC) to the 18 MLRA Regional offices (MOs) located in conjunction with State offices. Also at this time the quality control function was reassigned from the State Office to the Soil Survey Office. The MOs have responsibility for soil survey mapping and assuring quality and consistency across a broad geographic area that has similar soils with the goal of eliminating the mismatch in mapped soils at state and county boundaries. These mismatches are the result of the age of the soil surveys and changes in user requirements, changes in soil classification, and changes in available technology to gather data, and disagreements between states and counties on concepts. During the 1995 reorganization, Soil Correlator positions were moved from the NSSC and from Non-MO State Offices to MO offices and their titles were changed to Soil Data Quality Specialists to emphasize assurance of the quality of all soil survey data. The State Soil Scientists in the Non-MO States were directed to focus more on new soil applications and uses (technical soil services) to build demand and use of soil information.

[1] Graphic by Dana York, Associate Chief, from the 2005 State Soil Scientists Meeting, Laughlin, Nevada

The 18 MOs are generally functioning well; however, some problems exist. MLRA Soil Survey Offices (SSOs) have been established in some states, but many of the leaders are working primarily within state and sometimes county boundaries. Many single county offices have only one or two soil scientists on staff.

The county-by-county approach to soil survey served us well and is the core of the Agency's farm field conservation planning. However these data do not service us well in watershed, eGovernment (self-service) and modeling approaches. Data are missing or are incorrect and requirements for new data are difficult or impossible to generate on a county by county basis.

### IMPLEMENTATION ACTIONS

***NRCS will complete the following actions in order to fully implement the MLRA Soil Survey and to meet the needs mentioned earlier.***

1. Improve management efficiency by reorganizing and reducing offices. Offices will be reduced from 255 to approximately 146. Average staff size per office will increase to 3 to 5 people for maximum efficiency.
2. Improve productivity and quality by organizing survey crews by large multi-county and state geographic areas of similar kinds of soils, climate and land use.
3. Aggressively adopt new GIS, remote sensing, and landscape modeling technologies.
4. Increase existing partnerships and develop new partnerships with federal agencies, and target joint mapping on mixed federal and private lands to increase efficiency.
5. Make all soil survey publications available via the Web Soil Survey to reduce staff time in serving the public by enabling self-service, reducing publication costs, increasing access and usability.

### TECHNICAL ADVANTAGES TO SOIL SURVEY BY MLRA

NRCS Soil Survey Division has led the development of MLRA's. MLRA's have soil type as a fundamental, and some would say the underlying framework. The 1995 Soil Survey reorganization chose to use MLRA boundaries as the spatial framework because they are, in as much as possible, areas of like kinds of soils, geology, ground water, temperature, precipitation, vegetation, wildlife, and land use. As such, they are the best spatial framework for conducting inventories such as the Soil Survey. Mapping concepts must change somewhere and MLRA's provide a better break point than artificial state, county or watershed boundaries. MLRA soil survey areas increase productivity because soil scientist will map similar catenas of soils and become expert in those soils' mapping and interpretation.

### CURRENT ORGANIZATION STRUCTURE AND STAFFING PLAN

There are 929 soil scientists in the NRCS. About 501 of these scientists are field engaged in mapping. About 132 are in area offices and 192 are in state offices assisting customers, performing technical soil services or managing and supporting the soil survey. The remainders are in other support locations or working on other program areas. The 501 field soil scientists are mapping or updating an average of about 60,000 acres per year. Of the 929 total soil scientists about 172 are eligible to retire now and about 435 will be eligible to retire within 5 years. About 1.5 percent are American Indian/Alaska Native, 1 percent is Asian, 7.1 percent are Black, 3.5 percent are Hispanic, 86.8 percent are white, 16 percent are female and 84 percent are male. The entry point for most soil scientists in the agency is field soil survey. About half the new hires are lost in the first few years to other conservation positions, other State and Federal agencies or the private sector.

***In 2006 about 501 soil scientists are involved in soil survey mapping activities. About 60 of the 501 are funded by other federal state and local partners; therefore, NRCS funds are supporting about 441 field staff.*** The number of soil scientists devoted to soil survey mapping activities has decreased from 875 in 1983 to 501 in 2006 largely because of the demand for technical soil services. This shift has been uneven across the U.S.; generally in states where mapping is complete Resource Soil Scientists have been trained to provide support to NRCS staff and the public. In states where mapping is not complete, SSO staff often both map and provide technical soil services. In these offices the demand for technical services is so great that the mapping has progressed at a very slow rate.

Table 1 Current Soil Survey Office Staff with reimbursable funds

| Staff per Office | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Totals 552 staff |
|---|---|---|---|---|---|---|---|---|---|
| Number of Offices | 104 | 71 | 46 | 18 | 5 | 8 | 1 | 2 | 255 offices |

Table 2 Current MO Regional Office Staff

| Staff per Office | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 13 | Total<br>122 staff |
|---|---|---|---|---|---|---|---|---|---|
| Number of Offices | 1 | 5 | 3 | 2 | 2 | 1 | 1 | 2 | 18 offices |

Table 3 shows the number of soil scientist supporting all agency programs, their location and their grade. This table was developed from NFC data and includes all 470 series soil scientists in NRCS. ***In the current organizational structure and staffing there are inconsistencies in grade levels, areas of responsibility and kinds of responsibilities.***

Table 3 NRCS Soil Scientist Staffing for all programs (March 2006)

| Grade` | Location | | | | |
|---|---|---|---|---|---|
| | West | Central | East | NHQ/Centers | Total |
| 5 | 1 | 1 | 2 | | 4 |
| 7 | 12 | 26 | 11 | | 49 |
| 9 | 63 | 58 | 56 | | 177 |
| 11 | 79 | 104 | 98 | 1 | 282 |
| 12 | 58 | 121 | 124 | 7 | 310 |
| 13 | 10 | 10 | 15 | 19 | 54 |
| 14 | 4 | 5 | 6 | 21 | 36 |
| 15 | | | | 15 | 15 |
| SES | | | | 2 | 2 |
| Total | 227 | 325 | 312 | 65 | 929 |

## NEW ORGANIZATION STRUCTURE AND STAFFING PLAN

The objective of the new organization and structure is a nationally consistent, seamless, digital soil survey of the nation. All lands and coastal areas will be mapped and updates will be done on a continuous basis. A major step towards this objective will be the full implementation of the MLRA concept, which includes establishing SSOs in approximately 146 locations across the U.S. The SSOs are responsible for conducting soil surveys for their assigned geographic areas. The areas are often multi-county and cross state lines. The offices are permanent, which reduces relocation costs and increases productivity by allowing staff who are expert in the soils and landscapes of an area to stay in that area. Soil mapping is a science based on information and techniques learned through experience in a particular area. The more that is learned about an area the better the professional judgment of the soil scientist.

Soil mapping is best done as a team. The collective experience and judgment of the team and the day to day interaction leads to improved quality and performance. New soil scientists bring the latest university teachings and understanding of technologies. They ask the experienced soil scientists many questions, some of them difficult to answer; about why is this, or why do you do it that way, often forcing the experienced scientist to re-examine just why it is. For the new soil scientist there is a trove of information about soils, soil landscapes, soil behavior, etc. that can not be gained except through on the job training with soil scientists experienced in an area. A team of 3 to 5 people has been determined to be the right size. Any fewer and you do not get the synergy. Any more and it becomes too difficult to manage for the long term. With 3 to 5 people, it allows some to specialize in certain areas such as geospatial technologies (GPS, GIS and remote sensing) for landscape analysis (topography, vegetation, climate, geology, and hydrology), soil data comparison, soil data analysis and population, soil classification, etc. This leads to improved team performance, job satisfaction, and improved quality of the soil survey.

*MLRA Regional Offices (MO)*

The diagram in Appendix A. shows the staffing plans for an MO. It shows the new organizational structure with the expected positions and grade levels. Final grade levels of any positions will be determined by a human resource specialist. There is currently approximately 122 staff in the 18 MOs. Approximately 62 are GS-12 Soil Data Quality Specialists. Approximately 10 are GS-12 English Editors and 9 are lesser grade Editors and Editorial Assistants. Other staff includes GIS Specialists, administrative assistants and a geomorphologist.

Table 4 New MO Regional Office Staff

| Staff per Office | 4 | 5 | 6 | Totals<br>85 staff |
|---|---|---|---|---|
| Number of Offices | 7 | 9 | 2 | 18 Offices |

All MOs would have a GS-13 Soil Scientist, either an Assistant MO Leader or a Senior Regional Soil Scientist (technical position). All MO's would have a GS-12 Soil Scientist that would assist the SSOs with implementing geospatial and be responsible for data bases, and an administrative assistant. Each MO region will evaluate the workload for editorial positions and make appropriate adjustments. ***Some existing GS-12 soil data quality specialist positions could be migrated to MLRA Soil Survey Leader positions as vacancies occur over a 3 year period.***

*MLRA Soil Survey Offices (SSO)*

The diagram in Appendix A. shows a sample staffing plan for a SSO. It shows the new organizational structure with the kinds of positions and grade levels. Typically the SSO will have a staff of 3 to 5 soil scientists. There may also be other staff such as range, forestry, biology, GIS, and Remote Sensing specialists. The MLRA Soil Survey Leader is a GS-12 (or grade level determined by HR) and staff members are GS-5 through 11. The Leader is a key position in the new organization. They are responsible for balancing production and quality needs of the states they serve. They also must be skilled in leadership and human relations. Table 5 shows the number of staff per office in the New MLRA Soil Survey Offices based on FY07 Presidents budget and current local, state and federal reimbursable funding.

Table 5 New MLRA Soil Survey Office Staff with reimbursables

| Staff per Office | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Totals<br>552 Staff |
|---|---|---|---|---|---|---|---|---|
| Number of Offices | 5 | 24 | 40 | 38 | 22 | 9 | 9 | 147 Offices |

*Resource Soil Scientists and Technical Soil Services*

As mentioned earlier, the demand for technical soil services has grown and will continue to grow. As a result most states have established Resource Soil Scientists or Area Soil Scientist positions. ***SSO's staff will typically have less than 15 percent of their time to spend on technical soil service and other responsibilities.*** This clear separation of responsibilities serves two purposes. First, it enables SSO staff to focus and be efficient and productive at completing and updating soil surveys. Since SSOs can serve multiple states, it also ensures that inequities between states do not develop if the host state redirects staff to other activities. Second, NRCS and other Federal, State and Local programs and regulations are complicated and becoming more complicated over time. This requires soil scientists who provide technical soil services to become well versed in all programs. Resource Soil Scientists play a key role in providing feedback to SSO staff on user requirements and soil survey quality issues. The number and location of Resource (Area) Soil Scientists are at the discretion of the State Conservationist based on workload and other factors.

*The New Soil Survey and MLRA Soil Survey Office Space and Equipment*

Soil Surveys conducted by SSOs will not be completed in the same manner as the initial soil surveys. Much of the soil survey update will be completed with computers utilizing existing geospatial information as a template. These geospatial data include SSURGO, elevation, climate, vegetation, streams, land use and other layers. Geospatial technology will be used to analyze these data across the survey area in order to improve the quality of the data. SSO staff will travel to the field to verify the need for changes or to add more detail to existing mapping. In some instances they will be required to correct inaccurate mapping, but most map unit boundaries should not change. In order to complete these tasks SSO staff will need high end computers with large processing capacity and access to large amounts of disk storage. ***A separate CCE Configuration will be developed for these offices.*** Appendix B provides a summary of business requirements and piloting activities.

In addition, each office will have an area for a laboratory of sufficient size for routine soil analysis such as pH. SSO laboratories should include a sink, counter, and storage space for equipment (drying oven, test kits, hydrometers) and chemicals. Additional space requirements include adequate storage for field equipment including GPS, EM meters, GPR, hand tools, sampling equipment, and for storing soil samples See Appendix C.

## TRANSITIONING SSURGO, DIGITIZING UNITS, AND DIGITAL MAP FINISHING SITES

### *SSURGO and Digitizing Unit Transition*

We expect to complete the digitizing of all of the previously mapped soil surveys in FY07, bring to an end a massive and very success data conversion effort that was formally initiated in 1995. We will have completed 2950 soil survey areas. Beginning in 2007 we will begin to transition these staff and refocus this effort to complete SSURGO for the remaining unmapped areas of the U.S. The Digitizing Units are funded under the CO-01 program. Total initiative is phasing down from a high of $12.5 million. Table 7 shows the transition of the SSURGO staff and funding through 2010 when all soil surveys will be complete and digitized.

Table 7 SSURGO and Digitizing Unit Transition

| FY | FY06 | FY07 | FY08 | FY09 | FY00 |
|---|---|---|---|---|---|
| Offices | 7 | 7 | 1-3 | 1-3 | 1-3 |
| DU Funding | 4,146,000 | $2,300,000 | 1,000,000 | 1,000,000 | 1,000,000 |
| State & MO NCGC funding | 5,654,000 | $1,700,000 | 1,500,000 | 1,500,000 | 1,500,000 |
| Completion of SSURGO for initial soil survey's | 0 | 5,000,0000 | 5,000,0000 | 5,000,0000 | 5,000,0000 |
| Total | 9,800,000 | 9,000,000 | 7,500,000 | 7,500,000 | 7,500,000 |

In FY07 we will reduce the funding to both the Digitizing Units and State Offices and shift this funding to complete SSURGO for the remaining initial soil surveys. We will maintain about 2.5 million to be used to maintain the national SSURGO data.

Some of the Digitizing Unit staff is needed to support field soil survey work including data processing and pre-mapping. MO Boards of directors will identify this staffing need and place these employees according to the transition plan. State Conservationists should encourage these employees to apply for career promotions and look for opportunities to place them in vacancies within their state

### *Map Finishing Transition*

Currently we have seven (7) digital map finishing sites, Six (6) are in states and one is at the NCGC. They are focused on producing quality digitally finished maps that are then used as PDF files in electronic manuscripts or used to produce copies of the maps through GPO or at NCGC. As enhancements are added to Web Soil Survey, and surveys are updated more frequently, the need for digitally mapped finished maps is expected to decline. As a result we expect to phase out this function over the next 3 years, retaining only a small staff, likely housed at NCGC to address map finishing related workload.

Table 6 Phase out Plan for State Housed Digital Map Finishing Sites:

| FY | FY06 | FY07 | FY08 | FY09 | FY00 |
|---|---|---|---|---|---|
| Offices | 6 | 6 | 3 | 0 | 0 |
| Funding | 1,200,000 | $990,000 | 400,000 | 0 | 0 |

Funding for Digital Map Finishing is slated to decrease equally by site during FY07 and FY08, but adjustments will be made where natural attrition depletes staff at specific sites, and workload redistributed with funding. The number of staff at the DMF sites tends to be low, 4 or fewer employees, and generally includes some temporary staff. Due to the skill sets of these employees, relatively low level of funding, low number of staff and identified phase out plan, State Conservationist will be expected to absorb the staff into suitable positions in their staffing plan as funding runs out. Some of this staff is needed to support field soil survey work including data processing and pre-mapping. MO Boards of directors will identify this staffing need and place these employees according to the transition plan. Other funds freed up by phasing out the DMF sites will be distributed through the CO-02 funding formula.

In addition, NRCS will explore options for using some of the Digitizing Unit and Map Finishing Site staff for other agency activities or as enterprise business units.

### TRANSITIONING SOIL SURVEY SUPPORT AT NATIONAL CARTOGRAPHY AND GEOSPATIAL CENTER

The National Cartography and Geospatial Center (NCGC) is a major partner of the Soil Survey Division (SSD) inventory program providing extensive support. This partnership will continue to evolve as the implementation of the new Major Land Resource Area Soil Survey structure progresses. NCGC will provide expanded and enhanced geospatial products in support of future SSD inventory program business developments. NCGC utilized approximately 17 FTEs in FY05 and FY06 in support of soil survey business.

NCGC envisions three priority core business areas that will serve the new structure. Beginning in FY07, increased support of MLRA Soil Survey will incorporate the core technologies of geospatial service, geospatial data, and geospatial technology. Leading these core technologies is NCGC's contribution and will help the SSD provide the basis for science-based soil survey inventory and analysis support for growth into the coming decades:

- The existing Geospatial Data Warehouse is expanding to provide enabling geospatial technology to the new SSO in areas such as Data Provisioning
- Data Management
- Data Marts
- Geospatial Data (Gateway)
- Web Services
- Imagery Acquisition (Best Available)
- Remote Sensing (Terrestrial)
- Geospatial Applications
- Mobile Mapping Applications
- Enhanced Web Soil Survey Products

**<u>Geospatial Service</u>**

NCGC's legacies of supporting soil survey assistance and conservation applications are illustrated in new soil survey story lines that reveal the need for new geospatial business applications and tools such as the emerging Soil Resource Inventory Toolbox (SRITB). NCGC will assist in the design, development, and application of the critical geospatial components that will increase efficiency, accuracy, and provide rapid delivery of soil survey products.

**<u>Geospatial Data</u>**

NCGC maintains an abundance of appropriate and readily available geospatial data layers that will support the update soils inventory process. This support incorporates evaluation of surface features such as elevation, geomorphic surface geology, vegetation type, aspect, topography, soil moisture and soil temperature indices, and precipitation data for use in the SSO locations.

**Geospatial Technology**

Technology will automate the downloading of imagery and elevation data from the Geospatial Data Gateway to desktop workstations and versatile tablet computers. Additionally technology will facilitate:

- connecting to geospatial web services at NCGC;
- assisting field soil scientists to improve soil polygon placement;
- providing and maintaining accurate digital elevation data (IFSAR and LIDAR are examples);
- providing and maintaining other digital data layers such as temperature and precipitation that correlate current map unit and soil series concepts
- maintaining access to the Official Soil Series data base until the integration into NASIS
- employing GPS applications for spatial decisions; and
- providing data management utilizing SDE technologies.

Providing geospatial support to the Soil Survey Program is a high priority for the National Cartography and Geospatial Center now and into the future. The historical partnership between NCGC and the Soil Survey Division represents an effectual legacy working model that will ensure the delivery of geospatial services, geospatial data, and emerging geospatial technologies that will provide critical assistance for complete implementation of the new Major Land Resource Area Soil Survey Office structure.

## COMPLETING THE INITIAL SOIL SURVEY ON ALL LANDS BY 2010

As discussed earlier, about 60 million acres of non-federal (private, state and Native American land), and 109 million acres of federal lands are not mapped. In addition about 10 million acres of coastal zone areas need updating. Much of the private and state land without soil information is intermingled with the Federal land and cannot be efficiently mapped without agreements to include all the federal land. Timely completion of soil surveys on all lands is very important in order to coordinate resource planning between the public and the private sector, especially when the watershed approach is used. The Federal Lands Advisory Group has developed a national set of priority areas and plans to target federal resources towards the efficient completion of soil surveys for these priority areas. In the West and Alaska the soil survey will be done in concurrently with the development of potential natural vegetation, plant species composition and production, and ecological site descriptions.

In conjunction with the MLRA Implementation we will accelerate the completion of the initial soil survey in order to complete the conterminous U.S. by December 2010. This acceleration will be made possible by;

- Detailing soil scientist
- Hiring additional soil scientists
- Contracting
- Working with NCSS partners
- Establishing Premapping Centers
- Re-focusing SSURGO initiative funds to digital mapping work

***In states where initial soil survey's remain we will refocus most staff who are performing update and maintenance functions and some staff who are performing technical services functions so that initial mapping can be completed.***

As the initial soil survey is completed for the eastern and gulf coast states we will transition some staff to update poorly mapped near shore areas such as "beaches" and unmapped subaqueous soils in the costal zone in order to address the demand driven by the projection that 75 percent of the U.S. population will live within 50 miles of a shoreline by 2010.

### OPERATING PROCEDURES

SSOs are under the organizational structure of the State Conservationist in which the office is located. They will work across county, state and other administrative lines to cover their Soil Survey Areas of responsibility. Offices are located with Service Centers when possible in order to take advantage of their infrastructure and support or with partners such as universities, Bureau of Land Management, Forest Service, and National Park Service. Offices are located within the soil survey area to reduce costs and travel time.

SSO has responsibility for:

1. Managing the survey including quality control (the process of providing direction, inspection, and coordination of soil survey activities to ensure that soil survey products meet the defined standards for content, accuracy, and precision)
2. Conducting the survey, including field data collection, investigation, description, classification, correlation and developing and maintaining the soil geographic data for their area of responsibility including;
    - Ensuring accuracy of line placement with respect to landforms.
    - Ensuring the accuracy and consistency of the soil map unit attribute data.
    - Ensuring that soil series are mapped regionally on appropriate parent materials and landforms.
    - Geo-referencing locations of sampled soil profiles and ensuring adequate representation of soil series by laboratory data.
    - Quantifying distribution and extent of designated benchmark soils.
    - Ensuring that sufficient and appropriate benchmark soils are designated to represent the most common soils in the region.
    - Creating sufficient, high quality block diagrams to represent the benchmark soils of the MLRA region, etc.
3. Publishing to the Web Soil Survey as areas are completed and reviewed
4. Reporting progress for their geographic area of responsibility
5. Periodically completing a review of new soil survey area data
6. Developing a long range work plan and investigations plan
7. Meeting with SSA Technical Team which includes state staff, cooperators, NRCS field staff, resource soil scientists, and others
8. Developing an annual business plan with priorities and resource requirements
9. Meeting with each states' Work Planning Conference (WPC)

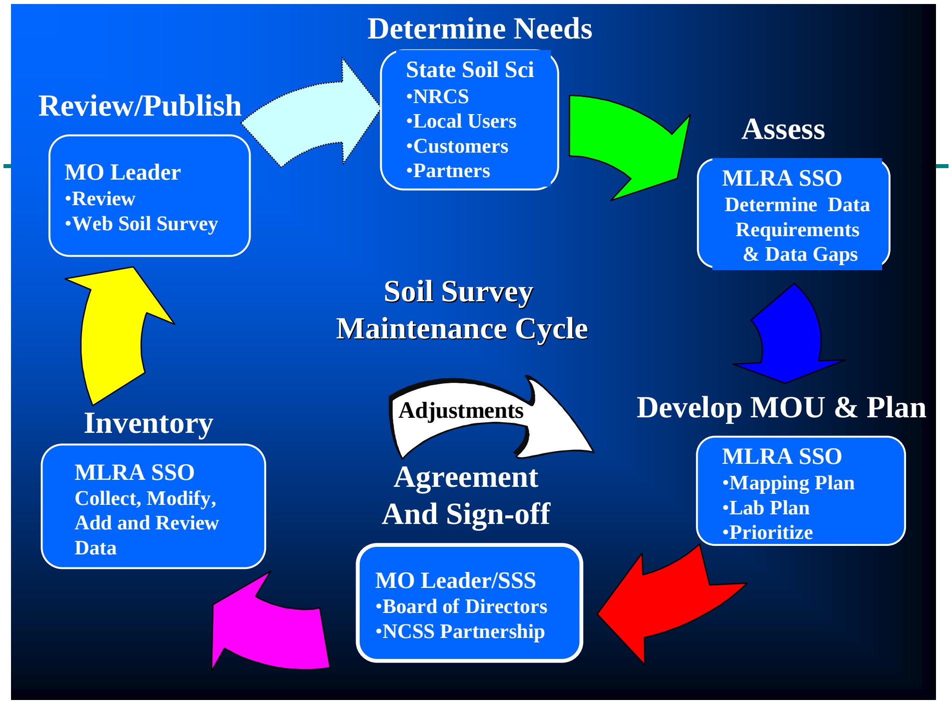
Appendix D. provides a description of these duties in the form of a story.

MOs have responsibility for;

1. Leadership in production of soil surveys for their area

2. Quality assurance (the process of providing technical standards, review, and training to support soil survey quality control) for all phases of the soil survey
3. Assuring adherence to NCSS standards
4. Training and support for SSO
5. Developing and maintaining a seamless national soil geospatial database
6. Reviewing data before it is added to the soil data mart and published to the Web Soil Survey
7. Field reviews in the SSR on multiple SSOs to examine a catena or group of soils across a broad geographic area to ensure consistency of mapping rather than the traditional county field review.
8. ***MOs will spend more time reviewing the national soil geospatial data base for quality issues.***

The diagram below shows the work flow for production Soil Survey




State Soil Scientists have responsibility for;

1. Leadership in the development of requirements for soil survey information within the state. It is the responsibility of the MO and SSO to meet those requirements.
2. Leading soil survey application and information delivery for NRCS. State Soil Scientists and their staffs are the “front office” of the Soil Survey Program in each state. They insure that the correct information is delivered and that the information is understood by both internal and external customers. Their role is to synthesize all the requirements from NRCS and other Federal, State and Local agencies and the general public, and provide these to the MO Leaders and MLRA Soil Survey staff who develop this information.
3. Leading the development of new applications and uses of soil survey information.

4. Conducting the State Work Planning Conference (WPC). The State WPC needs to be robust with technical sessions and all cooperators fully represented. Resource soil scientists play a lead role in these conferences. MLRA Soil Survey Leader and staff participate in these conferences to gain understanding of the needs and priorities and present findings of mapping and investigations.
5. Developing cooperative agreements with customers to accelerate the analysis, retrieval or collection of any state specific soils data or information. State Soil Scientists work with MO Leaders and MLRA Soil Survey Leaders to ensure that their offices have the capacity to meet the requirements of the cooperative agreement before it is signed.
6. Leadership of the Resource Soil Scientists in the state and assuring that the soil information needs of all MLRA's within the state are met.

## SOIL SURVEY FUNDING FORMULA AND PERFORMANCE MEASURES

MLRA Soil Survey Funding

The funding formula for MLRA Soil Survey Offices uses a complexity factor to estimate relative differences in workload required to maintain soil surveys. The components of the complexity factor are:

| | |
|---|---|
| Age: | Years since correlated, which gives general since of correctness |
| Scale: | Represent detail of the existing survey |
| Polygon Density: | An indication of detail of mapping |
| Map Units: | Used to measure complexity of the soils |
| Unique Components: | Measure of complexity of database workload |
| Land use Change: | Used as an indication of changing use of the soil survey |

The individual factors range from 1 to about 1.5. An average of the six factors was used to get a single complexity factor ranging from 1 to 1.5. It was used to establish estimated maintenance rates of 80,000 to 120,000 acres per FTE. The New Soil Survey will focus more on keeping all areas current than on extensive updates of specific areas, but these maintenance rates give a relative number that is divided in to the total acres to get a workload estimate.

Mapping rates for areas without and initial soil survey were set at 35,000 to 55,000 acres per FTE based on general split by MLRA Soil Survey Area between order 2 and order 3 mapping. Order 3 rates for rangeland areas west of the front range of the Rocky Mountains were set at 100,000 acres per FTE.

State Office Funding

Base Staffing:
States without MLRA Regional Office: 3 FTEs
MLRA Regional Office States: 2 FTEs
PR & DE: 2 FTEs
RI and Pac Basin 1 FTE

Database or state complexity factor bonus
Using total Official Series Descriptions, total Map Units and total Components some states get an additional 0.5 or 1 FTE depending on thresholds set for these items.

Off the top items not included in the formula calculations include:
Congressional Earmarks

Native American Mapping Initiative
State Reimbursable and reimbursable bonus
MLRA Regional Office Funding
Digital Map Finishing Funding
Special Projects

MO Office Funding
MLRA Regional Office funding was targeted to the anticipated workload based on the number of NRCS field soil survey staff in the MLRA Region and the acres of other Federal land in the MLRA Region. Although federal lands are not used in the field soil survey staffing estimates, they are used for MLRA Regional Office Staffing, due to NRCS's NCSS leadership role and responsible for correlation work with federal partners. The Formula was figured at base of 2 FTE, plus 2 FTE for every 18 field soil scientist, plus 1 FTE for every 45 million acres of Federal lands. Computations were rounded to the nearest whole number, with a minimum of 3 FTEs, and an exception was made for Alaska where much broader mapping is done.

The formula factors are used to determine and estimated annual workload requirement to carryout the soil survey program, complete initial mapping, maintain and improve existing soil surveys and getting soils information out to the public. However there are not enough funds in FY 2007 to fund all the FTEs that the formula says are needed, so the amounts that are allocated to each state is reduced equally.

Performance Incentives:
FY07 will be used as a base year and a performance incentive will kick in for FY08 based on initial mapping progress. The performance incentives will effectively re-distribute a portion of the initial mapping funding to the better performing units.

## BENEFITS OF IMPLEMENTING THE MLRA APPROACH TO SOIL SURVEY (BUSINESS CASE)

The Soil Survey Division has charted a course to overcome the technological challenges and to pursue the improvement opportunities that lie ahead. Full implementation will transform the program as described below.

### *Direct Economic Benefits*

The Soil Survey Division recognizes its accountability responsibility and has conducted the necessary cost-benefit analyses to ensure that this restructuring is economically sound.

1. There are approximately 501 Soil Scientists making soil surveys in 255 Soil Survey Project Offices for an average of 2 people per office. Approximately 104 are one person project offices. By reducing to approximately 146 Soil Survey Offices the Soil Survey will gain approximately 16.5 staff years or reduce management costs by $1.57 million per year. (255-146 = 109 x 0.15 = 16.35 x $95,000 = $1.55 m)

2. Based on states experience, fully implementing the MLRA approach will result in an across the board productivity increase of at least 15 percent due to;
    - Better access to the appropriate technology and other discipline skills such as GIS and remote sensing.
    - Synergy of having larger staff with varying skills and expertise to solve problems
    - Competition between staff members

- Less diversity of soils in MLRA area.

This equates to an increase of 74 staff years or a benefit of $4.8 million per year (74 x $65,448) Labor savings benefits will help the Soil Survey Program to increase productivity and improve soil survey quality. ***Employees will be able to spend less time wrestling with manual, paper-based tasks, and use updated technology made possible by the Service Center Modernization Initiative.***

Annual Benefits from items 1 and 2 equals approximately $6.4 million.

*Customer Service and Program Delivery Benefits*

- Increased quality and consistency of soil survey information. Provide expanded data for more soil properties or to deeper depths, and improve soil data by addressing soil change or dynamic soil properties.
- Increase soil map detail and/or add new products, such as pixel based soil maps showing spatial variability.
- Soil Survey by MLRA will eventually replace the existing 100 years of county patch work soil surveys. This process will improve soil data quality, which will enable consistency across watersheds, counties, and states up to a national scale.
- Increased agency credibility, eGovernment (web-based self-service) and;
- ***Increased job satisfaction, morale and reduced financial burden by eliminating the need to move soil survey staff every 3 to 5 years.***
- Increased consistency in mapping rates, documentation, soil interpretations, and costs.

*Legislative Benefits*

MLRA implementation will help NRCS to fulfill 2002 ***Freedom to E-File Act*** deadlines for Web services, the ***Government Paperwork Elimination Act (GPEA)*** IT efficiencies in the ***Clinger-Cohen Act***.

*Cost*

Costs include; one time increased moving costs, beyond our normal costs, of $4.5 m. for approximately 75 more GS-12 MLRA Soil Survey Leaders over a 3 year period or about $900,000 per year. (75 x $60,000 = $4.5 m) This cost is a very rough estimate because each SSO will be implemented over time as work is completed elsewhere and many staff would have moved anyway. Some of this cost will be offset by not filling some vacant MO Data Quality Specialist positions as they become vacant. Other Costs are;

1. Increased annual travel cost of approximately $ 1.2 m per year (240 staff x 10 weeks x $500 per week) to field check, sample and related activities.

2. Increased annual salary cost of $300,000 for 75 new GS-12 MLRA Soil Survey Leaders ($4,000 x 75 = $300,000)

3. Increased annual salary cost of $189,000 for 18 new GS-13 Senior Regional or Assistant MLRA Leaders ($10,500 x 18 = $189,000)

Annual Costs equals approximately $2.6 million.

Table 7 Estimated NPV, B/C Ratio and ROI*

| Annual Cost | Annual Benefits | Net Benefits | Annual NPV of Net Benefits | Annual Benefit Cost Ratio | Annual ROI |
|---|---|---|---|---|---|
| $2,600,000 | $6,400,000 | $3,900,000 | $2,702,931 | $2 | 145 |

**Annual Benefit Cost Ratio:** Number of benefit dollars that each cost dollar produces (benefits/costs)
**Annual Return on Investment (ROI) Percent:** Number of net dollars each cost dollar produces (benefits-costs = net/cost*100).
**Annual Net Present Value (NPV):** the value of $1 one or more years from the date of calculation. In this case we used 5 years.

The ROI for the MLRA Soil Survey Restructuring is 145 percent. Costs are estimate to be $2.6 million over the next five years and deliver an additional $6.4 million in increased productivity during the same time. These calculations assume $2.6 m. of costs and $6.4 m. of benefits in the first through last years. In reality both the costs and the benefits will begin much lower and increase over 5 years.

$$ROI = \frac{\text{Benefits} - \text{Costs}}{\text{Costs}} = \frac{\$6.4\text{ m} - \$2.6\text{ m.}}{\$2.6\text{ m.}} = 145\%$$

**MLRA Soil Survey Restructuring provides a benefit-cost ratio exceeding 2-to-1 or more than a $2 return for every $1 invested, well above the 1-to-1 ratio needed to justify such investments.**

## IMPLEMENTATION TIMELINE

New Soil Survey Areas and offices will be implemented by MO Regions under the direction of the MLRA Region State Conservationists Board of Directors (BOD). The time line may be separate for each area depending on workload and current staffing, and on agreements with cooperators. The intent is to minimize the relocation of staffs. Plans will provide for the relocation of staff after existing initial and update survey commitments are completed. Staff who would normally move to a new office will instead move to a permanent Soil Survey Office. In addition new and vacant positions would be filled in these new offices.

MLRA Soil Survey Offices will be implemented according to the timeline in table 8.

Table 8 Estimated Numbers of Areas/Offices Implemented per MLRA Region by Fiscal Year.

| MLRA Region | FY07 | FY08 | FY09 | Total |
|---|---|---|---|---|
| 1 | 6 | 1 | 2 | 9 |
| 2 | 8 | 1 | | 9 |
| 3 | 3 | 2 | | 5 |
| 4 | 1 | 1 | 2 | 4 |
| 5 | 3 | 3 | 3 | 9 |

| | | | | |
|---|---|---|---|---|
| 6 | 3 | 1 | 1 | 5 |
| 7 | 7 | 2 | 2 | 11 |
| 8 | 7 | | | 7 |
| 9 | 11 | 2 | | 13 |
| 10 | 5 | 7 | | 12 |
| 11 | 9 | 2 | | 11 |
| 12 | 8 | | | 8 |
| 13 | 4 | 3 | | 7 |
| 14 | 3 | 3 | 2 | 8 |
| 15 | 2 | 5 | 2 | 9 |
| 16 | 6 | 2 | 1 | 9 |
| 17 | 3 | | | 3 |
| 18 | 2 | 4 | 1 | 7 |
| Total | 92 | 39 | 14 | 146 |

***At least 132 of the 146 areas/offices are at existing Service Center Locations.***

## PLACEMENT STRATEGY

**Coverage**

- This placement strategy applies to:
  - permanent employees occupying positions presently located at MLRA Region Soil Survey Offices, MLRA Soil Survey Offices, Soil Survey Project offices, Digital Map Finishing Sites and Soil Survey Digitizing Units
  - Employees, located in states, who are tasked with duties associated with production soil survey.

**Guiding Principles**

- This is not a Reduction in Force (RIF) action. Each employee will be offered a position for which they qualify, at the same grade level and promotion potential as their current position.
- This plan is a realignment of office locations and geographical scope of responsibilities. The functions of the MLRA Region Offices, MLRA Soil Survey Project Offices and Soil Survey Project Offices are being realigned (and in some cases consolidated) for more efficiency and consistency throughout the country.
- Civil Rights Impacts will be assessed and addressed in each of the 18 MLRA Region transition plans.

**Management Actions**

Effective October 1, 2006 through September 27, 2009, pay retention has been approved for employees affected by this plan who voluntarily accept a lower grade position.

**Transition Plan: October 1, 2006- September 30, 2008**

- Transition plans will be developed by the State Conservationists and the 18 MLRA Regional Boards of Directors by July 31, 2006.
  - The plans will identify, by fiscal year, the office slated to close during the transition period and the business reason for closure and/or opening a new office.
  - To the extent possible, voluntary reassignments and merit promotion will be used to fill positions in the MLRA Soil Survey Offices during the transition period.

- Employees in current offices that are located and staffed according to the plan as of October 1, 2006 will not be affected by this realignment.
- Vacancies in offices whose functions are slated to be realigned to other offices by September 30, 2009 will not be filled. Requests to fill positions on a temporary basis to address critical short term workloads will be made only when approved by the Soil Survey Division Director in accordance with position management policy.
- When the priority workload is completed in an office that is slated to be realigned, the office will be closed and the staff reassigned, as per the applicable Transition Plan.
  - Priority workload includes commitments under MOUs with cooperators and high priority work identified in MLRA project plans.
  - To the extent possible, staffing of MLRA Soil Survey Offices will be accomplished either through voluntary reassignment actions or merit promotion actions.
- In addition, the Agency will take advantage of opportunities that arise during the transition period, such as lease agreements running out or agency space becoming available at new office locations, to open MLRA Soil Survey Offices and close existing offices earlier than slated in the transition plan. However, employees in the existing offices should be given at least 6 months notice that the office will be closed.

**Placement Plan FY 2009 --** Placement plan will be activated on October 1, 2008 and completed by September 30, 2009.

- All employees in offices whose functions have been realigned will be placed in another position according to nationwide needs.
- Employees will be required to relocate to their new official organizational location.
- Most employees should be in place in the MLRA Soil Survey Offices not later than September 30, 2009.
- Where more efficient and practical, some employees in offices that have not completed the soil survey may remain in their current location until the survey is complete, even if the time is beyond September 30, 2009.

**Placement Procedures**

**I. Vacant Positions**

- Employees not placed through voluntary reassignment or merit promotion actions prior to the beginning of FY 2009 will be placed into vacant positions according to nationwide needs.
  - Employees will be placed in a position at the same grade level, for which they qualify, which has similar duties to their current position.
  - Employees will be placed in a location closest to their current duty station and where the Agency determines the position is needed.[4]
  - When the number of employees exceeds the number of positions needed in any one location employees will be selected for reassignment to a location closest to their current duty location based on their reduction-in-force (RIF) service

[4] Rand McNally's online mileage system (www.randmcnally.com) will be used to determine closest location.

computation date (SCD) based on where the agency determines the position is needed.[5]

- Employees will receive a reassignment letter if their placement is to a position within their current commuting area.
- Employees will receive a directed reassignment letter if their placement is to a position outside of their current commuting area.
- If declinations are received from the initial directed reassignment notices, placements will be reviewed again to allow employees the opportunity to be placed in a closer location than initially determined based on agency needs.
- Positions (not filled through the placement process) will be advertised and filled through merit promotion procedures.

**II. Assistance Programs**

NRCS is committed to offering a position at the same grade level to every applicable affected employee, and to use the appropriate tools to ease the transition for everyone involved. This includes the following services:

- Employee Assistance Program (EAP) – available to assist employees and their families in all types of personal problems and crisis situations.
- Career Transition Assistance Plan (CTAP) - priority selection for vacancies that the employee applies for at the same or lower grade level as the position the employee is being separated, and that does not have greater promotion potential, in the same commuting area, and is found to be "well qualified". Employees are eligible for CTAP assistance beginning the day after they decline the directed reassignment notice. They will receive a certificate of eligibility for CTAP from their servicing human resources office. The certificate is effective from the day after declining a directed reassignment to until their actual separation date.
- Interagency Career Transition Assistance Plan (ICTAP) - priority selection for vacancies at other Federal agencies when they are filling vacancies from outside of their workforce, that the employee applies for at the same or lower grade level as the position the employee is being separated, and that does not have greater promotion potential, in the same commuting area, and is found to be "well qualified". Employees are eligible for ICTAP assistance beginning the day after they decline the directed reassignment notice. They will receive a certificate of eligibility for ICTAP from their servicing human resources office. The certificate is effective from the day after declining a directed reassignment up to one year after separation.

## CIVIL RIGHTS ANALYSIS AND IMPACT

The restructuring affects the Soil Survey Division, its MO Regional Offices, its Field Offices and the State Offices. Our civil rights review considered whether the proposed action would negatively affect or have a disproportionately adverse impact on minorities, women or persons with disabilities. The NRCS is committed to offer a position to every applicable employee at the same grade level affected by this restructuring and to use the appropriate tools to ease the transition for everyone involved. The Agency will make the placements to include reassignments, directed reassignments, and merit promotion procedures of adversely affected employees in accordance with Federal civil service personnel policies and procedures in

[5] RIF SCD is based on 4 retention factors: tenure, veterans' preference, length of service and performance.

consultation with the NRCS Human Resource Division. The NRCS will implement the following measures to mitigate any adverse effects of the restructuring:

- Authorize pay retention for period of time for employees affected by the plan who voluntarily change to a lower grade position;
- When applicable, use veterans' preference and service computation dates as well as a mileage system in placing employees;
- Advertise vacant leadership/supervisory and non-supervisory/staff positions through merit promotion procedures;
- Offer career transition services, Employee Assistance Program, Career Transition Assistance Plan (CTAP) and Interagency Career Transition Assistance Plan (ICTAP) to employees who choose to separate or apply for other jobs including NRCS vacancies instead of relocating to their new duty stations

The NRCS will reduce the number of the Soil Survey Division's offices from 255 to approximately 147. However, the Agency will increase the number of staff assigned in each office from 1 - 2 employees per office to 3 – 5 employees per office. While the total number of employees in the Field Offices and MO Offices will go from 552 to 518 employees and 126 to 84 employees, respectively, the employees who will leave the Soil Survey Division are not soil scientists. NRCS will most likely absorb these employees in the State Offices. Employees may also apply for other NRCS or State vacancies for which they qualify.

### SUMMARY - MLRA SOIL SURVEY RESTRUCTURING

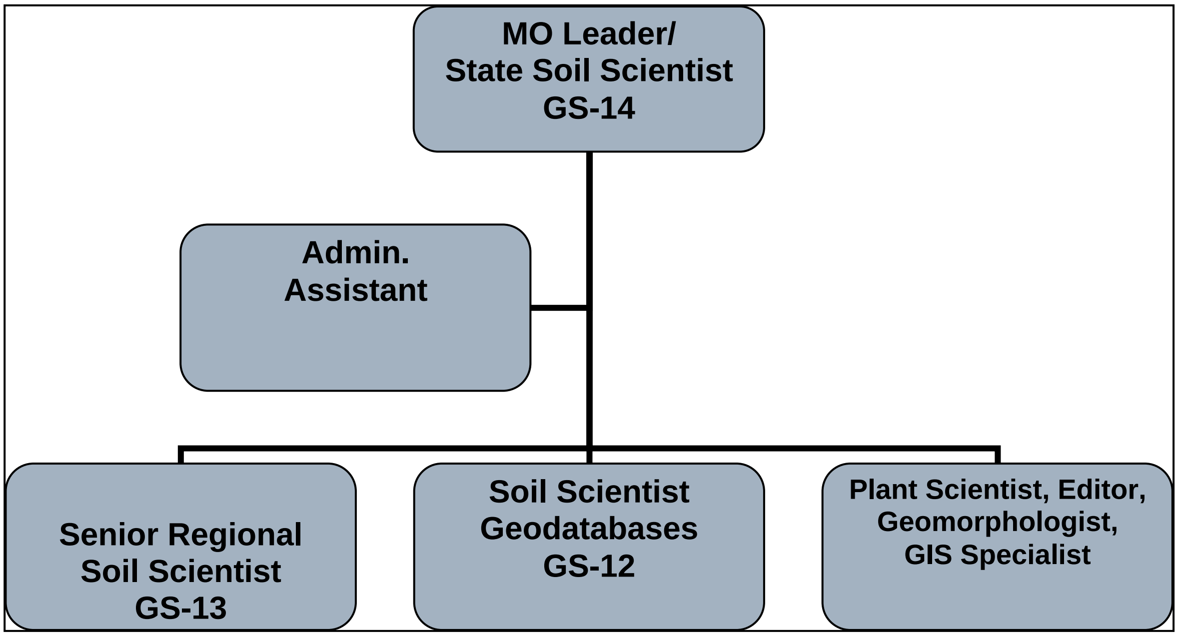
Implementation of the MLRA approach will result in the delivery of higher quality, more timely and responsive, and more economical soil survey information to the customers and partners of NRCS.

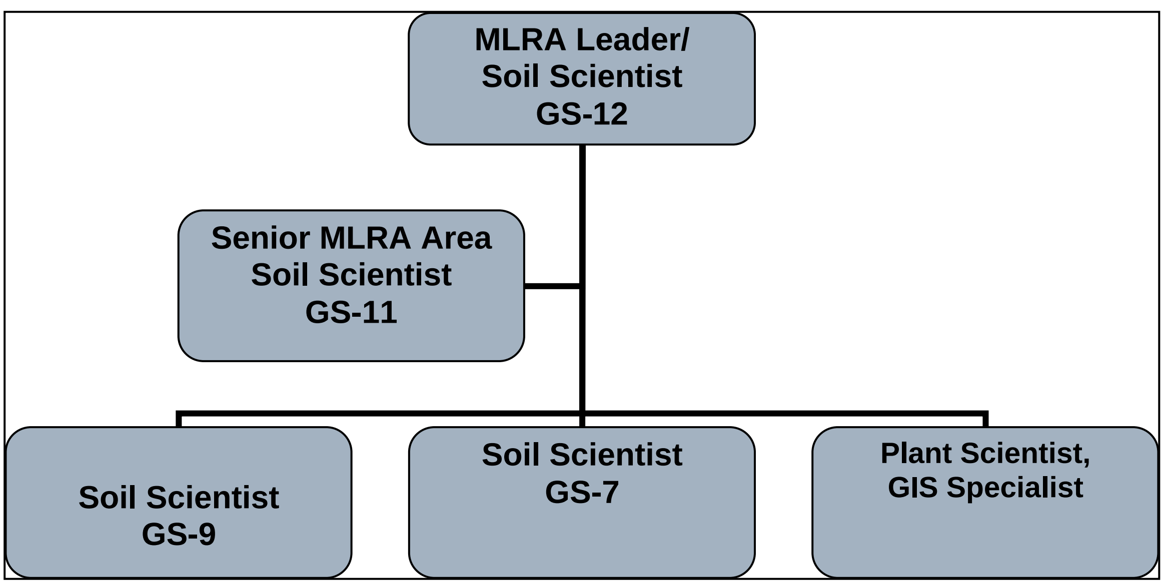
- We will have a single seamless national soil survey geographic data base (SSURGO).
- A MLRA Soil Survey Leader and appropriate staff will have responsibility for an area that averages about 15.8 m. acres. They will be responsible for ensuring an up-to-date soil survey that meets the needs of NRCS and its customers.
- SSOs will have the proper field investigation and laboratory equipment to produce high quality information.
- All staff members will have a GPS enabled field computer with a suite of data collection, analysis and quality control tools that they will use to check out a subset of SSURGO and other available data, edit SSURGO and check it back in.
- Field staff will be well trained in the use of technologies and have a strong understanding of soil science.
- After a second level quality assurance review data are quickly published to the web soil survey.
- In the new Soil Survey every acre may be touched in some way every year by updating the data.

In summary and in response to the Chiefs challenge we plan to:

- Establish new soil survey areas and offices by MLRA to be more efficient
- Change staffing at MLRA Region Offices to meet current and emerging needs.
- Aggressively implement new technologies
- Aggressively work to improve the NCSS partnership and
- Implement a paperless (start to finish) soil survey

## APPENDIX A – MLRA SOIL SURVEY STAFFING PLAN



## APPENDIX B – STANDARD MO/SO AND SSO COMPUTER CONFIGURATION

### SO/MO Office

**Agency Applications:**

- NASIS (web)
- Soil Data Viewer
- Web Soil Survey (web)
- SoLIM
- Windows Pedon
- PedonCE
- PedonPC
- OSEDs (web)
- Soil Series Classification (SC file) (web)
- OSD Check
- Soil Characterization Database (web)
- Soil Geochemistry Spatial Database (web)

**Commercial Software Applications:**

- Microsoft Office:
  - Word
  - Excel
  - Access
  - PowerPoint
  - Outlook
  - Project
  - Visio
  - SQL Server/Client
- Internet Explorer
- Citrix
- NetManage ViewNow
- Hummingbird (legacy)
- ArcGIS
- ArcSDE
- ERDAS Imagine
- Leica Photogrammetry Suite
- OrthoMapper
- DNR Garmin
- MapSource
- 3dMapper

**Hardware Requirements:**

Computers:

Five computers, three different models, are being procured for testing to meet the following requirements, where applicable. The basic configurations for these test computers are:

1. Two each of dual core Xeon processor, XP Windows (32 bit), 4 ea. 500 GB data drives, dual monitors, CD & DVD read/write
2. One each of single (1X) dual core processor, XP Windows (64 bit), 4 ea. 500 GB data drives, dual monitors, CD & DVD read/write
3. Two each of two (2X) dual core processors, XP Windows (64 bit), 4 ea. 500 GB data drives, dual monitors, CD & DVD read/write

- Quick access to large geographic area geospatial data including those listed below (These areas range in size from about 84 million to 378 million in Alaska and with a national average of 133 million acres for the conterminous U.S.) with fast screen refresh for panning and zooming. Refresh and processing should take no more than five seconds (current CCE high end computers lack processing speed, RAM, video cards, storage capacity, etc. to meet these requirements)
- Capability to view attribute tabular data while viewing geospatial data (wider or dual monitors needed)

Peripherals:

- Input tools to facilitate point and streaming digitizing (more precise point and line placement as well as more fluid lines)

- Output devices to generate large format (greater than 42 inch), high resolution (1 meter) prints (larger format plotters)
- Digital Projector to project GIS applications onto white boards or wall surfaces along with PowerPoint presentations for team teaching and QA/QC review work
- Scanner to capture historic data (analog imagery, descriptions, notes, photos, etc.) with a minimum width of quad size maps at a resolution of greater than 1200 dpi
- Store data on removable media for backup, restoration, and sharing large datasets (e.g. external hard drives, tapes, DVDs)

Field Data Recorders:

- Electronically collect point, line, and tabular data in rugged field conditions with various framework datasets; must have connectivity for importing data into corporate databases, tabular and spatial (e.g. tablets and PDAs)
- Screens must be viewable in direct sunlight
- Global positioning systems (GPS) with differential correction capability; connectivity with field data recorders is also required.
- Data loggers for the collection of long term point data (e.g. soil temperature, moisture, water tables); connectivity with field data recorders is also required.
- Digital camera for the collection of still photos, video, and audio with GPS coordinates
- Geophysical devices (e.g. electromagnetic induction (EMI), ground penetrating radar (GPR)) to automate the collection of subsurface features; devices are required to have onboard data logging capabilities and/or connectivity to field data recorders for the storage and subsequent upload to office computer

**Telecommunications Requirements:**

- Access large datasets quickly (improved LAN and/or WAN speeds)
- Efficiently share data with neighboring soil survey offices, MO, and SO to facilitate joins, matches, data correlation, and quality control (connectivity with other offices and improved WAN speeds)
- Access other data layers through web services or other means as they become available (improved download speeds via LAN and/or WAN)

**Geospatial Data Requirements:**

- Elevation data (e.g. DEM, IFSAR, LIDAR); resolution needed dependent on topographic relief
- Digital Ortho Quads (DOQ); individual quarter quads and MrSID mosaics
- Hydrography
- Government units (county, state boundaries)
- Transportation
- Cadastral (e.g. PLSS)
- Digital Raster Graphs (DRG); individual quads and compressed mosaics
- Topographic quad boundaries
- Climate (e.g. PRISM of precipitation, temperature)
- Land Use/Land Cover
- Multispectral data (e.g. Landstat)
- Hydrologic units
- Ownership (boundaries and land owner)
- Common Land Units (FSA CLUs)

- MLRA and CRA
- SSURGO layers (polygons, points, lines)
- Pedon and Lab point data (shape files)
- STATSGO
- Geology
- Geomorphology
- Flood zones
- Wetlands
- Photo index
- Derivative maps (e.g. slope, curvature, shaded relief, topography, aspect, 3D, model products, reprojections, assorted projects in progress, etc.)

**Data Storage Requirements:**
- 3.7 – 12.0 TB (6.1 TB average/office); dependent on area (e.g. square miles) covered by each office
- Alaska: 21.2 TB

## SSO

**Agency Applications:**
- NASIS (web)
- Soil Data Viewer
- Web Soil Survey (web)
- SoLIM
- Windows Pedon
- PedonCE
- PedonPC
- OSEDs (web)
- Soil Series Classification (SC file) (web)
- OSD Check
- Soil Characterization Database (web)
- Soil Geochemistry Spatial Database (web)
- ArcMap Soil Survey Custom Applications including:
  Digital Soil Survey Mapping Tools
  Digital Soil Survey QC tools
  Slope Curvature Toolbox,
  Slope Gradient Toolbox
  Soils - Spatial Analyst Tools

**Commercial Software Applications:**
- Microsoft Office:
  - Word
  - Excel
  - Access
  - PowerPoint
  - Outlook
  - Project
  - Visio
  - SQL Server/Client
- Internet Explorer
- Adobe Reader-Publisher
- Adobe Illustrator (block diagrams)
- Citrix
- NetManage ViewNow
- Hummingbird (legacy)
- ArcGIS
- ArcSDE
- ERDAS Imagine
- Leica Photogrammetry Suite
- OrthoMapper
- DNR Garmin
- MapSource
- 3dMapper

**Hardware Requirements:**
<u>Computers:</u>

- Quick access to large geographic area geospatial data including those listed below (These areas range in size from about 2 million in Puerto Rico to 177 million in Alaska and from 4 million to 37 million in the conterminous U.S. with a national average of 15 million acres) with fast screen refresh for panning and zooming. Refresh and processing should take no more than five seconds (current CCE high end computers lack processing speed, RAM, video cards, storage capacity, etc. to meet these requirements)
- Capability to view attribute tabular data while viewing geospatial data (wider or dual monitors needed)

Peripherals:

- Input tools to facilitate point and streaming digitizing (more precise point and line placement as well as more fluid lines)
- Output devices to generate large format (greater than 42 inch), high resolution (1 meter) prints (larger format plotters)
- Scanner to capture historic data (analog imagery, descriptions, notes, photos, etc.) with a minimum width of quad size maps at a resolution of greater than 1200 dpi or other as appropriate.
- Digital Projector to project GIS applications onto white boards or wall surfaces along with PowerPoint presentations for team teaching and QA/QC review work.
- Store data on removable media for backup, restoration, and sharing large datasets (e.g. external hard drives, tapes, DVDs)

Field Data Recorders:

- Electronically collect point, line, and tabular data in rugged field conditions with various framework datasets; must have connectivity for importing data into corporate databases, tabular and spatial (e.g. tablets and PDAs)
- Screens must be viewable in direct sunlight
- Global positioning systems (GPS) with differential correction capability; connectivity with field data recorders is also required.
- Data loggers for the collection of long term point data (e.g. soil temperature, moisture, water tables); connectivity with field data recorders is also required.
- Digital camera for the collection of still photos, video, and audio with GPS coordinates
- Geophysical devices (e.g. electromagnetic induction (EMI), ground penetrating radar (GPR)) to automate the collection of subsurface features; devices are required to have onboard data logging capabilities and/or connectivity to field data recorders for the storage and subsequent upload to office computer

**Telecommunications Requirements:**

- Access large datasets quickly (improved LAN and/or WAN speeds)
- Efficiently share data with neighboring soil survey offices, MO, and SO to facilitate joins, matches, data correlation, and quality control (connectivity with other offices and improved WAN speeds)
- Access other data layers through web services or other means as they become available (improved download speeds via LAN and/or WAN)

**Geospatial Data Requirements:**

- Elevation data (e.g. DEM, IFSAR, LIDAR); resolution needed dependent on topographic relief

- Digital Ortho Quads (DOQ); individual quarter quads and MrSID mosaics
- Aerial photography scans (i.e. stereo capable)
- Hydrography
- Government units (county, state boundaries)
- Transportation
- Cadastral (e.g. PLSS)
- Digital Raster Graphs (DRG); individual quads and compressed mosaics
- Topographic quad boundaries
- Climate (e.g. PRISM of precipitation, temperature, point data from weather stations)
- Land Use/Land Cover
- Multispectral data (e.g. Landstat)
- Hydrologic units
- Ownership (boundaries and land owner)
- Common Land Units (FSA CLUs)
- MLRA and CRA
- SSURGO layers (polygons, points, lines)
- Pedon and Lab point data (shape files)
- STATSGO
- Geology
- Geomorphology
- Flood zones
- Wetlands
- Photo index
- Derivative maps (e.g. slope, curvature, shaded relief, topography, aspect, 3D, model products, reprojections, assorted projects in progress, etc.)

**Data Storage Requirements:**
- 0.13 – 1.8 TB (0.79 TB average/office); dependent on area (e.g. square miles) covered by each office
- Alaska: 5.0 – 10.0 TB (7.1 TB average/office)

## APPENDIX C – MLRA SOIL SURVEY OFFICE SPACE

1. Office accessible though both front and back doors.

2. Soil Survey Field Lab Requirements

    2.1. 150 Square Feet - acoustically treated insulated interior partitioning to provide STC 50.
    2.2. Provide and install a stainless steel double bowl sink in a minimum six (6) foot long base kitchen-type locking cabinets with countertop and sink to measure 33" X 22" X 7" with hot and cold running water and high spout faucet. . Provide and install minimum 3 foot long overhead cabinet
    2.3. Provide two (2) 110-volts, 20-amp dedicated circuits each with isolated grounding with 2 duplex outlets evenly spaced above the countertop.

3. Soil Survey Equipment, Sample and Document Storage Requirements
    3.1. Backdoor accessible store room - 150 square feet with storage shelves.

## APPENDIX D – CONCEPT OF OPERATIONS FOR THE NEW SOIL SURVEY

**What follows is a story of how a field soil scientist operates in "The New Soil Survey".**

Rebecca works in the Farmville MLRA Soil Survey Office as a GS-11 field soil scientist. She is one of 4 soil scientists in the office. Their soil survey area covers 12 million acres and includes part or all of 30 counties in 3 states.

Rebecca arrives at the office at 7:30 am on Thursday. She turns on her computer, checks her email and then opens the Soil Resource Inventory Toolbox application. The Soil Toolbox remembers the area where she worked the day before and brings this area up on her computer screen. She is reviewing the soil survey information for the Camp Valley River floodplain and associated terrace complex. This area covers parts of 4 counties. Soil Surveys for these 4 counties were completed over a 20 year period. The Soil Survey Plan of Operations for her office identified this as a priority area for updating soil survey information. Rebecca has found that 3 soil map units that are on the same position in the landscape are named differently and have slightly different soil properties stored in the database. Her review also revealed that 2 of the map units are considered "non-highly erodible" while one is considered "potentially highly erodible". She is updating the soil map units and their associated data so that soils that are similar are named the same, have the same data set, and the same interpretations. In her review she is layering the digitized soil surveys, elevation, surficial geology, precipitation, temperature, vegetation and orthoimagery data together and analyzing them to find inconsistencies. In addition, she has gathered 10 soil descriptions written by the original mappers, as well as laboratory data from the National Soil Survey Laboratory for 3 of the pedons. She has also found that the archived correlation document for one of the counties contains a pertinent correlation note about the classification of the soil she is investigating. This note will also help her in her efforts today. She has downloaded the imagery and elevation data to her computer from the data warehouse by using the Resource Data Gateway. She accesses the other layers using web services. She makes sure that the soil map units are positioned correctly in relation to the landform information provided by the elevation data. She makes sure that the temperature and precipitation geospatial data are in line with the soil map unit and soil series concept. She compares soil property data such as hydrologic unit, depth to water table, salinity, pH, and others for all map units against the series component standard to assure consistency. To complete this comparison she runs a series of queries. The results of the queries show inconsistencies by both highlighting them on the map and in the tabular data. She is able to see both the map and tabular date on the screen(s) at the same time. She corrects most of these inconsistencies in the office, but there are a number of areas that she will have to check in the field. She highlights these areas on the map on her computer. The following week she travels to the field to examine these areas. Before she leaves she checks out the data listed above to a tablet computer. She will use a GPS unit to navigate to the area. She will examine the soils, and use the Toolbox to collect and store the information she collected. She determines that some of the soil lines are not correct and uses the Toolbox to adjust map unit delineation lines to their correct position. As a result of her efforts, 1,500 acres that were mapped as 3 different map units are now coordinated into delineations of just 1 map unit that extends across 4 counties in a seamless fashion.

Having spent four days and three nights on travel and in the field, Rebecca drives back to the office and reconnects her computer. The computer automatically transfers the edited data to a transactional national soil survey geodatabase and sends an email to Carlos the MLRA Soil Survey Leader. Carlos will perform a quality review of Rebecca's and other crew members edits the following week. Two times per year (in April and October) Juan meets with the State Soil Scientist and MO office staff to review and approve these edits. Once these edits are approved the changes are committed to the soil data mart and are automatically made available to the Web Soil Survey.

**What follows is a story of how a resource soil scientist operates in "The New Soil Survey".**

Bob Took, District Conservationist in Elk County, calls about a precision farming project. A young farmer had purchased a farm a few years back and has been row cropping an area along the Bear River. Having graduated from the State University with a degree in Agriculture, he has a deep interest in precision farming. With assistance from the Agricultural Extension Service, the local farm supply distributor, and the NRCS District Conservationist, he has gathered considerable geo-referenced production data for the site. Together with help from local agricultural representatives, he hopes to establish a demonstration farm for vegetable production. But a large area located on a low stream terrace in the bend of the river appears to have soil problems. According to the data, the fertility level is there, but the yields just don't match those of other areas mapped as the same soil. Much of the farm is under pivot irrigation. When irrigation is applied or during periods of above normal rainfall, problems with wetness occur even though soil survey data indicate that this is a well drained soil with good permeability. They suspect some physical problem with the soil. Since it is important to the farmer to have this area in production if possible, my help is being requested in evaluating the properties of this soil and to provide input for practices to overcome soil limitations. A day is scheduled to meet as a team to evaluate the site.

The soil survey of Elk County has been done for almost fifty years now. The MLRA Project Office Staff are doing some maintenance work in Elk and adjoining counties, but on a different physiographic area that they have defined and prioritized for study. They have separated a spatial dataset and a NASIS dataset out to do this maintenance work and will amend the official County SSURGO and NASIS datasets with these newer data once the work in this physiographic study area is completed and re-correlated. The older soils mapping for the area in question is digitized, but it is outside of their current study area, and has had only minor NASIS data revisions and no correlation amendments done since the original survey was correlated.

I had seen areas of this soil in other parts of the county and it usually is a deep, well drained, loamy soil. However, I had observed in some places, that there were areas included that have a restrictive layer. Generally, this layer is fairly deep. I remembered a devastating flood event that occurred about twenty years ago along this river. That led me to think that, perhaps scouring and deposition may have occurred. I had seen it in other areas along the river. Could this be the case on this farm?

I begin assembling information about the area. I import the soil layer from Soil Data Mart, download ortho-imagery, and import and create fertility and productivity layers from soil sample and yield monitor data that were collected and geo-referenced by the farmer and other members of agencies involved with the project. Other geo-spatial data and hyper-spectral imagery are downloaded for terrain, soil, and vegetative analysis. I obtain historic stream gage data for the river from USGS, as well as rainfall data from the climate database. From these data, I am able to determine the flood intensity and elevation, and the extent of the flooding event that occurred years ago. I create data layers from these data sources and merge the layers in ArcGIS for analysis.

Now a picture begins to emerge. From these data, I can see a portion of this site consistently showing signatures different from other areas having characteristics I would normally expect of soils mapped on these landforms. I download these data to my tablet computer and am now ready to visit the field.

I arrive at the farm. I'm greeted by the farmer, Jon Jonson. We are joined by the District Conservationist, Sue Kelly from the Extension Service and Paul Rad from State University. I explain what I think might be the case and we proceed to the field. By visually observing where we are on the terrain and using GPS to reference our position in relation to GIS imagery and layers on my tablet PC, we quickly locate the problem area.

We begin by observing layers in the soil. We don't need to dig far. We soon encounter a very slowly permeable layer. Perhaps I may be right about the problem and the events that caused it.

I am somewhat relieved. We all remember that event sometime early in our careers when we announced with some pride, usually during some field review with plenty of folks present, what soil characteristic we expected to see at a site only to be proven wrong when some person produced a sharpshooter and began to dig.

The team continues evaluating the site. Further observations indicate the presence of the restrictive layer over most of the problem area. Observations reveal isolated thin layers of sand and gravel over the very slowly permeable restrictive layer in places. Observations on adjacent areas prove to be within the ranges in characteristics for the mapped soil type. Notes on observations are recorded and geo-referenced using the Pedon Program on a tablet computer. Digital photographs are taken of some soil profiles to link to the site descriptions.

The history of this area begins to emerge. Scouring caused by the flood event appears to have removed the topsoil down to the more resistant layer. Evidently, some land leveling had occurred after the flooding, and there is a significant discontinuity between the loamy topsoil material and the underlying restrictive layer. Machinery apparently had added to the problem during reclamation operations by further compacting and sealing the layer, then smoothing sandy and gravelly material deposited from sources upstream over the layer, and finally leveling the site with better loamy soil material from adjacent areas. Subsequent tillage operations had combined and blended the surface layer so that the limitation could not be readily detected without observing the soil profiles.

Analysis of the subsurface morphometry by ground penetrating radar shows that the top of the restrictive layer forms a slightly concave feature. This feature was most probably caused by scouring during the flood event, but land leveling and subsequent tillage operations left no indication of the underlying water-receiving morphometry. The area is acting as a subsurface reservoir by holding water during periods of rainfall and irrigation, and it dewaters slowly, mainly by evapotranspiration. Mapping of the farm continues and is soon completed. The manner and extent of the soil limitation here has been discovered and documented in a matter of a few hours. In the past, it would have taken perhaps days of surveying a grid, transecting and making many more soil observations and notes in the area.

Its late afternoon, and I'm on my way back to the office. The pivot irrigation system is in bad shape and I think the farmer really is considering an irrigation system that will be more efficient for vegetable production. Our NRCS Engineer and the District Conservationist will design a system to help resolve the wetness problem at the site. Together with the Extension Agent, they will also provide information to help the farmer customize a cropping plan for the site that will produce vegetables best suited to the site conditions.

Tomorrow, I'll flag this area on a copy of the official SSURGO data that is maintained on a shared server for the State. Using ArcGIS tools, I can attach notes to the spatial data about the soil properties found here, and place tentative lines on the soils layer to document what we discovered in this mapping delineation. I'll upload the pedon descriptions and photographs we collected to a copy of the Pedon PC that is on a shared drive at the MLRA Project Office. I will also add a correlation note in the Mapunit text table in NASIS to record that this may tend to be a common minor component in the mapunit along these parts of the river. I'll use the information I stored in these databases to generate my written report. The MLRA Project Staff will review and use the data I stored in these databases when they begin to do intensive study and maintenance work in this Physiographic area.

It's been a good day!