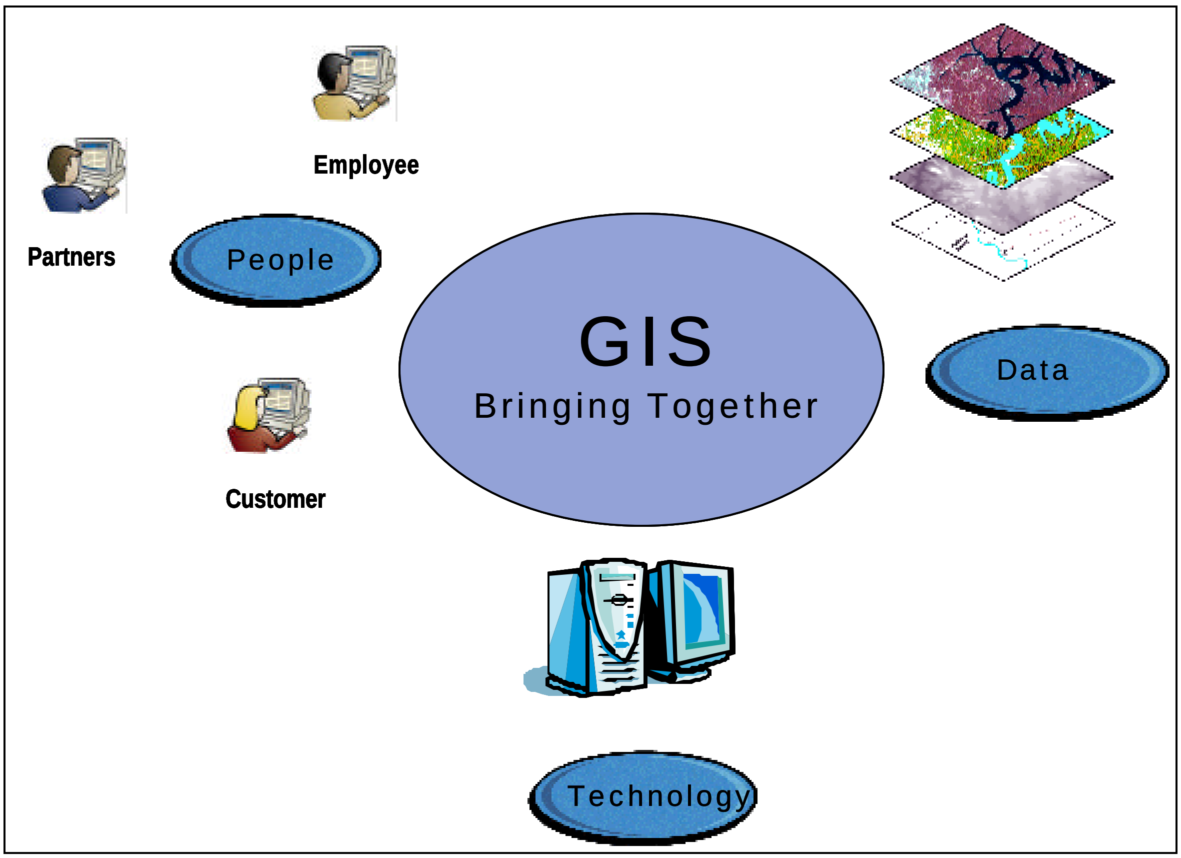
Farm Service Agency
Natural Resources Conservation Service
Rural Development

USDA Service Center Agencies
Geographic Information System (GIS) Strategy



December 2001

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EXECUTIVE SUMMARY

In September 2001, USDA released a document entitled *Food and Agriculture Policy – Taking Stock of the New Century* [1]. That document characterizes the current agriculture system in the U.S. and provides a vision for the future. In the section on Integrated Programs, that document describes emerging technologies such as Geographic Information Systems (GIS) and the impact it will have on USDA and the agriculture community. The USDA Service Center Agencies (SCAs), which include Farm Service Agency (FSA), Natural Resources Conservation Service (NRCS), and Rural Development (RD) have been, and will continue to be key USDA leaders in implementing the vision outlined in this document. USDA SCAs are also providing key leadership to the Office of Management and Budget (OMB) Geospatial Data One-Stop Initiative that has a goal of making all federal, state and local geospatial data Internet accessible. Both the Food and Agriculture Policy and Geospatial Data One-Stop Initiative point to the growing recognition of the importance of GIS. No other technology integrates, synthesizes, and displays complex agricultural information and relationships as completely or intuitively as GIS. GIS brings together people, data, and technology to support better decision making.

Early analysis of GIS in the Service Center Modernization Initiative business case documented the expected benefits of GIS. In this business case GIS implementation accounted for over 34 percent (or $168 million) of the annual savings that were possible through business process reengineering. Subsequent piloting proved that these benefits were achievable, and in fact identified other areas where additional savings could be achieved. A very recent reevaluation of our business case for GIS implementation reconfirmed these results and documented a payback year of 2005.

The SCAs have been steadily developing and implementing a coordinated GIS infrastructure since 1995. This GIS system includes the hardware (computers, printers, plotters and Global Positioning Systems) and software of the SCA's Common Computing Environment (CCE). The hardware component will be largely complete by the end of fiscal year 2002. The SCAs recently lead the effort to acquire GIS software for all of USDA; thus much of the Information Technology infrastructure needed to support GIS has been acquired and is being installed. The system includes data, and the SCAs have developed a large number of digital maps such as soil survey, orthoimagery, common land unit, and others that will be used both internal to USDA and by the wide range of customers USDA supports. Often the SCAs have worked closely with partners to develop these necessary data. They have developed data centers and data warehouses for these data, with online access. The system includes people such as employees, partners, and customers. The SCAs have developed a number of business applications that support each of these groups. They have also initiated training in GIS for a large segment of their employees. Given this considerable progress over the last seven years, much work still remains.

Major challenges remain in the creation and sharing of data. The cost of data conversion, or digitizing paper maps, and data acquisition accounts for approximately forty to sixty percent of the total GIS implementation cost. SCAs must move aggressively to digitize the remaining ninety percent of the Common Land Unit (CLU) or farm field boundaries. The CLU is a key component of the data infrastructure, without which most of the FSA and many of the NRCS programs cannot fully modernize. CLU is also critical to many other federal, state, and local government agencies' GIS systems, and may be even more critical to landowners and producers. For landowners and producers who are striving to become more efficient, the CLU will provide the infrastructure for improved farm records management including yield monitoring, nutrient and pest management, and many other activities. However, FSA has no funds available to contract for CLU development in FY 2002, so progress will continue to be slow. SCAs must also move aggressively to complete digitizing the remaining fifty percent of the Soil Surveys of the U.S. This critical theme underpins most of the programs in NRCS and many in FSA and RD, and through the National Cooperative Soil Survey (NCSS) provides similar support to other federal, state, and local agencies with nearly any issue related to the land. The SCAs have and will continue to be very active participants in the Federal Geographic Data Committee standards setting process and in the OMB I-Team efforts to coordinate data development across all levels of government. OMB is closely scrutinizing agency budgets to insure that geospatial data are collected according to FGDC standards and made available.

In addition, SCAs must improve and expand partnerships with the public and private sector in order to ensure that all data are sharable. They must continue to ensure that security and privacy requirements are met, especially as more business applications are migrated to the Internet. Much work remains to be done to achieve our vision of nationwide seamless geospatial data that are available to everyone.

Finally, SCAs must accelerate efforts in training both employees and customers. Success in implementing GIS will depend largely on how well staffs are trained. The wide range of knowledge, skills, and abilities of our employees make training challenging. A one-size-fits-all approach will not be successful. In addition, the SCAs differ widely in the range of programs they deliver, thus training must be provided in completing business process using GIS, rather than in GIS technology.

In summary, GIS in many ways is the future and the SCAs recognize this reality. Significant progress has been made. The focus for the next three years must be on data development, delivery and training. GIS will be crucial as the SCAs move to provide online services to their customers over the next three years. The SCAs hold a unique position in rural America, and have an opportunity to use GIS to bring together employees, customers, partners, data, and technology to improve our natural resources, rural communities, and support increased efficiencies and improved competitiveness in agriculture sector.

LIST OF ACRONYMS

AGDC .... Agriculture Geographic Data Committee
APFO........................ Aerial Photography Field Office
ARS .... Agricultural Research Service
BCR.......................... Benefit Cost Ratio
BLM .... Bureau of Land Management
BOC.......................... Bureau of Census
BPR.......................... Business Process Reengineering
CAD .... Computer Aided Design
CCC.......................... Commodity Credit Corporation
CCE.......................... Common Computing Environment
CD-ROM.................. Compact Disc Read-Only Memory
CORA....................... Climate Observations in Rural America
CLU .... Common Land Unit
CRP.......................... Conservation Reserve Program
CST .... Customer Service Toolkit
DAIC .... Data Acquisition and Integration Center
DBMS .... Database Management Systems
DEMs........................ Digital Elevation Models
DOQ .... Digital Orthophoto Quadrangle
DOT.......................... Department of Transportation
DRG .... Digital Raster Graphics
DVD .... Digital Video Disk
EAI............................ Electronic Access Initiative
EPA .... Environmental Protection Agency
EQIP .... Environmental Quality Incentives Program
ESRI......................... Environmental Systems Research Institute
FAC .... Food and Agricultural Council
FAQ .... Frequently Asked Questions
FAS .... Foreign Agricultural Service
FEMA .... Federal Emergency Management Agency
FGDC .... Federal Geographic Data Committee
FISs .... Flood Insurance Studies
FOIA .... Freedom of Information Act
FPP .... Farmland Protection Program
FS............................. Forest Service
FSA .... Farm Service Agency
FTEs......................... Full-time Equivalents
FWS .... Fish and Wildlife Service
FY............................. Fiscal Year
GCBD....................... Geographic Coordinate Data Base
GIS .... Geographic Information System
GNIS .... Geographic Names Information System
GPRA .... Government Performance Results Act
GPS.......................... Global Positioning System
HEL .... Highly Erodible Land
HR .... Human Resources
IDP............................ Individual Development Plan
IFSAR .... Interferometric Synthetic Aperture Radar

LIST OF ACRONYMS

IRR	Internal Rate of Return
IT	Information Technology
ITC	Information Technology Center
KCMO	Kansas City Management Office
LAN	Local Area Network
MLRA	Major Land Resource Area
NACo	National Association of Counties
NACD	National Association of Conservation Districts
NAPP	National Aerial Photography Program
NARC&DC	National Association of Resource Conservation and Development Councils
NASCA	National Association of State Conservation Agencies
NCGC	National Cartographic and Geospatial Center
NCSS	National Cooperative Soil Survey
NED	National Elevation Dataset
NDEP	National Digital Elevation Program
NDOP	National Digital Orthophotography Program
NFIP	National Flood Insurance Program
NHD	National Hydrology Dataset
NILS	National Integrated Land System
NID	National Inventory of Dams
NLCD	National Land Cover Dataset
NMAS	National Map Accuracy Standard
NPR	National Performance Review
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NSDI	National Spatial Data Infrastructure
NSGIC	National States Geographic Information Council
NWI	National Wetland Inventory
NWS	National Weather Service
OCE/WAOB	Office of the Chief Economist/World Agricultural Outlook Board
OGC	Open GIS Consortium
OIP	Office Information Profile
OLAP	Online Analytical Processing
OMB	Office of Management and Budget
PDAs	Personal Digital Assistants
PLSS	Public Land Survey System
PRISM	Parameter-elevation Regressions on Independent Slopes Model
RC&D	Resource Conservation and Development
RD	Rural Development
RMA	Risk Management Agency
SCAN	Soil Climate Analysis Network
SCAs	Service Center Agencies
SCIMS	Service Center Information Management System
SCMI	Service Center Modernization Initiative
SNOTEL	Snowpack Telemetry
SSURGO	Soil Survey Geographic Database
UCAN	Unified Climate Access Network

LIST OF ACRONYMS

USACE..................... United States Army Corps of Engineers
USDA .... United States Department of Agriculture
USGS .... United States Geological Survey
WAN......................... Wide Area Network
WRP......................... Wetlands Reserve Program

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1.0 Introduction

The Service Center Geographic Information System (GIS) Strategy was first published in August 1998. Since that time, progress has been made within the three Service Center Agencies (SCAs) across USDA and in the geospatial community as a whole. In 1998, the primary legislative motivation for development of the strategy was the USDA Reorganization Act of 1994 and the Service Center Modernization Initiative (SCMI). Over the last three years, additional legislation has been identified, further driving the need for technology and cooperation at the field level to assist in delivery of USDA services. Some of the legislative drivers are:

- OMB Circular A-16 (coordination of spatial data) 1991 (revised July 2001)
- Executive Order 12906 (Coordinating Geographic Data Acquisition and Access: The National Spatial Data Infrastructure) 1994
- The Paperwork Reduction Act of 1995
- The National Technology Transfer and Advancement Act of 1995
- Executive Order 12951 (Release of Imagery Acquired by Space-Based National Intelligence Reconnaissance Systems) 1995
- The Clinger-Cohen Act of 1996
- The Freedom of Information Act (FOIA) and the Electronic Freedom of Information Act Amendments of 1996
- The Government Paperwork Elimination Act (GPEA) of 1999
- The Government Information Security Act of 1999
- Rehabilitation Act, Section 508, Electronic And Information Technology, 1999
- The Federal Records Act
- OMB Circular A-130 (Management of Federal Information Resources)
- The Stafford Act, 2000
- Freedom to E-file Act of 2000
- Farm Bill 2002

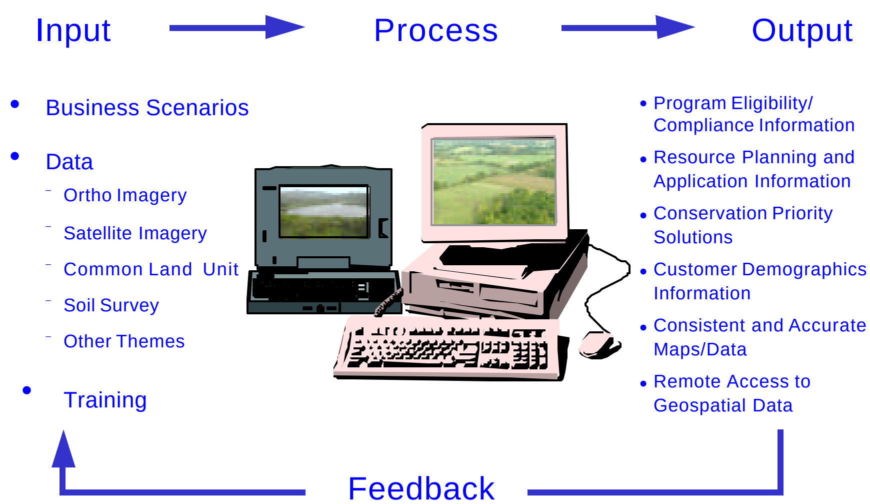
As stated in the 1998 strategy document,

> “GIS will most directly benefit four core business areas: (1) Farm and Community Programs, (2) Eligibility/Compliance, (3) Conservation, and (4) Resource Inventory and Assessment.” However, over the last several years, applications outside of these areas have increased exponentially and positive impacts can be seen in less anticipated areas using GIS, such as strategic planning, performance goal monitoring and workforce planning.

GIS is a comprehensive set of software tools for the analysis of spatial data and associated tabular attributes. When efficiently implemented within an organization, the technology can revolutionize business practices, resulting in increased productivity, increased data sharing, enhanced customer satisfaction, increased levels of creativity among employees, and increased agency compliance with legislative mandates. The technology demands a high degree of coordination between telecommunications, hardware, software, and data development efforts to support business processes at the field level.

The SCAs and GIS are a natural fit because of our strong technical and cultural reliance on spatial data, such as maps and aerial photography. Though GIS supports the generation of high quality, timely, and accurate products, it affords several other advantages over traditional cartographic techniques. For example, analysis of county datasets having a specific soil type might take several days or weeks when done by hand. Using existing digital soil data and GIS, the same analysis may take minutes. Not only does the analysis take a shorter amount of time, slight modifications can be made immediately to meet customer demand, generate alternative development strategies, and transfer map products to users. Exhibit 1-1 illustrates the interaction between the output and input processes in GIS operations.

SERVICE CENTER OPERATIONS WITH GIS
Exhibit 1-1



The Service Center GIS System enables the sharing of technology and data to support the following programs and activities:

- Determine program eligibility and compliance by providing GIS access to common land unit (CLU) information and other common customer data
- Provide a comprehensive conservation options analysis for landowners and communities
- Provide environmental assessments for loan and grant programs
- Identify areas where service center programs have been applied
- Facilitate partner agency business coordination
- Assess natural resource status and trends more accurately
- Provide access to framework data (e.g., common land unit, imagery, streams, roads, political boundaries, etc.)
- Provide access to natural resource data (e.g., soil, vegetation, climate, wetlands, watershed boundaries, flood hazard areas, etc.)
- Identify priority areas more accurately
- Identify customer-base demographics and under-served areas
- Identify disaster and risk areas quickly and accurately
- Improve customer service

- Reduce agency workload
- Report program application results more accurately

Throughout this document, reference is made to Service Centers, which are the actual offices that are the principle providers of service to customers at the field level. However, these are not the only offices using or needing GIS technology. These offices are supported by an infrastructure of data collectors, producers and developers and support personal, having direct access to GIS tools. Other offices and units in the Service Center structure using GIS include RC&D, Service Centers, Soil Survey Project, Centers, Institutes, State Offices, Regional Offices, and National Headquarters, as well as Digitizing and Map Finishing units.

Coordination within USDA and among federal agencies continues to enhance the availability of data, facilitate data access, standardize quality, and generate a larger and more robust user community. While the Federal Geographic Data Committee (FGDC) continues to focus predominantly on standards development within the federal community, the Office of Management and Budget (OMB), with assistance from FGDC, has begun to facilitate local data development and maintenance efforts. Referred to as I-Teams, FGDC and OMB are working with local, state, and municipal partners to identify and generate needed datasets for a variety of applications. With increased visibility and support from OMB, I-Teams and state GIS consortiums will be better able to leverage financial and human resources, while developing data strategy plans addressing local needs. Consortium-generated detailed datasets will then feed into the National Spatial Data Infrastructure (NSDI), allowing access and use by the entire geospatial data community. The SCAs continue to be active participants and a key partner in supporting these OMB and FGDC efforts.

Continuous progress has been made since 1998 to build a business case and gain management support for the integration of GIS into the SCAs. Accomplishments include:

- GIS software suite recommendation for Service Centers, 1999
- 2,800 licenses for GIS software at the Service Centers, 2000
- Completed an enterprise buy of ESRI software products for USDA in August 2001
- Deployment of common hardware platforms for GIS use
- Installation of LAN/WAN technology in all field offices, with upgrades planned for FY02
- USDA Department-level recognition of the value of geodata and GIS technology in supporting USDA programs, and the development of a USDA Geodata Business Plan
- Continuation of the Agriculture Geographic Data Committee (AGDC)
- Creation of a series of USDA standards for the development and use of geospatial data
- Participation in the OMB I-teams effort
- Update of OMB circular A-16 to reflect the development and maintenance of the NSDI and expanded role of the federal agencies in data coordination efforts
- Continued federal partnerships between USDA and others related to data development and delivery
- Development of a geospatial data portal from which customers can download data

- Establishment of Soil Survey Geographic Database (SSURGO) digitizing centers and development of customized tools to conduct quality control and maintain layers
- Establishment of CLU digitizing centers and development of customized tools to delineate and maintain the CLU data layer
- Development of a process for digital compliance
- Deployment of the NRCS Customer Service Toolkit (CST) and Wetlands and Easements Toolkits for use at the field office
- Digital Orthophoto Quadrangle (DOQ) coverage available for ninety nine percent of the conterminous U.S.
- Development of seamless county DOQ coverage for high priority areas in the U.S.
- Digital Soil Survey coverage for fifty percent of the nation
- CLU coverage for ten percent of the nation
- Development and delivery of CST, CLU, and ESRI ArcView software training to state and field office staff, and increased training for field staff in the use of GIS technology

The strategy outlined in this document is intended to reaffirm our need and commitment to GIS as a means for enhanced customer service. This document presents a high-level overview of accomplishments, progress, and intended direction over the next several years. Much of the information contained within has been extracted from existing documentation; a full bibliography is presented in Section 8 for further reference.

2.0 Business Requirements for GIS

The SCAs are following a business-driven approach to implementing GIS. Starting in the early 1990's, the SCAs began acquiring digital orthoimagery to satisfy the NRCS Soil Survey Program need for a base map for digitizing soil surveys. About the same time FSA began using digital orthoimagery for digitizing farm field boundaries. In 1996, as part of the Service Center Modernization Initiative (SCMI), the SCAs identified key business processes that could be reengineered or improved with GIS technology (*USDA Geospatial BPR Report 8/97*[2]). The SCAs developed a business case in 1997 (*USDA Service Center Business Process Reengineering Business Case 9/97*[3]) to support this implementation. During 1997 to 2001, the SCAs piloted several GIS-enabled business applications in Service Center pilot sites. Based on the successful results of this piloting and the availability of data, they purchased approximately 2,300 ArcView GIS licenses at the end of FY2000 and began integrating GIS and customized business applications into daily activities. The Customer Service Toolkit (CST) is one such application, providing a customized interface for non-GIS professionals'. The Service Center Information Management System (SCIMS) application is another example. Users of SCIMS have access to tools to manage and access cooperator files including name and address. Farm field boundaries (CLU), cropping records that support eligibility, compliance, and conservation activities will be integrated in stages. Other tools continue to be developed that support program needs in each agency; for example, Rural Development Agencies are developing a GIS tool for environmental assessments.

The three SCAs vary in their missions; however, a common thread is the need to integrate technology into the daily business process. By implementing technology, offices expedite customer requests, share data, generate high quality products, meet legislative mandates, and develop a skilled workforce able to address sophisticated resources issues. Each USDA mission area has core business processes that define the high-level activities performed by the agency. Each core process is directly linked to strategic goals, objectives, and productivity indicators at the Service Center level. Consequently, implementation of GIS in the agencies will support the agencies' core processes.

Within the SCAs, GIS is being implemented as data, software, hardware, and other resources become available. This implementation strategy is not unlike that being undertaken by state and local governments. According to the *April 1998 edition of GIS World* [4], 40 percent of local governments surveyed in 1992 were using GIS; in 1997, 87 percent of local governments surveyed were or would soon be using GIS. Additionally, the *2000 E-Government Survey Conducted by the National Association of Counties* [5] indicated that 39 percent of the counties responding planned to implement web mapping and GIS in the near future. In the same survey, 23 percent of the counties planned to allow citizens to register to vote on line, 28 percent to pay property tax, and 23 percent to apply for building permits – all online. It is worth noting that each of these applications, though captured separately from GIS, require some spatial referencing component to be fully implemented. Consequently, USDA SCAs are conducting business in an increasingly digital and spatially-enabled world. To meet the needs of our customers, we must embed GIS seamlessly into our daily business practices and develop a knowledgeable workforce.

2.1 Business Case

The SCAs began documenting the benefits of GIS in 1997 in the USDA Geospatial Business Process Reengineering (BPR) Report. This early report listed the following benefits:

- Ability to use geospatial information to make informed business decisions,
- Access to geospatial information by all agencies simultaneously,
- Access to a common base map that is jointly managed,
- Elimination of redundant work and data, resulting in reduced service center workload, and
- Improved map quality.

Additionally, agencies will:

- Have an increasingly knowledgeable workforce able to communicate with a wider customer base,
- Be able to conduct data analysis and integrate data for program support that previously was not possible,
- Access and use data from other federal, state, and local partners that would not have been considered in the past because of quality and time constraints,
- Develop customized applications to allow a wider range of staff expertise to support the conservation planning effort, and
- Capture geographically-linked trending data to support strategic planning and evaluation needs and determine program effectiveness.

The USDA Service Center BPR Business Case documented cost savings to the SCAs. Exhibit 2-1 presents the estimated annual savings of conducting business operations with enabling GIS technology based on this document.

ANNUAL SAVINGS FROM GIS USAGE
Exhibit 2.1

Activity	Annual Savings (in millions)
DETERMINE ELIGIBILITY	
Determine Area	$14.8
Determine Cropping History	$16.1
Determine Land Eligibility	$34.5
DEVELOP PLAN	
Complete Onsite Inspection	$11.5
Develop Schedule of Application	$27.1
PREPARE/APPROVE CONTRACT	
Process AD 245	$1.8
Provide NRCS with AD 862	$1.7
Perform Onsite Inspection	$5.6
Complete AD 862	$3.5
MONITOR COMPLIANCE	
Perform Status Review (NRCS)	$6.4
Notify FSA	$2.1

Activity	Annual Savings (in millions)
Manipulate Spatial Data	$38.1
Perform Damage Assessment	$1.8
Process FOIAs	$3.5
Committee Elections (15% of Service Centers)	$0.4
Total Annual Savings	$168.9

In 2001, NRCS contracted with the Science Applications International Corporation to identify geospatial information architecture options and the associated cost benefit to the SCAs for each option. This report, entitled *Requirements and Cost Benefit Analysis, Managing Geospatial Data for Better Program Delivery, A Service Center Initiative, NRCS/SAIC 2001*[(6)] built on the original 1997 business case, but included more information based on the SCAs up-to-date information on costs and benefits. This study also looked at these costs in relation to four different architectures or methods for GIS implementation. A cost-benefit analysis was calculated for each of these architectures using a 10-year period, fiscal years 2001 to 2010. Exhibit 2.2 summarizes and compares the current architecture with three proposed architectures. It lists the percent of the business requirements that each architecture meets, the costs and benefits in millions of dollars, the benefit-cost ratio (BCR), internal rate of return (IRR), and the payback year.

GIS ARCHITECTURE ALTERNATIVES AND BENEFIT-COST
Exhibit 2.2

Alternative	Business Req.	Cost	Benefit	BCR	IRR	Payback Year
As-Is	25%	$196	$135	-	-	-
Distributed	83%	$814	$1,351	1.97	86%	2004
Centralized	80%	$1,197	$1,156.5	1.02	6%	2010
Mixed	100%	$1,237	$1,540	1.35	49%	2005

The “distributed” alternative implements GIS at the local Service Center level, including the required hardware, software, and data. This alternative has lower telecommunications cost than the centralized alternative, which implements most GIS applications and data in a few central offices that are accessed via the Internet by Service Centers. The “mixed” alternative, as its name implies, is a combination of the first two.

Based on the cost-benefit analysis, the investment in either the distributed or mixed alternative will greatly benefit the SCAs. However, the monetary benefit of the distributed alternative is significantly superior. The mixed alternative is technically superior as it allows selective exploitation of the advantages found in both the central and distributed. The centralized alternative is consistently the third and least desirable choice.

As is clearly indicated from the above exhibits, an investment in GIS using any of the alternatives benefits the SCAs. All these savings come from reduced labor cost. They do not consider non-quantifiable benefits such as increased quality and service to customers, and secondary benefits to non-SCAs that will realize their own reduced labor cost by having free access to the SCA data.

Exhibit 2.3 shows the cost in millions associated with each of the four alternatives and the percent of the cost for each item. The estimated costs of satellite data were included in the data costs in this study and are included under the data item in Exhibit 2.3. These costs are not included in data costs later in this report because of the uncertainty of the estimate.

GIS Costs
Exhibit 2.3

	Centralized		**Distributed**		**Mixed**		**As-Is**	
ITEM	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent
Personnel	$177	15%	$182	22%	$180	15%	$15	8%
Hardware	$78	7%	$111	14%	$121	10%	$0	0%
Software	$46	4%	$46	6%	$46	4%	$38	19%
Training	$89	7%	$89	11%	$89	7%	$9	4%
Data	$405	34%	$405	50%	$405	33%	$115	59%
App. Dev.	$78	6%	$78	10%	$78	6%	$6	3%
Telecom	$494	41%	$0	0%	$494	40%	$0	0%
Misc.	$0	0%	$0	0%	$0	0%	$20	10%
Total	$1,197		$814		$1,237		$196	

The SCAs are implementing a mixed architecture. In this architecture most of the NRCS and FSA GIS applications and data are being implemented in a distributed architecture on Service Center personal computers and servers. NRCS and RD are also developing and implementing some limited GIS applications and data in central locations. It is likely that as telecommunications capacity increases and cost decrease, and as Internet GIS technology matures, more applications will be developed for a centralized architecture.

3.0 Data Requirements and Development Strategies

Today, even with the advances mentioned previously, most Service Centers record and maintain geospatial information manually on hardcopy paper maps. In some cases these products are more than ten years old and contain pen and ink changes in land use, management practices, and installation of conservation practices. The continuous use of a single spatial product results in degradation and loss of critical historical data and possible misinterpretation. Sharing hardcopy information between agencies becomes increasingly difficult as changes occur and source materials degrade over time.

There are several negative consequences to using hardcopy maps and photos and documenting changes on these spatial products:

- Customers and partners will receive inconsistent information from SCAs, leading to potential misuse of information.
- SCAs will find it increasingly difficult to sustain staffing levels to meet program requirements and legislated mandates as more staff years are consumed by simple but time-intensive tasks.
- For certain services, customers must continue to visit the Service Center where source photography and maps are stored.
- Data sharing among SCAs will remain limited and SCAs will collect duplicate and redundant data to support individual agency needs and programs.
- SCAs will find it increasingly difficult to cooperate with other federal agencies since data are not consistently formatted, available, or maintained in a timely fashion.
- Customers will rely less on agency data and expertise and rely increasingly on third-party vendors for services to meet their basic analysis requirements.
- Natural resource data will continue to be broken down by artificial political boundaries, resulting in the inability to integrate large datasets for wide-area natural resource planning and modeling efforts.
- Third-party, for-profit entities will generate digital renditions of USDA products, which may not meet our specifications or may misrepresent the intended use of the product. Ultimately the consumer will pay the price by not having free and open access to the data or by making poor decisions based in inadequate information.

Exhibit 3-1 presents examples of geospatial information used by some agency programs. This is not a complete list of programs or data.

GEOSPATIAL DATA USAGE
Exhibit 3-1

Programs	EXAMPLES – Geospatial Data							
	Soils	Land Units	Wetlands	Tracts	Easements	Conservation Practice Location	Conservation Priority Areas	Watershed Boundaries
Agricultural Market Transition Act Payments	X	X	X	X				
Boll Weevil Eradication Program		X	X	X		X	X	
Business and Industry Direct Loan Program	X	X	X		X	X	X	
Business and Industry Guaranteed Loans		X	X		X	X	X	
Colorado River Basin Salinity Control Program`	X					X	X	X
Commodity Loans and Loan Deficiency Payments	X	X		X				
Commodity Warehouse Activities								
Community Facilities Loans and Loan Guarantees	X		X	X	X			X
Conservation Farm Option	X	X	X	X				
Conservation Reserve Program	X	X	X	X	X	X	X	X
Cooperative Services		X	X	X	X	X	X	
Crop Insurance	X	X	X	X	X	X	X	X
Dairy Indemnity Payment Program		X		X				
Dairy Refund Payment Program		X		X				
Emergency Conservation Program	X	X	X	X		X	X	X
Emergency Watershed Protection Program	X	X	X	X	X	X	X	X
Environmental Programs	X	X	X	X		X	X	X
Environmental Quality Incentives Program	X	X	X	X		X	X	X
Farm Loan Programs	X	X	X	X	X	X	X	X
Farmland Protection Program	X	X	X	X				X
Flood Risk Reduction Program	X	X	X	X	X	X	X	X
Forestry Incentive Program	X	X	X	X		X	X	X
Grazing Lands Conservation Initiative	X	X	X	X		X	X	X
Great Plains Conservation Program	X	X	X	X		X	X	X
Highly Erodible Land Conservation	X	X	X	X		X	X	
Home Improvement and Repair Grants and Loans				X	X			
Housing Repair – 504				X	X			
Intermediary Re lending Program Loans								
Noninsured Crop Disaster Assistance Program	X	X	X	X	X			X
Outreach and Assistance for Socially Disadvantaged Farmers and Ranchers	X	X	X	X	X	X	X	X
Plant Material Centers	X							
Rental Assistance				X				
Resource Conservation and Development Program	X	X	X	X		X	X	X
Rural Cooperative Development Grants	X							

Rural Economic Development Loans and Grants	X		X	X				X
Rural Housing – 502	X		X	X	X			
Snow Survey and Water Supply Forecasts						X	X	X
Soil Surveys	X	X	X	X		X	X	
Stewardship Incentive Program	X	X	X	X				
Sugar Program	X	X		X				
Tobacco and Peanut Price Support and Production Control Program		X		X				
Water Bank Program		X	X	X	X			
Water Resources Assistance (Watersheds, Surveys, and Planning, and the Watershed and Flood Prevention Operations Program)	X		X			X	X	X
Watershed Operations and Small Watersheds	X	X	X	X		X	X	X
Wetland Conservation	X	X	X	X	X	X	X	X
Wetlands Reserve Program	X	X	X	X	X	X	X	X
Wildlife Habitat Incentives Program	X	X	X	X	X	X	X	X

Historically, data deemed critical to the management of legislated programs have been generated internally. For example, the location of streams and drainage areas is often captured during the soil mapping process and used both in the interpretation of soil maps and for watershed planning. In turn, this information is useful to other agencies for program support applications. Exhibit 3-2 summarizes the common thematic spatial layers of use to the SCAs. This exhibit is from the *USDA Geodata Business Plan* [(7)]. This plan was developed to identify common data requirements and investments across USDA, and highlight opportunities for collaborative data development within USDA and the need for common standards of data collection and maintenance.

GEOSPATIAL DATA REQUIREMENTS
Exhibit 3-2

Theme	FSA*	NRCS*	RD*
Aerial Photography	P	P	
Air Quality Control Regions			U
Aquifers (sole source recharge areas)		U	U
Cadastral (Public Land Survey)	R	U	R
Cellular Communications Network			U
Census (Agriculture)	U	U	U
Census (U.S.)	U	U	R
Climate (ppt, temp, ggd, etc.)	R	P	U
Coastal Barrier Resources		U	R
Coastal Zone Management Areas		U	R
Common Land Unit	P	P	U
Compliance Slides - Digital 35 mm	P	U	
Crop Models	P	U	
Cultural Resources	R	P	R
Ecological Regions	U	P	
Elevation	U	R	U
Environmental Easements	R	P	R
ERS Farm Resource Regions		U	
Flood Hazard	U	P	R
Geographic Names Information System	U	U	U
Geology		U	R
Government Units (local, state, federal)	U	U	R
Hazardous Waste Sites	U	U	R
Hydrography	U	P	U
Hydrologic Units (8, 12, 14)	U	P	
Land Use/Land Cover (Cropland, Rangeland, Forestland, etc.)	P	P	R
Major Land Resource Areas		P	U
Map Indexes	P	U	U
Orthoimagery	P	P	R
Postal Zip Codes	U	U	U
Prime & Important Farm, Forest and Rangeland	U	P	R
Research Site Data (georeferenced)		P	
Rural- Urban County and Census Tract Typologies	U	U	U
Satellite Imagery	R	R	
Soil Survey Inventories & Interpretations, Properties, Productivity	R	P	R
Topographic Images (DRG's)	U	U	U
Transportation	U	R	R
Utilities and Utility Easements		U	U
Vegetation (PNV)	U	U	
Water Control Infrastructure	U	P	U
Wetlands	P	P	R
Wild and Scenic Rivers	R	U	U
Wildlife (Endangered Species) Habitat	U	R	R
Zoning			R

*(P = Producer, U = User, R = Required)

3.1 Critical Service Center Agency Data Themes

Using GIS to conduct Service Center business depends on many factors; the availability of accurate geospatial information is one of the most critical. This strategy identifies 21 data themes useful in administering programs and meeting customer needs. Not all of these themes are needed by all SCAs since resource concerns, available data, and customer needs vary geographically. The SCAs have identified four data themes critical to their business needs: orthoimagery, soils, common land unit (CLU), and demographics. The coincidence of these four layers in any one county or service area will enable the three agencies to take full advantage of existing software applications and GIS tools. Presently, several hundred counties have these datasets, the required software, and hardware and staffing, enabling them to use reengineered business practices. Counties lacking one or more of the critical layers are able to conduct analysis, but the capacity to take full advantage of all software capabilities is limited by the lack of data.

The following sections detail the benefits of implementing specific geodata themes to support USDA programs.

3.1.1 Orthoimagery

Orthoimagery is a photographic image of a geographic area taken from the air and that has had all photographic and natural distortions removed. Images having distortions removed are referred to as “corrected” and display geographic features in their true location on the earth in reference to a known coordinate system. This layer serves as the foundation or base map upon which other themes are developed. By using a standard, corrected base as the principle building block for subsequent layers, more accurate and precise analysis can be conducted. Exhibit 3-3 displays a sample of orthoimagery.

ORTHOIMAGERY MAP
Exhibit 3-3

Orthoimagery provides a base map on which staff can develop soils information, CLU data, conservation practice boundaries, and the like. Without orthoimagery, development of these themes is possible, but accuracy will be impaired and may hamper subsequent analysis. In the absence of digital orthoimagery, digital raster graphics are sometimes a suitable short-term substitute for NRCS or RD, however FSA requires orthoimagery.

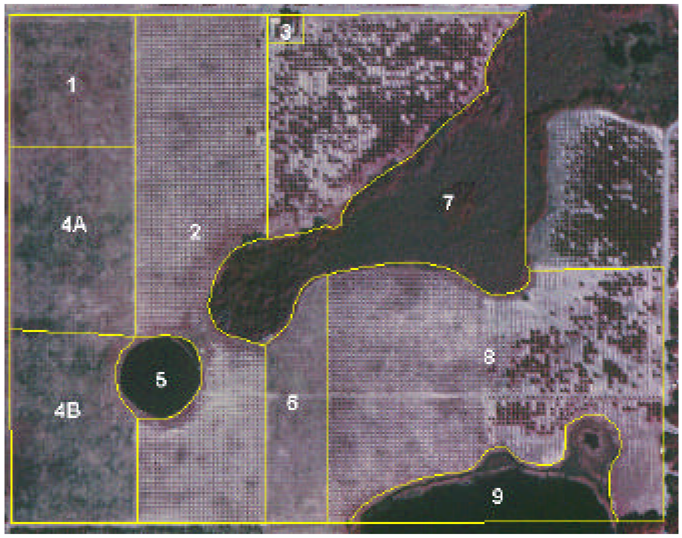
Additionally, orthoimagery supports on-screen-viewing capabilities to help employees complete “what if” scenarios, compliance, and eligibility analyses. Employees are able to discuss resource management alternatives and draw proposed management practices, such as buffer strips and grassed waterways, on-screen to help customers visualize the length and location, as well as provide a hard copy map printout specifying recommended practices.

In the Common Computing Environment (CCE) of the Service Centers, digital orthoimagery and other critical spatial datasets are shared resources and accessible to staff using GIS software. Data sharing eliminates reliance on multiple hardcopy products whose information content may vary by agency and program need. In the shared environment, a common base product can be accessed, additional themes generated and made available to customers or staff, thereby minimizing duplicate and disparate datasets.

3.1.2 Orthoimagery and CLU

Adding a common land unit (CLU) theme to the orthoimagery base will provide employees with additional GIS capabilities and a more professional map to deliver to customers. CLUs serve as a key framework layer for the Service Centers and customers. It enables the automation of key farm records management and payment and compliance processes. When CLU and DOQ data are available to Service Center employees, boundaries are computer drawn on softcopy maps. Field boundaries are spatially linked to tabular databases, providing land unit and annotations for map display. Employees and customers view and use accurate position information for farms, tracts, fields, storage facilities, etc. This information allows employees and customers to identify the exact location of the customer’s land and what the customer is doing with the land. Additionally, the composition of a land unit can be edited by changing on-screen boundaries. Exhibit 3-4 is an example of an orthoimagery map with delineated CLU boundaries.

ORTHOIMAGERY AND COMMON LAND UNIT MAP
Exhibit 3-4



Service Centers can use orthoimagery and CLU delineations to:

- Digitize and maintain CLUs
- Process program payments and compliance
- Reduce duplication of customer reporting
- Create resource and conservation plan maps
- Eliminate the current requirement to manually determine acreage measurements by tracing projected images on hard-copy maps
- Determine the actual acreage automatically from on-screen maps and polygons for use in compliance and eligibility determinations, as well as numerous other business processes
- Collect and maintain crops and cropping history
- Determine which farms were affected by disaster conditions

3.1.3 Soils

Currently, Service Centers provide customers with hard-copy soils maps that are rarely customized to specific resource application needs. Generating interpretative products from soil survey data is labor intensive, time consuming, and, historically, a manual process. Consequently, customers have not always benefited from the vast amounts of data found in the soil survey owing, in part, to its complexity and shortage of agency resources available to meet customer needs. In the past, NRCS generated thousands of colored soil interpretative maps for farmers, ranchers, watershed planners, and county planners. In the absence of widely available staff skilled in manual compilation and the time required, these products are no longer generated in a traditional fashion. Today, the availability of the digital soil survey and customized software applications have reversed this trend and allow staff and customers to quickly and effectively generate customized map products as needed.

Access to a common digital soils database by SCA staff facilitates use of a managed single source of data from which agencies can extract interpretations and maps. Soil data and interpretations are key components of community-wide, locally led, land use-planning activities. Examples of additional applications are:

- Animal waste management
- Contaminant remediation
- Crop, range, and woodland productivity and management
- Flood hazard
- Mass movement
- Nutrient (nitrates, phosphorous, etc.) management
- Pesticide management
- Potential natural vegetation
- Riparian area identification and management
- Salinity and alkalinity levels and management
- Soil quality
- Streambank and shoreline erosion and degradation
- Urban/building site development
- Water table problems
- Wetland delineation
- Wind and water erosion and deposition
- Windbreak development
- Woodland harvest/management

3.1.4 Orthoimagery and Soils

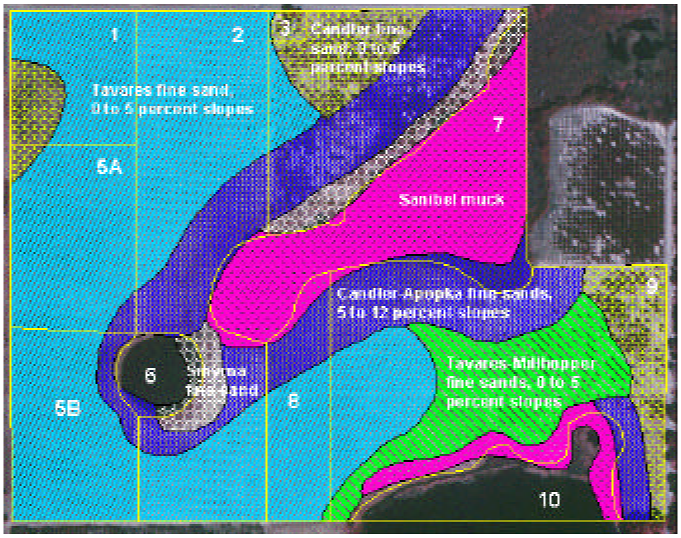
Once SCAs are able to superimpose soils data over the orthoimagery, they can more readily discern relationships of landscape, soil type, and potential soil interpretations. These two themes support the generation of map products to assist the customer in interpreting land use patterns, potential land use, and visualizing alternative conservation practices. These products also enable Service Center staff to improve business processes, such as sampling designs for precision agriculture and creating site-specific conservation plans based on sub-field soils delineations. Exhibit 3-5 shows a sample soil map displayed over orthoimagery.

ORTHOIMAGERY AND SOILS MAP
Exhibit 3-5

3.1.5 Orthoimagery, Common Land Unit, and Soils

Adding the CLU theme to soil and orthoimagery allows Service Center staff to provide additional details and interpretations by individual farm field. It also allows staff to determine program eligibility by individual field for highly eroded land (HEL) and other similar programs. Since the CLU is linked to owner and operator information, it is the basis for farm related customer interaction and reporting. This combined and complete set of digital data provides the maximum benefit to the SCAs and their customers. Exhibit 3-6 is an example of a combined orthoimagery, CLU, and soils map.

ORTHOIMAGERY, COMMON LAND UNIT, AND SOILS MAP
Exhibit 3-6



3.1.6 Cultural and Demographic Data

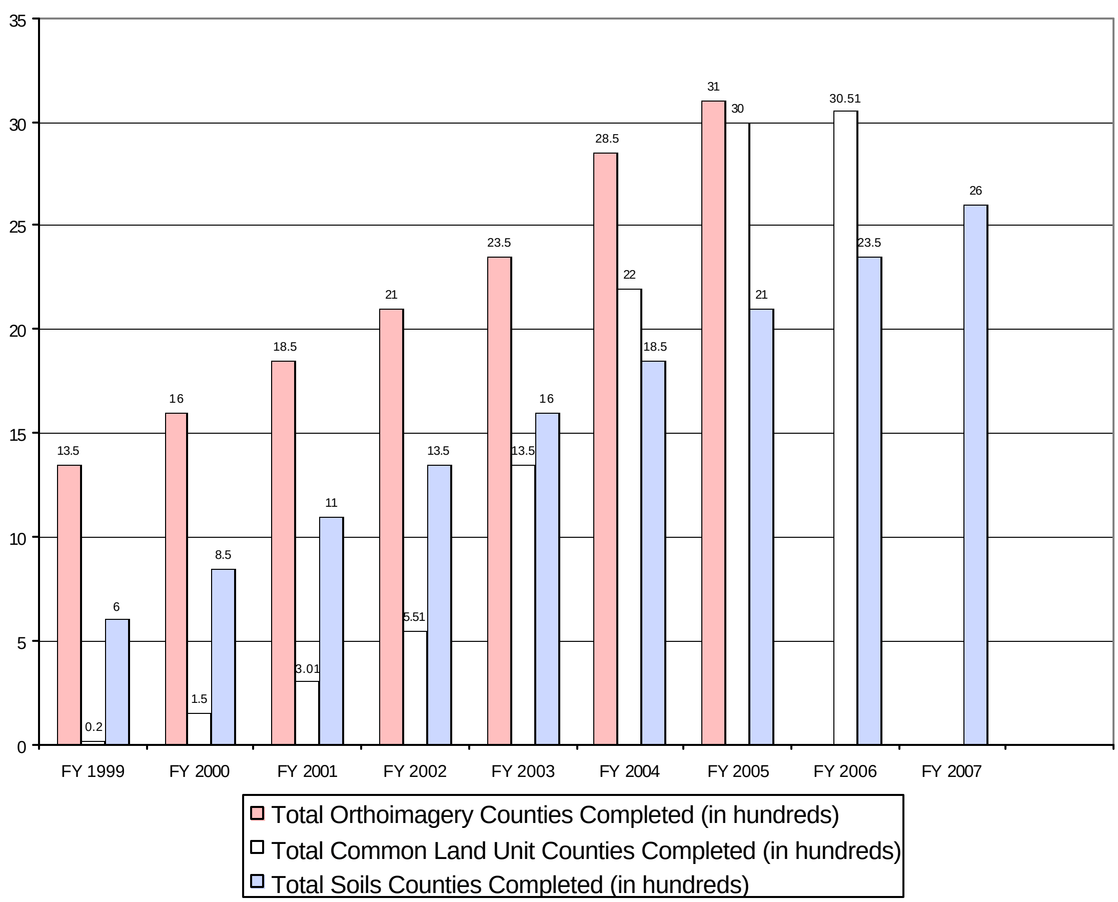
Adding the cultural and demographic data theme will further strengthen SCA GIS capabilities. The cultural and demographic information will help SCAs identify potential customers, as well as any under-served areas. It will also allow comparison of targeted group participation in programs that were specifically designed for their benefit.

Though the full impact of GIS use on programs is evident in the presence of these four layers, counties having any combination of the four are able to conduct some level of analysis and use the tools with positive results. Staffs are able to learn the capability of software tools, share data with local municipalities, and generate cooperator-specific datasets while awaiting the completion of the remaining critical layers.

3.2 Projected Completion and Costs of Critical Themes

Exhibit 3-7 identifies the projected number of counties in hundreds completed per fiscal year.

PROJECTED COMPLETION OF CRITICAL THEMES
Exhibit 3-7



The total investment in millions required to complete the orthoimagery, CLU and soils themes, and maintain orthoimagery and soils on the timeline in Exhibit 3.7 is listed in Exhibit 3.8.

COSTS FOR CRITICAL THEMES
Exhibit 3-8

Fiscal Year	2001	2002	2003	2004	2005	2006	2007
Orthoimagery	$2.3	$3.5	$10.0	$10.0	$10.0	$7.0	$7.0
CLU	$0.5	$0.0	$8.0	$8.0	$8.0	$0.0	$0.0
Soils	$7.5	$7.5	$7.5	$7.5	$7.5	$7.5	$7.5
Total Cost	$10.3	$11.0	$25.5	$25.5	$25.5	$14.5	$14.5

	Total Cost to Complete	Per County Cost (thousands)	Annual Maintenance
Orthoimagery	$33.5	$26.8	$7.0
CLU	$24.0	$8.7	$0.0
Soils	$45.0	$30.0	$5.0
Total Cost	$102.5	$65.5	$12.0

The critical themes are described in detail in the following sections. Additional details on the estimated completion timeframe and cost for each theme are also provided.

States and local entities have been aggressively developing high-resolution digital geospatial data for several years. Because of the localized nature of planning needs, declining GIS implementation costs, and increased public knowledge, much of the local data are of more use to SCA business applications than lower resolution national data. For example, while 1:100,000 hydrography is useful to the Service Center, 1:24,000 hydrography is much more helpful owing to the increased level of detail captured and displayed to the user.

State GIS Specialist participation in the state-level data and coordination consortiums is critical to the success of this strategy, and funding must be provided to support these positions. Maintaining free and open access to data, cooperative partnerships, development of local standards, and maintenance of partnerships are critical at the local level where data are generated. The SCA presence will allow us to contribute to and benefit from the local data development efforts and feed these products into the national clearinghouse to ensure the archiving of this data. State staff will assist in the acquisition, integration, and delivery of state and local data to Service Center offices according to the data standards and structures. They will also coordinate with partners in the development of data that meet the business needs of the SCAs.

State GIS staff will also play critical roles in providing support to Service Centers through training, help desk support, cartographic support, and aggregation of spatial themes to meet large-area business needs of GIS such as watershed planning. These staffs will also coordinate across state boundaries and with technical centers and headquarters staff when necessary.

3.2.1 Orthoimagery

For more than 50 years, SCAs have used aerial photography to inventory natural resources and administer programs involving farmers, ranchers, and other rural clients. However, aerial photographs do not meet National Map Accuracy Standard (NMAS) requirements and must be enhanced by conversion to digital form prior to use with GIS technology.

A digital orthoimage is a digital representation of an aerial photograph or satellite image with ground features located in their true map positions, and therefore meets NMAS. Currently, there is no civilian satellite that meets the Service Centers' broad area requirements; therefore, orthoimagery is being developed using aircraft. The primary source of aerial photography for developing digital orthophoto quadrangles (DOQs) is acquired from the National Aerial Photography Program (NAPP). NAPP is a multi-Federal and state agency cooperative effort to acquire new imagery for the 48 conterminous states in the U.S. over a seven-year cycle.

To support the acquisition and development of orthoimagery, a steering committee National Digital Orthophotography Program (NDOP) was formed that includes NRCS, FSA, Forest Service (FS), U.S. Geologic Survey (USGS), U.S. Bureau of Census (BOC), Federal Emergency Management Agency (FEMA), Bureau of Land Management (BLM) and the National States Geographic Information Council (NSGIC). This committee manages and operates NDOP by providing program and technical leadership in the acquisition of DOQs.

A technical standard that complies with the Federal Geographic Data Committee (FGDC) national orthoimagery standard is used to develop either black and white and/or color infrared DOQs with a 1-meter ground sample distance and NMAS for a 1:12,000 scale map product.

The NDOP partners and cooperators have funded approximately 99 percent of the conterminous U.S., Hawaii and Puerto Rico. DOQ products are available for some 87 percent of the nation. About 12 percent are being generated. The program is scheduled to complete national coverage of private lands by year 2002, and national coverage of Federal lands by year 2004; however it takes approximately 2 years from completion of acquisition to delivery to SCAs. The maintenance and updating of digital orthoimagery was begun on a limited scale in 2001 by USGS and state agencies.

FSA is incurring additional costs to reformat DOQs into county mosaics to facilitate their use in the field Service Center. By implementing the mosiac process, FSA provides USDA with a consistent, accurate image base. The process includes the removal of visible seam lines between separate DOQs, typically due to different dates of source photography and misalignment between DOQs. The actual pixel locations, and the coordinate system they are cast upon, are not altered. The orthoimagery is being delivered to offices as a county orthomosaic with associated full resolution 7.5-minute quadrangle tiles. Updating of the orthomosaic in 2006 and beyond may be accomplished by image matching existing DOQs using aerial photography, or commercial satellite imagery, or recreating the DOQ using traditional means where the digital elevation models (DEMs) are updated. The orthomosaic update strategy, timeline and, resources needed are presently in the planning stage. Exhibit 3-9 shows the annual investments required and the schedule for delivery of orthoimagery to the SCAs.

DELIVERY SCHEDULE AND COSTS FOR DIGITAL ORTHOIMAGERY
Exhibit 3-9
(goal in counties per year, cost in millions)

Fiscal Year	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Goal	1850	2100	2350	2850	3100	3100
NAPP	$0.5	$0.5	$1.0	$1.0	$1.0	$1.0
Mosaicing	$0.5	$0.0	$3.0	$3.0	$3.0	
DOQ	$1.3	$3.0	$6.0	$6.0	$6.0	$6.0
Total Cost	$2.3	$3.5	$10.0	$10.0	$10.0	$7.0

The total cost for completion of orthoimagery is approximately $33.5 million. The annual maintenance cost beginning in 2003 to replace outdated DOQ's is approximately $7 million per year. The mosaicking costs here do not include the cost of the contractors working at APFO, which we estimate at $1M in 2002 and 2003, and $0.5M in 2004. Not having funds to contract for mosaicking in 2002 may limit the productivity of FSA operated digitizing centers and further delay GIS implementation.

3.2.2 Common Land Unit (CLU)

To administer USDA programs, field staffs draw farm fields, pastures, and land tracts on aerial photographs. Fields and pastures are attributed with a label, linked to a tract, and associated with the landowner/manager or borrower. The boundaries that result from this delineation process are called common land units (CLUs). The SCAs have standardized the process of defining, mapping, numbering, digitizing, and maintaining CLU data. FSA Handbook 8-CM, Revision 1 provides current standards used by the SCAs.

The CLU theme defines the critical relationship between customers (e.g., landowners/managers, borrowers, etc.) and land (e.g., farm, tracts, fields, pastures, etc.). The CLU theme will be used to link most business information to a unique geographic location. The theme will also:

- Improve agency and customer farm records management
- Improve program compliance
- Improve communication and data flow between SCAs and customers
- Improve communication between information system applications
- Facilitate creation of a single SCA database
- Provide for analysis of SCA business data using outside spatial data such as demographic data, satellite imagery showing crop residue after planting, or elevation data
- Support the development of consistent and accurate land measurements
- Provide for aggregation of business data to a county, watershed, regional, state, or national level
- Provide for program-specific data

The development of the CLU layer is key to successful GIS implementation. USDA will not be able to offer "one-stop" service to customers without this digital theme. A schedule and dollar estimate to develop CLU data for the private land in the conterminous U.S. by the end of fiscal year 2005 is shown in Exhibit 3-10. Costs to digitize public lands such as reservations and national forests are not included in these calculations. Digitized public lands will be obtained from other sources.

PROJECTED COMPLETION AND CONTRACT COSTS OF COMMON LAND UNIT THEME
Exhibit 3-10
(goal in counties per year, cost in millions)

Fiscal Year	2001	2002	2003	2004	2005	2006
Goal	301	551	1350	2200	3000	3051
Total Cost	$0.5	$0.0	$8.0	$8.0	$8.0	$0.0

The total contracting cost for completion of common land unit digitizing is estimated to be approximately $24 million. This number does not include the costs for imagery (DOQ program support and mosiacking). It also does not include the costs of hardware, software, personnel and other costs for the digitizing centers, which may rise substantially in FY 2002-2005. The annual maintenance cost will be included in normal FSA business operations.

3.2.3 Soils

The soils data theme consists of the Soil Survey Geographic Database (SSURGO), a county/project level digitized version of the soil survey generated by the National Cooperative Soil Survey (NCSS). NRCS and NCSS have partnered to complete soil surveys for 100 percent of U.S. cropland, which translates to roughly 96 percent of private lands and 81 percent of public lands. Most soil surveys were mapped and published using rectified photography or photo mosaics as the base map and not the more accurate orthoimagery. As a result, these surveys are being compiled to the rectified DOQ base map to ensure the accurate placement of the soil boundaries in relation to the surrounding geography. In addition to updating the spatial location of boundaries, associated attribute and classification data are reviewed and updated to conform to the latest soil mapping standards and practices. Exhibit 3-11 shows the annual investments required to achieve this schedule.

PROJECTED COMPLETION AND COSTS OF SOILS THEME
Exhibit 3-11
(goal in counties per year, cost in millions)

Fiscal Year	2001	2002	2003	2004	2005	2006	2007
Goal	1100	13.5	1600	1850	2100	2350	2600
Total Cost	$7.5	$7.5	$7.5	$7.5	$7.5	$7.5	$7.5

The total cost for completion of soil survey digitizing is approximately $45 million. The annual maintenance cost is approximately $5 million. There are approximately 2,600 soil surveys; some counties, particularly Federal lands, may not have digitized soils.

3.2.4 Cultural and Demographic Data

Cultural and Demographic Data consists of data from the U.S. Bureau of Census (BOC) and Census of Agriculture. The U.S. Bureau of Census provides information on the distribution of people in the U.S., age, gender, race, and cultural and economic information. Census of Agriculture data provides county-level information on the kind and amount of crops grown, number and kind of livestock, and other cultural and economic information. U.S. Census data are collected at 10-year intervals and have been acquired by the SCAs from BOC.

3.3 Other Common Themes

There are 17 additional common themes that build on the four critical data themes to improve the way business is done. The combined 21 themes are divided into three broad categories—Framework, Natural Resources, and Business—and are listed in Exhibit 3-12. For each category, the 21 themes are listed in the order they need to be created using USDA agency funds; created with other Federal, state, or county partners; or acquired from public and private organizations

OTHER GEOSPATIAL DATA THEMES
Exhibit 3-12

Geospatial Data Themes for USDA Service Centers	Create With USDA Agency Funds	Create With Other Federal/ State/ County Partners	Acquire Existing Data
Framework			
1. Orthoimagery **(Critical)**	X	X	X
2. Satellite Imagery	X	X	X
3. Governmental units and place names			
• State and county boundaries			X
• Minor civil divisions			X
• Incorporated places and consolidated cities			X
• Indian lands			X
• Geographic Names Information System (GNIS)			X
4. Elevation	X	X	X
5. Hydrography	X	X	X
6. Cadastral			X
• Public Land Survey System (PLSS)			X
• Military installations			X
• National forests			X
• Bureau of Land Management (BLM) lands			X
• National parks		X	X
7. Transportation			
• Roads			X
8. Digital Raster Graphic (DRG)			X

Geospatial Data Themes for USDA Service Centers	**Create With USDA Agency Funds**	**Create With Other Federal/ State/ County Partners**	**Acquire Existing Data**
Natural Resources			
1. Soils—SSURGO **(Critical)**	X		
2. Land cover/vegetation/plants	X	X	X
3. Environmental Data			X
4. Watershed boundaries (11-14 digit hydrologic units)	X	X	
5. Wetlands		X	X
6. Wetland and floodplain easements	X	X	
7. Climate—precipitation and temperature	X	X	X
8. Flood hazard maps			X
Business			
1. Common land unit **(Critical)**	X		
2. Cultural and demographics **(Critical)**			
• Census tract boundaries			X
• Census of Population and Housing			X
• Census of Agriculture			X
• Economic census			X
3. USDA Office Information Profile (OIP)	X		
4. Applied conservation practices	X		
5. Water control infrastructure/National Inventory of Dams	X		X

Though the applications of GIS vary widely, SCAs use common data themes frequently. As suggested by Exhibit 3-2, the three SCAs have common needs for hydrography, roads, watershed boundaries, and the like. Some examples of common data theme benefits include:

- Administrative/governmental units and place names to assist Service Center employees with inquiries and making geospatial products for farmers, ranchers, agriculture industry, school districts, or county planners
- Watershed boundaries provide data on hydrologic units that local groups can use for decision making in locally-led conservation activities, and to assist local groups with identification and priority setting
- Federal Emergency Management Agency (FEMA) flood hazard data will provide information for rural housing, facilities, and building site locations, waste, nutrient, and pesticide management
- Applied conservation practices will help SCAs identify the level of source treatment in counties to determine priorities for directing assistance and funding
- Additional themes can help SCAs maintain and update utilities maps that contain information on well heads, water quality problem areas, wildlife habitat and threatened/endangered species, high pressure gas lines, buried utility lines, etc. and that enhance safety awareness and reduce potential for damage resulting from constructive activities

- The affects of current climatic conditions and crop management practices on yield potentials can be analyzed to provide improvements to disaster assessments, environmental impacts, and risk management programs

In addition to the 21 themes identified in Exhibit 3-12, state and local data will be created with Federal/state/county partners or acquired as needed. Descriptions for the 17 common themes are provided in the following sections.

3.3.1 Satellite Imagery

USDA through the Foreign Agricultural Service (FAS) maintains a satellite imagery library. Each USDA member agency contributes approximately $75,000 per year to maintain this library. The SCAs use satellite imagery for compliance, resource inventory and assessment, disaster prediction and response, and other purposes. This use is expected to expand if imagery costs decrease and availability increases. At this point, FSA is the only SC agency that has access to the image library. Many other USDA agencies are contributing funding and satellite imagery to this effort.

FSA is using Landsat imagery to create county-based Landsat data sets for use at the Service Center for compliance and disaster response. FSA funds FAS to analyze multi-resolution satellite imagery and weather data for U.S. crop condition assessment and disaster monitoring.

3.3.2 Governmental Units and Place Names

Governmental units and place names include state and county boundaries, minor civil divisions, incorporated places and consolidated cities, Indian lands, and the Geographic Names Information System (GNIS) place names.

The GNIS is maintained by USGS and consists of all names shown on the 7-½ or 15-minute quadrangle series. These names are attributed with their geographic location and can be displayed on digital maps. The present resolution of the GNIS data should be adequate for SCA use.

The Indian lands sub-theme is available at the scale of 1:100,000 and is maintained by the Bureau of Land Management (BLM).

3.3.3 Elevation

Elevation data provide information about terrain. Land surfaces are often represented using a matrix of elevation points at regular intervals called a digital elevation model (DEM). USGS has Federal leadership for developing this data theme and has completed national seamless data coverage of 30-meters or better. The dataset is referred to as the National Elevation Dataset (NED). NRCS is presently working with USGS to develop means of accessing the data at limited or reduced cost. As a member of the NDOP, NRCS and FSA have contributed to the cost of developing DEMs. Approximately 98 percent of the U.S. is already finished or in progress.

A growing percentage of DEM coverage (and the bulk of recent demand) is at 10-meter post spacing. These products are more faithful to existing 1:24,000 contours and hydrography, at only marginally greater cost than 30-meter DEMs. Recently produced 30-meter DEMs and all 10-meter DEMs at USGS have a vertical accuracy equal to half the interval of the 1:24,000 contours from which they were derived. In the development of the NED product, much of this higher-resolution data were used, and as increased-resolution data become available, the NED product will be updated to incorporate these sources. This concept of a multi-source, multi-resolution, multi-temporal digital product will require a greater reliance on accurate metadata, user subscription services to inform users of data updates, and more rigid attention to data management. However, this will likely be the data management trend for the future.

The resolution of existing DEMs is generally adequate to meet SCA needs for wide-area county and watershed planning. However, it is not sufficient for planning at the field level. Service Centers require a 2-foot contour accuracy or better to meet field level planning needs. The cost for acquiring this level of accuracy using conventional photogrammetric techniques is too great to justify a national program. However, advanced technologies such as light detection and ranging (LIDAR) and interferometric synthetic aperture radar (IFSAR) will support these needs, and their use and application is becoming more widely distributed within the Federal community. The Service Centers will use existing data or complete site-specific elevation surveys as required.

Identifying the need for greater resolution of elevation data, the federal community, led by the USGS, has formed a consortium to facilitate the development of data. Focusing on LIDAR and IFSAR data, federal agencies are compiling sources of information and planned collection efforts in order generate a higher resolution NED product. The consortium is modeled after the NDOP program and is called the National Digital Elevation Program (NDEP). NRCS and U.S. Forest Service are members of the Steering Committee.

3.3.4 Digital Raster Graphics

The digital raster graphics (DRGs) are digital representations of USGS 7½-minute 1:24,000 scale quadrangles. DRGs have proven useful for a variety of program needs, especially those involving resource inventory efforts. Using GIS tools, the DRG can be draped over the DOQ and combined with other products to enhance location identification, sampling needs, and the like. In the absence of DOQ, these rectified products are used as a base material for digitizing. This database has already been purchased for SCAs.

3.3.5 Hydrography

Hydrography data include surface water features such as lakes, ponds, streams, rivers, canals, oceans, and shorelines. USGS federal has responsibility for this data theme and has worked with the Environmental Protection Agency (EPA) and others to create the National Hydrography Dataset (NHD) at a 1:100,000 scale. USGS will continue to develop NHD to include multi-resolution, multi-source, multi-temporal data from many cooperating sources. The resulting 1:24,000 (or better) product will take years to generate and require effective and long-term partnerships. In the absence of more detailed coverage, the SCAs have several options. For example, Kansas has chosen to recompile the hydrography from USGS 7½-minute quadrangle maps to the DOQ to generate rectified digital water features. This partnership between NRCS and USGS has been fruitful in defining roles and maintenance agreements for long-term data update. In the absence of such an arrangement, states may use the 1:100,000 data, or create the 1:24,000 data independently. Each of these options has several shortcomings and should only be pursued when all efforts at cooperative development have proven unsuccessful.

Hydrography is one of the most commonly needed data layers for resource management and planning. Because of the lack of formally accepted data content standards and feature definitions, the cooperative development of a mutually agreed upon layer meeting USDA needs at the field level has not occurred. Consequently, USDA agencies have generated hydrography to support their business needs. These parallel efforts have resulted in several hydrography datasets, which vary by need and source material.

3.3.6 Cadastral

Cadastral information from the federal framework perspective includes the Public Land Survey System (PLSS) and publicly administered parcels, such as military installations, national forests, BLM lands, national parks, and state parks. The PLSS database is available from the Bureau of Land Management for 14 states and was compiled at a scale of 1:24,000. The BLM's Geographic Coordinate Data Base (GCDB) is a collection of geographic information representing the PLSS of the United States. The GCDB grid is computed from BLM survey records (official plats and field notes), local survey records, and geodetic control information, and was compiled using 1:24,000 base materials.

The National Integrated Land System (NILS) is a joint project between the BLM and the USDA Forest Service in partnership with states, counties, and private industry to provide business solutions for the management of cadastral records and land parcel information in a GIS environment. The goal of NILS is to provide a process to collect, maintain, and store parcel-based land and survey information that meets the common, shared business needs of land title and land resource management. USDA will coordinate with and stay abreast of this effort to ensure access to the best available boundary data for SCA use.

3.3.7 Transportation

Transportation data includes roads, trails, railroads, waterways, airports, ports, bridges, and tunnels. The Department of Transportation (DOT) has responsibility for this data theme. DOT recently developed an agreement with Geographic Data Technology to procure the 1999 road network layer for the nation at 1:100,000. This product is an added-value layer originating from TIGER files and will be in the public domain and maintained in a national seamless format. Some state and county governments maintain more accurate data, which SCAs will acquire and use when greater detail is needed. Responsibility for the development of these detailed datasets lies with each state department of transportation and is minimally coordinated by the federal DOT. Therefore, at this writing there are no formal plans for the development of a national seamless transportation layer at 1:24,000. In the absence of detailed transportation data, Service Centers may chose to forgo this layer and rely on evident transportation networks on the digital orthoimagery.

3.3.8 Land Cover/Earth Cover

Land cover includes the natural and cultural features (such as urban build-up, transportation corridors, grasslands, etc.) that cover land surface at a distinct point in time.

Federal, state, and county governments collect land cover and land use data in support of various programs. However, these are not often part of an effort to develop a national land cover database. The National Land Cover Dataset (NLCD), developed by USGS, is the first national land-cover dataset produced since the early 1970s. NLCD breaks down land cover into nine categories and is generated using Landsat Thematic Mapper imagery classification techniques. Though useful for some regional planning efforts, a greater level of detail is needed by SCAs. FSA is developing land use crop cover through their Land Use Project. This application will collect crop types by CLU when producers participate in SCA programs. An additional source of information is the NRCS National Resources Inventory, which is an USDA statistical survey capturing 12 broad land use categories. Lastly, locally developed data may be used where available.

3.3.9 Environmental Data

Environmental data sources include the Environmental Protection Agency (EPA), Department of Interior (DOI), USDA, and other federal and state agencies. Much of the data are updated annually and provided by these agencies on a nationwide scale in a downloadable format that can be easily imported into GIS. Examples include the location of brownfields, Superfund sites, endangered species and cultural resources.

3.3.10 Watershed Boundaries

Watershed boundaries (hydrologic units) define the aerial extent of surface drainage. Four levels of hydrologic unit boundaries (2, 4, 6, and 8-digit) were developed by USGS in the 1970s for large drainage areas. As an extension to these four levels, NRCS has developed criteria for delineating and digitizing drainage boundaries for smaller sized areas. The new levels are called watershed (fifth level, 10-digit) and subwatershed (sixth level, 12-digits). The watershed level is typically 40,000 to 250,000 acres and the subwatershed level is typically 10,000 to 40,000 acres, with a minimum of 3,000 acres.

NRCS first developed a standard for delineating the sixth level in 1992. Since that time, NRCS, USGS, BLM, EPA and other federal agencies have worked collaboratively to develop a single federal standard for the deletion of sixth level subwatersheds. In cooperation with the FGDC and the Advisory Committee on Water Information, a new interagency guideline has been written. The draft standard was provided to FGDC in 2001, to begin the review and comment phase of standards development.

Delineation and digitizing continues at a state level using partnerships with local, state, and federal agencies where possible. Though the delineation process continues as a mainly manual-intensive process, USGS has prototyped several automated methods to determine drainage patterns and associated watersheds using GIS technology and digital elevation models (DEM). This process looks promising for areas with a high degree of relief, though manual methods will continue to be required in coastal areas and those with little relief.

3.3.11 Wetlands

The Fish and Wildlife Service (FWS) has federal lead responsibility for the wetland data theme. The Emergency Wetland Resources Act of 1986 directs FWS to map the wetlands of the United States. The National Wetland Inventory (NWI) has mapped 90% of the lower 48 states, and 34% of Alaska. The Act also requires FWS to produce a digital wetlands database for the United States. About 44% of the lower 48 states and 13% of Alaska are digitized. FGDC standards have been adopted for the classification of wetlands and FWS mapping standards have been developed for 1:24,000 mapping and digitizing. This digital database is available via the Internet and can be downloaded and used at no expense to USDA. These data are not registered to the DOQ imagery used in the field offices and therefore must be processed to be of most use to Service Center staff. A cautionary statement as to the possible mis-registration with imagery should accompany NWI data provided to customers and staff that the user should be aware of this issue.

At the request of the landowner/operator, USDA will examine and document the presence, or lack, of wetlands on privately held lands. Areas found to be wetlands will be maintained in a geospatial database by Service Centers as a specific category of certified wetlands.

3.3.12 Wetland and Floodplain Easements

The SCAs administer several programs that authorize landowners to enter into perpetual and 30-year easement contracts for maintaining wetlands and floodplains. Approximately 1,000 of these agreements are signed annually. The specific boundaries of the wetland and floodplains are surveyed and geographic coordinates are provided to the landowner and to USDA. Sometimes the entire parcel of land (such as a PLSS 40-acre parcel) is made part of the easement contract, and these boundaries are also identified. Currently these locations are being maintained manually in Service Center files, with approximate locations drawn on aerial photographs. An easement survey, mapping, and digitizing specification was developed in 2000. A national layer should be available in 2002.

3.3.13 Climate

Climate information is essential for nearly every SCA operation. This encompasses both raw and analyzed data over a range of spatial and temporal scales. In a geospatial environment, climate information includes sequential time-series data collected at discrete points as well as spatial coverage derived from these point data or by other means.

Recognizing the need for coordination among all levels of federal government, as well as outside the government, the NRCS helped to establish the FGDC Spatial Climate Subcommittee in 1999. This group, led by the NRCS, helps coordinate and publicize geospatial climate activities, especially related to the development of spatial climate surfaces.

FSA is working with FAS to post current global weather data on the WWW. Weather data along with other current agro-metrological information can be found on https://ww2.fas.usda.gov/rssiws/. FAS sees the United States as part of the global picture and allows customers to monitor growing conditions in many part of the world, the data available from this web site will be expanding on a monthly basis.

The NRCS operates two climate data networks that support the creation of spatial climate data information: the Snowpack Telemetry (SNOTEL), and the Soil Climate Analysis Network (SCAN). The SNOTEL network has, for more than 20 years, provided high-elevation climate information from the major watersheds in the mountainous West. The network measures precipitation, temperature, and snowpack conditions in near real-time at 662 sites. The data are used primarily for forecasting water supply volumes and are collaterally used in emergency management to mitigate floods, avalanches, and other life- or property-threatening events.

SCAN was developed because of deficiencies in obtaining real-time soil-climate information. SCAN consists of 43 stations located in 39 states. The stations measure precipitation, temperature, relative humidity, wind speed and direction, solar radiation, atmospheric pressure, snow water content, snow depth, soil moisture, and soil temperature. Both networks use meteor-burst communications to transmit the data in near real-time to a central computer center located in Portland, Oregon.

Essential to SCA operations is the National Oceanic and Atmospheric Administrations (NOAA) Cooperative Observer Program. This program, now more than 100 years old, is a network of more than 8,000 volunteer weather observers across the nation who collect daily precipitation and temperature information. Data from the program are foundational the development of climate maps; in providing local climate information; and for providing a long time series of climate data for trend analyses, establishment of averages and measures of variability, and a host of other applications.

Once climate data are collected, the information is transferred to the Unified Climate Access Network (UCAN). UCAN is a collaborative effort between six Regional Climate Centers, the NRCS National Water and Climate Center, USDA World Outlook Board, state climatologists, and the National Climatic Data Center to standardize climate database structures and provide users with Internet access to climate data and analysis software. Once fully implemented, UCAN will support real-time nationwide spatial climate analysis.

Geospatial applications need more than data from discrete points. The NRCS has been a leader in the development of digital climate maps, typically based on climate station data, such as from SNOTEL or the Cooperative Observer Program. The NRCS joined forces with the Spatial Climate Analysis Service at Oregon State University to develop climate maps of mean monthly and annual precipitation, maximum and minimum temperature, frost dates, and many other elements. These data are used extensively in SCA GIS applications. Many more climate-mapping projects are currently being planned to assist with climate-critical applications in SCAs.

3.3.14 Flood Hazard Maps

The Federal Emergency Management Agency (FEMA) conducts hydrologic and hydraulic studies that identify flood-prone areas and provide flood risk data. Using these data, FEMA prepares flood hazard maps and other thematic features related to flood risk assessment. Special Flood Hazard Areas (SFHA) are areas subject to inundation by a flood having a one-percent or greater probability of being equaled or exceeded during any given year. This flood, which is also referred to as the 100-year flood (or base flood), is the national standard on which the floodplain management and insurance requirements of the National Flood Insurance Program (NFIP) are based. In 2000, NRCS and FEMA entered into a memorandum of understanding to facilitate cooperation on issues of mutual interest such as disaster mitigation and recovery. As a result, FEMA provides digital flood hazards data to NRCS and thus it is available to all the SCAs.

Flood risks have been assessed in approximately 20,400 communities nationwide, resulting in the publication of more than 100,000 individual hardcopy maps. Digital data are available for roughly 1,200 counties in the country, with that number increasing regularly. FEMA revises these maps as communities grow, as new or better scientific and technical data concerning flood risks become available, and as some Flood Insurance Studies (FISs) become outdated by the construction of flood control projects or the urbanization of rural watersheds. Several thousand flood hazard maps are updated each year.

3.3.15 Applied Conservation Practices

Applied conservation practices are geospatial information that is developed during conservation planning and application. Examples are well head, pipelines, grassed waterways, irrigation system tailwater recovery ponds, terraces, and windbreaks. Data also include tabular attributes linked to field boundaries such as conservation tillage. Examples of program data are certified wetlands, Conservation Reserve Program (CRP), Farmland Protection Program (FPP), and Wetlands Reserve Program (WRP) easements. Environmental Quality Incentives Program (EQIP) sites have been geographically referenced beginning in 1998. WRP, FPP, and WRP are in development and should be available in early 2002. Resource Conservation and Development (RC&D) boundaries, Soil and Water Conservation District Boundaries, and field office service area boundaries are available now.

3.3.16 Water Control Infrastructure/National Inventory of Dams

The National Inventory of Dams (NID), authorized by Congress, is the comprehensive source of U.S. dams information, and is maintained by the U.S. Army Corps of Engineers (USACE) in collaboration with other federal agencies and states. USDA maintains an inventory of approximately 26,000 dams built with NRCS technical assistance. The inventory currently contains 59 data fields on over 75,000 dams that meet minimum size criteria. Data fields include names, identification numbers, information on dam and reservoir physical size and features, potential hazard classification, ownership and agency involvement information, and location (latitude/longitude) information. Updates of the NID will include a GIS interface for improved data access.

3.3.17 USDA Office Information Profile

The Office Information Profile (OIP) system is a database application designed to record locations and characteristics of each office for the SCAs and partners. The OIP system serves as a tool for reporting to Congress, oversight entities, and agencies, and provides the public a means to locate program delivery offices for the three agencies. OIP serves as a keystone application on which other tools rely in order to eliminate redundant data and duplicative processes. OIP site records describe the physical location of a site by street address, latitude, and longitude, and site characteristics such as non-Federal worksite or organizational units. For each organizational unit, a record exists in OIP identifying the agency, the office type (e.g., Service Center office, Soil Survey office, etc.), the number of persons assigned, the counties serviced by the organizational unit, and an indicator as to whether the organizational unit provides services full or part-time. Phone numbers are also recorded for each site and organizational unit.

3.4 Prioritizing Core Geospatial Database Development and Delivery

This section describes the process the SCAs are following for the acquisition and creation of orthoimagery, CLU and soils.

The processes and prioritization criteria for developing each of the three databases are different. The differences are attributed to the uniqueness of each database, staff resources, funding, administrative considerations, hardware/software availability, individual agency needs, and participation of multiple agencies. The SCAs GIS Team, the Digital Orthophotography Team, the NRCS National Cartography and Geospatial Center, and the FSA Aerial Photography Field Office closely coordinate this development process. The following sections briefly describe the considerations that exist in determining priorities for developing the three core databases.

3.4.1 Orthoimagery Criteria

FSA and NRCS participate in the NDOP, a Federal and state agency program to develop orthoimagery (i.e., DOQs) for the nation. NDOP agencies have established prioritization criteria for DOQ acquisition, and have followed those criteria since the program began in 1993. The benefit of participating in a multi-agency program is the cost savings for each agency; the disadvantage is many agency priorities have to be considered. The criteria considered for cost sharing and prioritizing DOQ are:

- State-wide cost-share agreements between federal and state agency partnerships; these types of agreements are more cost effective and efficient because of the large size of the projects
- State-wide or large project areas with multiple federal agency funding; large blocks of land area or multiple adjoining counties are less costly to produce
- Date and availability of aerial photography
- Soil survey mapping program and soil digitizing initiative needs
- Service Center GIS implementation needs
- High priority conservation area or major conservation program initiatives and workload
- Private land and Indian Reservations
- Areas with no DOQ coverage
- Areas with DOQ coverage made from older NAPP photography with significant changes in land-use and land-cover

The current status of NAPP and DOQ coverage is available at
http://www.ftw.nrcs.usda.gov/status_data.html
or
http://www.apfo.usda.gov/cmsdoqqstatusmap.html.

3.4.2 Common Land Unit Criteria

SCAs have identified CLU as a critical geospatial database needed to carry out business applications and administer farm and conservation programs. FSA is leading efforts to convert CLUs from analog to digital form. Mapping and digitizing standards are complete. FSA established 13 digitizing centers in seven states in FY1999 and FY2000. Five additional digitizing centers in five states were put into operation in FY2001. In early 2002, 5 more states will establish centers. In addition to these 17 states, seven states were identified as targets for contracting with private vendors. Thirty-one counties in Washington and Idaho were contracted in 2001. This contracting program will be accelerated in 2002 if funding is obtained.

To determine the priority for digitizing common land units, FSA requested that each State Executive Director (SED) provide a priority list for implementing GIS in their state. Each state's priority list is based on farm and conservation program workload, predominance of agricultural activities, technical expertise, staffing resources, equipment, software and space availability. Where necessary, these priorities have been updated in the project states to group priority counties into large blocks to facilitate developing mosaics of DOQ and future compliance photography acquisition.

The current status of CLU development can be found at
http://apfonet.apfo.usda.gov/cluinspection.html.

3.4.3 Soils Criteria

NRCS began an initiative to digitize high-priority published soil surveys in fiscal year 1995. The process used to identify and select soil surveys to digitize relies heavily on the input of State Soil Scientists and Major Land Resource Area (MLRA) leaders. Each State Soil Scientist is intimately familiar with the status of the soil survey program, local cooperative partnerships, and resource issues for their state. The 18 MLRA leaders coordinate business activities for the states within their region. The MLRA leaders, in cooperation with the state soil leadership, complete regional prioritization of the surveys. State input is provided to the MLRA leaders, who aggregate data into one regional list of priorities. The regional lists are further aggregated into one national listing, which forms a pool of soil surveys most suitable for funding.

The final selection of surveys is partially impacted by the requirement to disperse funds to the four primary offices critical to SSURGO development: State Offices, MLRA offices, Digitizing Units, and the National Cartography and Geospatial Center. Prioritization criteria include:

- Status of soil survey; published surveys that require little or no mapping updates and are of the highest priority
- Status of compilation from the old soil survey map to the new DOQ framework
- Availability of DOQ for compilation and digitizing
- Existing local cooperative agreements for the soil survey
- Local cost-sharing partnerships for accelerating soil survey and digitizing
- Staffing available for the compilation and digitizing
- Factors such as agency program emphasis, cooperator needs, hardware/software needs, etc.

The current status of SSURGO coverage is available at
http://www.ftw.nrcs.usda.gov/status_data.html.

4.0 Data Management

4.1 Goal of Data Management

The goal of geospatial data management is to provide quality data and information to customers in the most timely and cost effective manner possible. The ultimate vision is access to seamless[1] geodata from any location where it is needed, any time the data are required. The data should be provided "turn key" so little or no effort is required by the field staff to use and manage the data.

The vision is access to quality, seamless, geodata anywhere, anytime, and with as little knowledge and effort on the user's part as possible

This vision is accomplished through the implementation of an infrastructure to acquire, integrate, organize, and manage geospatial data, and standard processes and procedures that assure access to consistent high quality data. The infrastructure consists of coordinated data warehouses and data marts managed by Data Acquisition and Integration Centers (DAICs) and web farms that provide online and seamless access and delivery to both internal and external customers.

4.2 Geospatial Acquisition and Integration

Efficient and accurate integration and delivery of geospatial information are essential to GIS implementation. Geospatial information will be acquired from, and may be developed and maintained at, various locations in agencies and institutions. These data vary by resolution, scale, format, projection, media, age, and geographic coverage. Significant effort is needed to generate data tailored for use by the SCAs.

To gain the most from the use of GIS at the field level, high-resolution data are needed. In the past, field staffs have required integrated and packaged data that meet their particular needs. This has required the staff to know a lot about how to access, manage, and use the data. An important goal is to automate and manage this process to minimize the data management effort on field staff. Because of the variability of data and the large number of field offices for which data is needed, the data integration effort will take several years to accomplish. However, in the meantime, offices have access to data that may not be the ideal scale for a particular application, but will provide some benefit to generalized analysis. Offices are encouraged to always use the best available data, which will vary based on the individual theme and level of integration to which the data have been incorporated with other datasets.

The first and most crude level of integration occurs by field office and technical support staff using the best available data at hand. Data may vary in scale, accuracy, and age.

[1] Managing data so they appear **seamless** allows users to access and use data without having to know or navigate the discrete blocks the data is stored in. For example, orthophotos can be delivered to the user in such a manner (mosaicked or tiled) that appear to be and can be manipulated as a single image, can be browsed as a single entity, and any portion can be extracted without having to be reassembled by image resampling.

Examples include transportation data at a scale of 1:100,000, uncertified soils data, or locally digitized farm field boundaries. Though these data may not be certified as final or may lack some of the detail needed for Service Center analysis, they do support business needs.

With the availability of digital orthoimagery datasets of a greater level of detail and quality can be generated, leading to the next level of data integration. Offices are supported in the integration of these data both within their state and by national technical centers such as the National Cartography and Geospatial Center (NCGC) and Aerial Photography Field Office (APFO). As data development increases at the local level and state GIS consortiums evolve, a variety of players contribute to data integration efforts. With roughly 3,000 potential GIS user locations across the nation, integration and data discovery to support SCA needs will rely on many partners and contributors. SCAs have prepared for this multi-player arena by developing detailed data development standards, cooperative agreements, and participating in locally-led GIS consortium efforts. The FGDC I-Team effort, begun in 2000, offers an additional collaborative environment in which SCAs can contribute to the development of local and more detailed datasets. Similar to a GIS consortium, the initiative strives to strengthen local, state, regional, and national partners for the purposes of developing digital goespatial data.

Horizontal integration, the so-called "seamless" database, is the next level of integration. Geospatial data themes should be aligned from DOQ base map to base map, and across county and state boundaries, to connect these features as closed polygons or connected networks. Soil surveys are being updated and integrated horizontally using a common correlation legend across MLRA or other physiographic areas in order to achieve agreement of soil classification and boundaries. CLU and other geospatial data themes such as roads and streams are aligned to the DOQ base maps and integrated horizontally as well.

Vertical integration is required to ensure coincident boundaries are identical. Although soil and wetland boundaries, hydrography, and elevation may all be registered to the DOQ, they may not coincide correctly because of differences in the data sources or different interpretations by natural resource scientists. Evaluations by natural resource scientists and GIS specialists may be needed to reconcile differences and achieve vertical integration.

4.3 Geospatial Data Access, Delivery, and Use

The goals of access and delivery of geospatial data to Service Center offices, internal customers, and external customers in support of business needs include:

- Support more efficient and timely program delivery
- Supply greater quantity and variety of products and services for the customer
- Expedite data delivery both internally and externally
- Support customer access to program data remotely
- Support the development of resources-based applications
- Optimize Service Center staff access to resource data and information
- Strengthen partnerships within government, research organizations, and private sector
- Encourage better use and management of data resources

With the growing maturity of Web technology and improving bandwidth, SCAs are being required to deliver information on a new technological foundation. This new foundation consists of *online data warehouses* as the authoritative source of data, *Web-based applications* that use the data via the Internet, and *automation of the data management process*.

The Service Center Modernization Initiative Data Acquisition, Integration and Delivery Business Process Reengineering (BPR) Team began addressing requirements for modernizing these functions in 1998 and their report *Geospatial Data Acquisition, Integration and Delivery National Implementation Strategy Plan, September 1999* [8], provided a framework for the follow on activities of the Service Center Data Management Team. This team has sponsored several studies over the past year detailing geospatial data warehouse architectures and telecommunications infrastructure, as well as and the associated costs, technologies, benefits, and risks for each alternative. These studies have been conducted in cooperation with the all three SCAs to determine the optimal geospatial data access and distribution architecture. This architecture includes determining the location for geospatial data warehouses, data marts, and Web-based geospatial applications.

A document entitled *Implementation of Geospatial Data Warehouses, October 2000* [9], included several broad recommendations that support the implementation of a distributed model for management of geospatial data. To achieve this distributed paradigm, additional recommendations were made supporting the establishment of geospatial data centers at both NCGC and APFO. These recommendations increase the need to build the communications infrastructure between these two centers. Additionally, a recommendation was presented to house geospatial Web-based applications in the Electronic Access Initiative (EAI) Web Farms in Kansas City, MO, and Ft. Collins, CO, which requires the acquisition of additional servers and support staff. These recommendations were presented to the USDA OCIO office in December 2000. In addition to these broad recommendations, the plan detailed several distributed architecture scenarios and evaluated the investment required to implement each scenario. Investments include telecommunications infrastructure improvement, hardware, software, staff, and training.

More specifically, the plan outlined three recommendations that were presented to the OCIO. The SCAs are implementing these recommendations

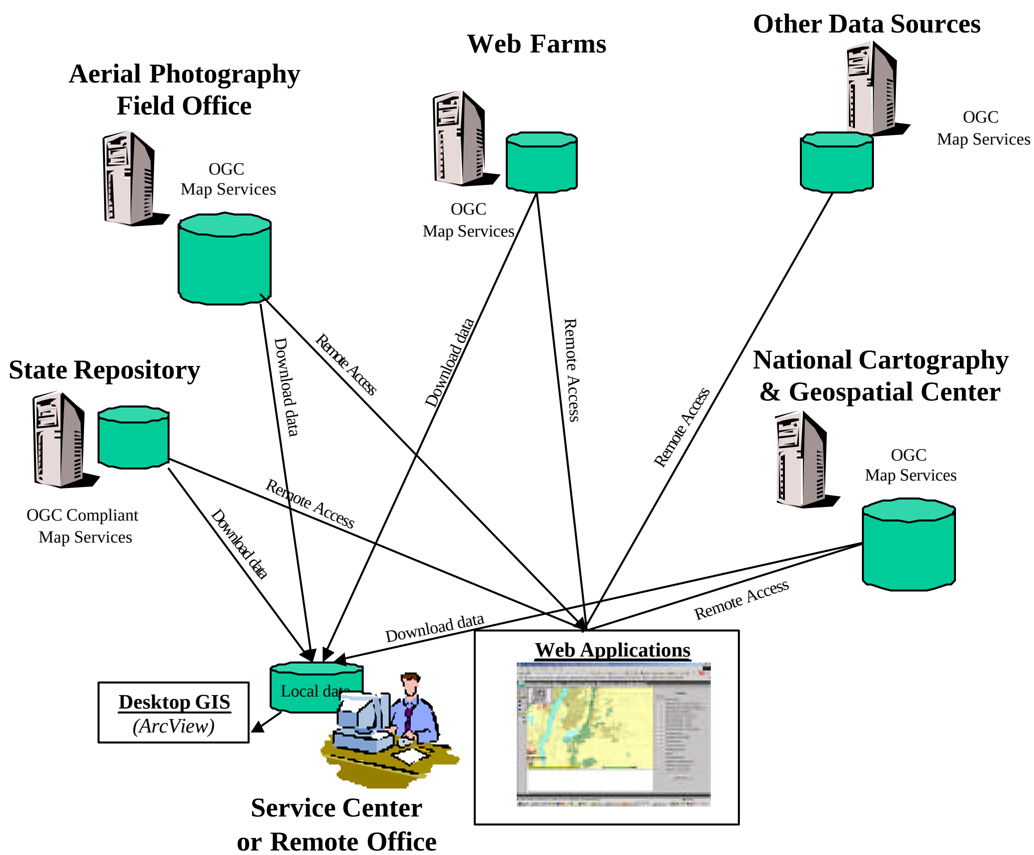
Establish online data warehouses at Data Acquisition and Integration Centers (APFO & NCGC). Centers serve as the authoritative source for data and are responsible for acquisition, integration, storage, archival, maintenance, and dissemination of geodata to internal users and public.

House online Web applications in EAI Web Farms. Leverage existing and future infrastructure in the Web Farms, including high speed Internet access, robust security features, common Web services, and staff support.

Establish a common Internet portal as a “one-stop-shopping” service for geospatial data. The distributed nature of the data appears seamless to users by linking the warehouses through a common Internet portal that provides one-stop-shopping services.

Basic to any GIS application is the requirement to obtain and manage geospatial data. Exhibit 4.1 illustrates access to distributed data sources.

ACCESS TO DISTRIBUTED DATA
Exhibit 4.1



In this model, USDA offices and the public access geospatial data that exist for their area of interests through a variety of methods. These methods are designed to be compatible with their unique telecommunications bandwidth capacity and their specific needs. These methods can be broken into two major categories: ordering and shipping the actual data, and accessing data online.

1. Ordering and shipping the data

Large, static datasets are provided by Service Centers by distributing datasets on CD-ROM. Data for the area of interest can be ordered and provided on request to external and internal users. The process of identifying an area of interest and initiating an order is facilitated through a data access portal that provides “one-stop-shopping” as a point of access to data. Smaller or more dynamic datasets can be obtained in real time by FTP download for immediate use in desktop GIS. The data access portal facilitates this process.

2. Access to data online

Data are accessed online through commercially available GIS viewers and browsers. An HTML viewer provides simple view, zoom, overlay, query, and print capability and has been shown to be usable with 56kbs connectivity. Where bandwidth is more robust, a Java viewer can provide more options and capability. Java viewers also have the added advantage of allowing local datasets to be used. Both the HTML and Java tools are simple to use. They can provide tools for the more casual users who do not need the full functionality of the desktop GIS. Technology in this area is growing rapidly with more capability being provided with every version.

Information is also provided through Web-based applications that are targeted to a specific business use of the data. The Soil Data Viewer is a good example of this kind of application. Online business applications have very specific data needs. Data are organized into data marts to optimize application performance. While more than one application may run against the same data mart, they have very specific needs and the data are organized to meet those needs in an optimal way.

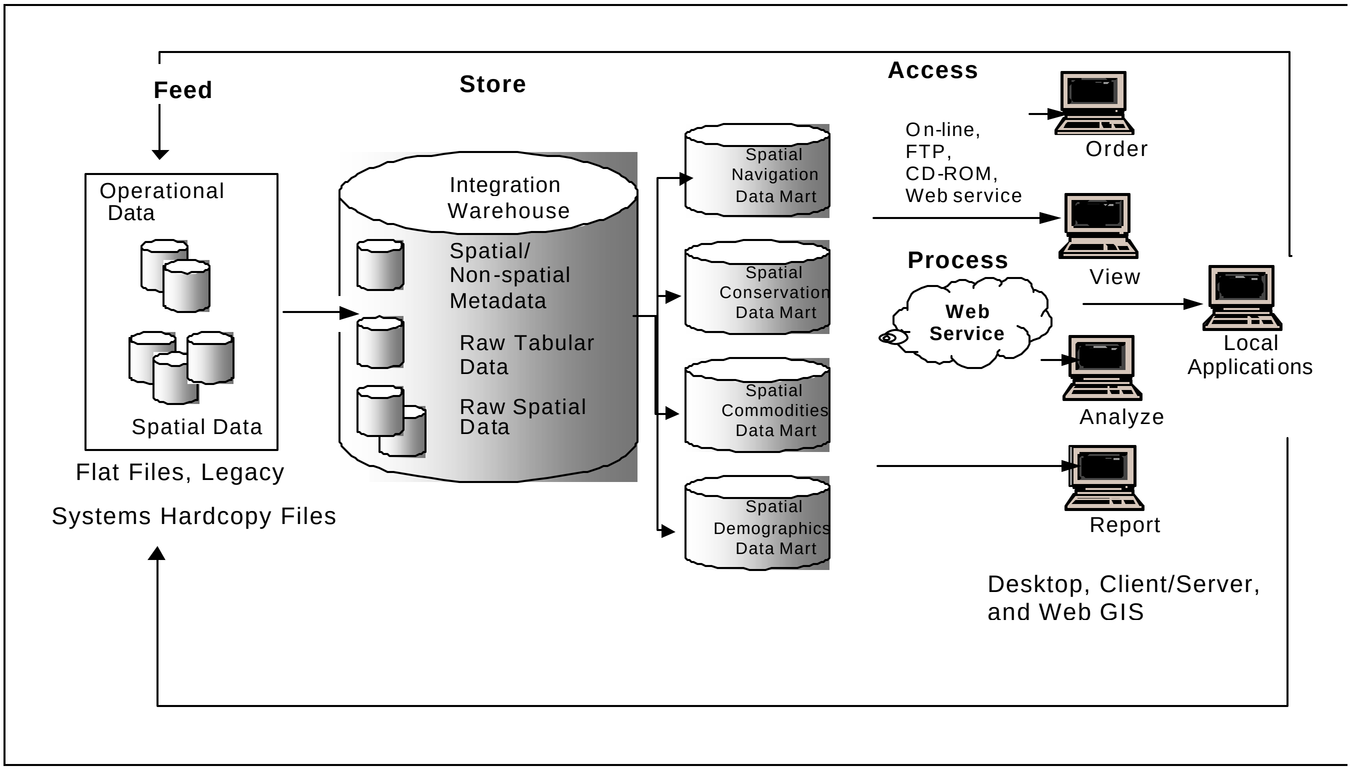
Web-based applications will depend on geospatial Web services provided from USDA Web Farms and other publicly available sites. These Web services will enable direct access by USDA applications to geospatial data sources and geospatial processing capabilities. For example, the Agriculture Research Service (ARS) will be using geospatial Web services to access geospatial data and request processing for Object Modeling System parameters during model execution. Web services will provide a new way to extend and support geospatial data applications for business processes.

4.4 Infrastructure for Managing Data

The source of data for each of the above methods of access and delivery is from organized and managed data warehouses, data marts, and repositories from a variety of sources including SCA partner agency data centers, web farms, external data sources, and where appropriate, state data repositories. Data are organized and managed so they meet the need of a variety of uses.

Exhibit 4.2 illustrates the conceptual components of a distributed data management model. Data is acquired from operational databases and may be in a variety of formats, projections, scales, media, age, and geographic coverage etc. This heterogeneous data is integrated through standard certification processes (Extraction, Transformation, and Load processes) and housed in the data warehouse.

DATA MANAGEMENT INFRASTRUCTURE
Exhibit 4.2



The acquisition and integration process is the function of the DAICs (primarily NCGC and APFO) who manage the data warehouses. Each DAIC is responsible for specific themes of data and one is identified as having responsibility for the authoritative dataset. The datasets are mirrored in another DAIC or web farm to provide security, immediate system failover, and load balancing to enhance performance.

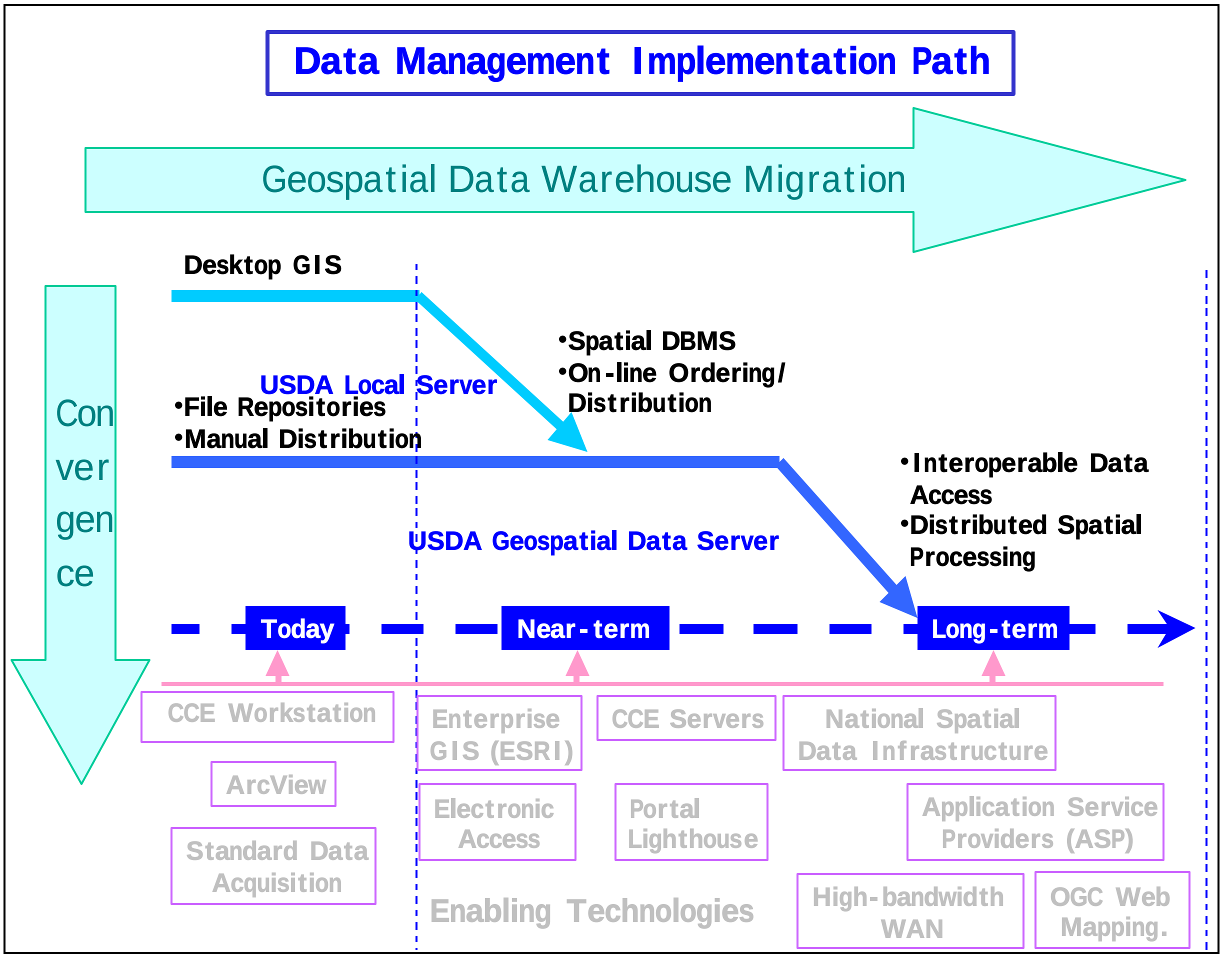
Data subsets for specific applications may be extracted from the warehouse into data marts. Data marts are designed to meet the specific business and performance requirements of the applications that use them. They are updated automatically as the data change in the warehouse, they may integrate data from multiple datasets, and they may be time-based.

4.5 Evolving Management of Geospatial Data

4.5.1 Current Geospatial Data Dissemination Activities

Geospatial data dissemination activities consist of a distributed acquisition, integration, and delivery model that was highlighted in the Geospatial Data Acquisition, Integration and Delivery National Implementation Strategy Plan mentioned earlier. The plan described how the SCAs disseminate geospatial data in a widely distributed environment supported by a modest telecommunications infrastructure. As the SCAs work to upgrade telecommunications and computers, SCA data production centers work to prepare a common set of integrated geospatial datasets. Exhibit 4.3 shows the planned evolution of data management implementation in the SCAs.

DATA MANAGEMENT IMPLEMENTATION ROAD MAP
Exhibit 4.3



At the national level, data dissemination is focused on two primary data centers located at APFO in Salt Lake City, UT, and NCGC in Ft. Worth TX. The implementation of this dissemination requires APFO and NCGC to acquire geospatial data from other federal agencies and process the data to a level that meets the business requirements of the SCA field office staff. This task is facilitated through partnerships and cooperative agreements with several federal agencies. Once acquired, both USDA-owned datasets and non-USDA datasets are integrated at the county level of geography. Currently, the dissemination responsibility includes organizations at the regional, state, and local levels as well.

APFO and NCGC production centers accomplish digital data delivery through a combination of mailing CD-ROM and/or tape and digital download via FTP. The production centers provide instructions to staff on the proper method to load data on their local personal computers or server. This dissemination model was acceptable in early limited GIS implementation; however, a more efficient distribution system is being developed for an enterprise-wide deployment.

4.5.2 Near-Term Geospatial Data Dissemination Framework

The near-term vision of geospatial data access and dissemination is improved significantly by the consolidation (logical or virtual) of geospatial data sets through a unified SCA geospatial portal and the availability of increased bandwidth between the production centers, the USDA backbone, and the Service Centers. The EAI Web Farms will enable the agencies to use both the intranet and Internet to enhance access to applications beyond the Service Center local area network. However, it is unlikely in the near term that all geospatial data will be transmitted via the Web for real-time or even one-time data transmission. It is envisioned that the near-term geospatial portal will facilitate online search, browsing and ordering, the automation of CD-ROM ordering and distribution, and piloting data streaming of a few small data layers across the Web.

As more applications become available and technological improvements in telecommunications are realized at the SCAs, there will be less emphasis on the storage of geospatial datasets at the local level and more of an emphasis of one or more centrally located data repositories accessed through the intranet and the Internet. The timeframe for this vision is within the FY 2002-2003 timeframe.

4.5.3 Long-term Geospatial Data Dissemination Framework

The long-term vision of geospatial data access and dissemination at the Service Centers is one that is shared by most federal data providers and many commercial entities. This vision consists of a network of shared data repositories that conform to mutually accepted open standards such as the Federal Geographic Data Committee (FGDC) standards, follow inter-operable exchange specifications, and use common application services. The focus of this vision is to minimize redundant applications and geospatial dataset storage, and focus on Web-based applications that operate using data stored at central and distributed data warehouses. This framework vision also supports the ability for the SCAs to concentrate on the dissemination of their owned datasets and enables applications to access data currently obtained from other federal agencies and partners directly. The benefit of this environment is reduced storage at the local level, access to the most current data available, and more efficient and cost-effective delivery and integration processes. Additionally, there will be less need to purchase and maintain software on a stand-alone desktop environment and more emphasis on applications and services delivered over the intranet and Internet. However, to take advantage of this vision, a high-bandwidth telecommunications infrastructure must be available to support large file transactions and short response times. This vision, although in place to some extent today, will not be fully operational until the FY 2003-2004 timeframe.

4.6 Standards

Data standards currently exist for some themes; others are still under development. The SCAs are working, and will continue to work, with the FGDC, other standard setting bodies, and internal agency staff to establish the necessary new standards. Exhibit 4-4 shows status of SCAs and FGDC standards development.

The cadastral, soils, and wetland themes show an "X" in more then one column. In these instances, the classification and tabular data have been standardized; however, the spatial component is either in progress or has not been developed.

STATUS OF GEOSPATIAL DATA STANDARDS
Exhibit 4-4

Geospatial Data Themes Required for USDA Service Centers	Adopted standard or final stages	Working draft	Work not begun or early stages
Framework			
Orthoimagery **(Critical)**	X		
Governmental units and place names		X	
• State and county boundaries			X
• Minor civil divisions			X
• Incorporated places and consolidated cities			X
• Indian lands			X
• Geographic Names Information System (GNIS)	X		
Elevation		X	
Hydrography		X	
Cadastral			
• Public Land Survey System (PLSS)	X	X	
• Military installations		X	
• National forests		X	
• Bureau of Land Management (BLM) lands		X	
• National parks		X	
Transportation			X
• Roads			
Digital Raster Graphic (DRG)	X		
Natural Resources			
Soils—SSURGO **(Critical)**	X		
Land cover/vegetation/plants		X	
Watershed boundaries (14 digit hydrologic units)		X	
Wetlands		X	X
Wetland and floodplain easements	X		X
Climate—precipitation and temperature		X	
Flood hazard maps			X
Business			
1. Common land unit **(Critical)**	X		
2. Cultural and demographics **(Critical)**			
• Census tract boundaries		X	
• Census of Population and Housing		X	
• Census of Agriculture		X	
• Economic census		X	
3. USDA Office Information Profile (OIP)	X	X	
4. Applied conservation practices			X
5. Water control infrastructure/National Inventory of Dams		X	X

The ability to access data from a variety of sources without having to collect and manage all the data locally has huge payoff. There are significant costs and resources involved with managing datasets locally and keeping them current. As bandwidth improves, more and more data will be access from a central location.

In the USDA's acquisition or development of data themes, content and geospatial accuracy standards are essential to foster access, use, and integration. If standards do not exist, theme owners will develop standards with input from partners. For example, the NRCS will continue to lead the development and maintenance of the SSURGO standard, and FSA will continue to lead the development of and maintenance of the CLU standard. The theme owners will also be responsible for ensuring quality and incorporating data updates and corrections.

4.6.1 Interoperability Standards

A key technology that provides the ability to access data from a variety of sources is provided through Open GIS specifications being developed by the Open GIS Consortium, Inc. (OGC). OGC is a not-for-profit organization that addresses the lack of interoperability among systems that process georeferenced data, and between these systems and mainstream computing systems. OGC's mission is to make georeferenced data behave like just another standard data type in systems of all kinds. To achieve that goal they develop standards and specifications that let data be access from a variety of sources that may not all have the same computing environment. See their Web site (www.opengis.org) for more information.

Products and services that conform to OGC specifications enable users to freely exchange and apply spatial information, applications, and services across networks, different platforms, and products.

The advantage of this approach is that each agency or data center can manage their own data in their own environment and share that data with others as appropriate. This eliminates having to manage datasets on partner agency data servers and bearing the burden for the data management and update of the data.

5.0 GIS and the Common Computing Environment

The GIS system is part of the overall SCA information system architecture. This architecture is described in *Common Computing Environment Information Architecture Version 5, September 2001*[10]. The architecture of the Common Computing Environment (CCE) system includes:

- unique and shared business applications
- common hardware such as personal computers, servers, printers, FAX, global positioning systems, digital cameras
- common software such as email, office automation, and GIS
- a common Local Area Network (LAN), Wide Area Network (WAN), and voice system that establishes the telecommunications network,
- a security and privacy system,
- a data management system.

GIS software is highly integrated with other software such as office automation and spreadsheet applications. Global positioning systems (GPSs), digital cameras, and personal digital assistants (PDAs) are used to collect and integrate data with GIS software. Networked data and application servers provide shared resources and a common environment from which Service Centers conduct business and support customer needs. Through the CCE, data are shared and accessed by staff and customers as appropriate. This common access and shared data brings employees, partners, and customers together, enabling consistent and easy access to consistently maintained data.

Certain geospatial data creation, data processing, data management, and exploration functions will be outside the scope of what can be expected of the Service Center employees. The size and complexity of SCA business applications requires a more sophisticated GIS and database management capability at the state, regional, national, and development center offices.

6.0 GIS Implementation

GIS implementation in SCAs has been driven by the agencies business and program needs and as has been mentioned, these business needs and programs are different, making coordination complicated. Agency business processes and requirements are also different, dictating different approaches to GIS implementation. However, even with these differences GIS implementation is being closely coordinated across all three agencies. The Service Center GIS Team works across all areas including application development and migration, telecommunications, security, data management and CCE to insure a coordinated approach. The GIS team has been very proactive in assuring a common GIS architecture. All three SCAs are deploying GIS using a common information technology infrastructure and are sharing a common set of standard geospatial data. They are also coordinating and sharing in GIS Training and Support.

6.1 GIS Software and Application Training

The magnitude of change necessary for GIS implementation requires a highly focused effort to train employees in the new software and processes.

In 1999, the GIS Software and Application Training Team developed a document entitled *Geographic Information System (GIS) National Training Strategy June, 1999*. [11] This training strategy included the following recommendations;

- Provide service center staff with GIS training and support to include:
  - GIS Concepts and Terms Training
  - GIS Core Training
  - GIS Customized Training (using USDA data)
- Use training materials representing program specific applications for each agency
- Support both CD-ROM (self-paced) and personnel training with employees
- Identify USDA business applications and business processes improved by GIS

To meet these needs, the GIS Training team developed:

- The customized portion of the Core Service Center GIS Training used for several pilots and subsequently for full Service Center implementation
- A Service Center GIS training strategy for both pilot sites and full implementation
- Effective and inexpensive GIS training methods
- A GIS support plan that included help desk support during piloting and full implementation

Beginning in early 2002, SCAs will use a combination of agency staff, contract support, and online tools to train agency staff in the use and application of GIS technology and spatial data. Efforts will focus on field staff using custom applications, GIS State and Regional staff who will provide support to the field, and national level institute and center staff. Existing training materials developed by contract support and agency staff will be used to support the development of standard documents. Efforts will focus on the development of program-specific exercises and data that best exemplify business needs at the different levels of the agencies.

6.2 GIS Support

To support GIS implementation, a network of the SCA staffs will be required. Expertise in hardware, software, programs, data, application development, telecommunications, and database development is critical to the long-term success of the effort. Several organizational levels of each of the agencies will provide support. The general roles and responsibilities are described in the following sections.

6.2.1 State Staff

GIS, Information Technology, and business support will be provided within the state structure by SCA staff. Typical assistance will include coordination with state and federal agencies, National Headquarters, National Centers, contractors, and the business help desk. State staff will also provide assistance for systems and programs using GIS as well as significant resources and expertise, such as regional planning and analysis. State-level staff will provide the first tier of the support structure for questions arising locally including:

- program specific questions,
- data development and access, and
- location and status of GIS-related documentation such as standards and training documents.

6.2.3 Help Desk

The Help Desk is critical to continued use and application of GIS by the Service Center Agencies. Help Desk staff will provide the second tier of the support structure for questions arising locally including:

- hardware and software,
- telecommunications, and
- software applications.

Complex questions will be logged and directed to experts at either state or national offices. For GIS software questions that cannot be answered by the Help Desk, there will be 15 authorized callers to the ESRI help desk. These authorized callers will be at the SCAs three Help Desks and at National Headquarters and at APFO, NCGC, KCMO and ITC.

A detailed FAQ and searchable database will support those users who are more familiar with the technology and are able to diagnose and remedy technical issues with a minimum amount of assistance.

6.2.2 National Headquarters and National Centers

National Headquarters and National Centers such as NCGC, APFO, KCMO, and ITC are providing assistance in the coordination of data development, data integration, data packaging, tool development, hardware support, telecommunications, standards development, and data delivery. These functions are similar to those of the state staff; however, the area of responsibility is the nation rather than the state. Contractor staff is used at these locations to assist in hardware and software development, and to staff the national help desk.

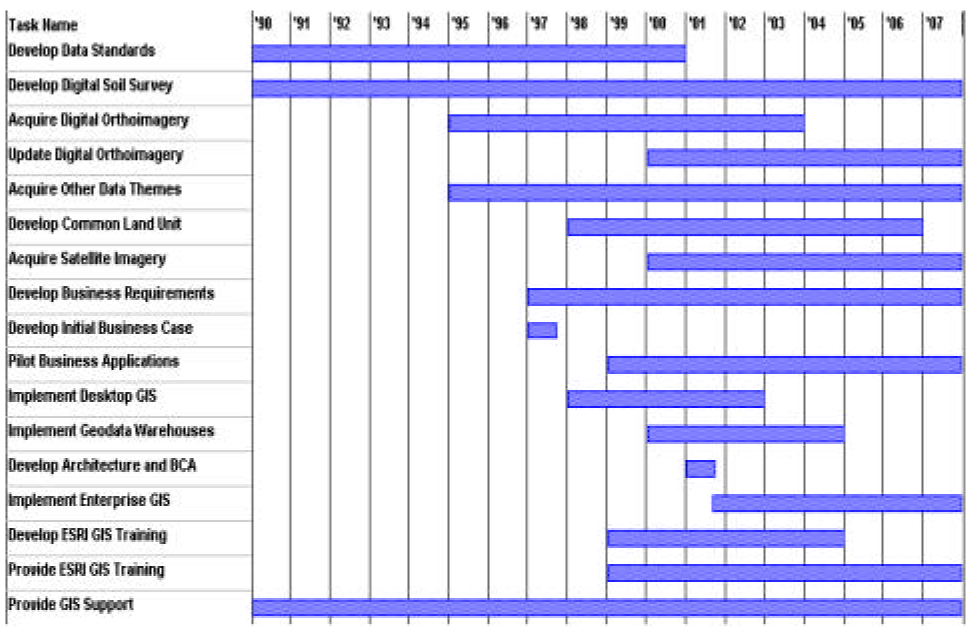
6.3 GIS Software Distribution and Licensing

GIS software and required license files will be distributed and maintained through SCA central support located in ITC. ESRI will deliver all software to this location for further distribution to State, Regional and National Headquarters and Center offices.

6.4 GIS Timelines

Exhibit 6-1 presents a high-level schedule of the SCAs GIS timelines. This chart shows the long-term development of GIS capabilities. Considerable early effort was devoted to developing critical data and data standards, and this effort continues today. However, the SCAs began a concerted effort to implement GIS in 1997. This schedule will continue to be revised based on resource availability. Future implementation progress will largely depend on speed of data development.

GIS TIMELINES
Exhibit 6-1



7.0 Conclusion

Integrating GIS technology into SCA business operations is crucial for Service Centers to provide timely program delivery, reduce customer burdens, and remain cost effective. As customers increasingly apply GIS technology within their own operations, they expect USDA Service Centers to deliver products and services that take advantage of similar technology. Service Centers will, through the use of GIS and reengineered or improved processes, be able to change business operations and deliver quality products and services.

GIS will benefit service centers and customers by:

- Improving core processes
- Improving customer service
- Building a major part of the national spatial data infrastructure for rural America
- Helping improve the quality of life for America

The SCAs have made a great deal of progress in developing and implementing GIS since they began their partnership and since the publication of the first USDA Service Center GIS Strategy in August 1998. This original strategy indicated that they would incrementally implement GIS. The SCAs approached GIS implementation from a business-driven perspective, and began data development very early with the goal of creating common shared geospatial data. The SCAs identified key business processes, including shared processes that should be reengineered or improved, and have completed much of that reengineering. Finally, they partnered in the acquisition of the shared Common Computing Environment. In the case of GIS, the SCAs expanded the partnership for GIS acquisition to include all of USDA. This department-wide acquisition provided large cost savings for the SCAs and other USDA agencies. As a result, much of the information technology infrastructure is in place. Good progress has been made on data development, especially in developing the critical themes, orthoimagery, soils, and CLU, and data standards are now in place. Numerous GIS applications have been implemented that are improving customer service. The SCAs are well on their way towards implementing GIS. However, much work remains to be completed, especially in the development of CLU and soils data. The SCAs will continue to incrementally implement GIS as these data are completed.

8.0 References

(1) Food and Agriculture Policy – Taking Stock of the New Century, September 2001

(2) USDA Geospatial BPR Report, August 1997

(3) USDA Service Center Business Process Reengineering Business Case, September 1997

(4) GIS World, April 1998

(5) 2000 E-Government Survey Conducted by the National Association of Counties

(6) Requirements and Cost Benefit Analysis, Managing Geospatial Data for Better Program Delivery, A Service Center Initiative, NRCS/SAIC, June 2001

(7) USDA Geodata Business Plan, February 2001

(8) Geospatial Data Acquisition, Integration and Delivery National Implementation Strategy Plan, September 1999
Geospatial Data Acquisition, Integration and Delivery National Implementation Strategy Plan, September 1999(9).
(9) Implementation of Geospatial Data Warehouses, October 2000

(10) Common Computing Environment Information Architecture Version 5, September 2001

(11) Geographic Information System (GIS) National Training Strategy June, 1999

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Appendix A. Partnerships

The broad implementation of GIS technology cannot be successful without strong partner relationships with other federal, state, and local government entities, and the private sector. These partnerships foster the development of framework and other data themes common to GIS implementations. Joint funding is necessary to build expensive geospatial themes such as orthoimagery. Data content standards must be developed by various federal agencies, in cooperation with state and local partners and customers, to foster joint funding and data sharing. Information technology interoperability standards must be developed and implemented in a public and private partnership, to facilitate geospatial data sharing. GIS cuts across all organizational lines, jurisdictions, boundaries, and public and private organizations. It pulls together people, technology, and data to create new data and partnerships. Partnerships are not new for GIS; in fact, over the last 20 years, GIS has been bringing these groups together. These partnerships are increasing especially at the state and local level. The SCAs have been leaders in developing and participating in the partnerships described in the following sections.

A.1 The Federal Geographic Data Committee

The Federal Geographic Data Committee (FGDC) is an interagency committee that promotes the coordinated use, sharing, and dissemination of geospatial information on a national basis. The Office of Management and Budget (OMB) established the FGDC in 1990 to coordinate the federal government's development of a National Spatial Data Infrastructure (NSDI). The FGDC is composed of representatives from 17 cabinet-level and independent federal agencies. The Steering Committee sets high-level strategic direction for the FGDC as a whole. The Coordination Committee advises on the day-to-day business. FGDC committees are organized by data categories such as soils, wetlands, and base cartographic. Working Groups are organized by crosscutting themes, such as standards, clearinghouse, and earth cover.

The USDA is an active participant in the FGDC. The Office of the Undersecretary for Natural Resources and the Environment represents USDA at the Steering Committee level. The SCAs are represented at the Coordination Group level. USDA agencies are involved in many of the subcommittees and working groups to help develop interagency standards, foster the development of collaborative programs, and promote data sharing.

The FGDC has authority to set geospatial information standards for federal agencies. The SCAs continue to follow the FGDC standards development process for the geospatial themes identified in this strategy document. The SCAs continue to coordinate with FGDC in the development of data themes for which other federal agencies have leadership responsibility.

A.2 Key Federal Agency Partners

The SCAs and USDA rely heavily on the cooperative nature of the geospatial community to generate and distribute data to support applications. Many critical partnerships exist between the agencies and other federal agencies, local and state governments, as well as private industry. Several of the partners are described below.

A.2.1 United States Geological Survey

The U.S. Geological Survey (USGS) is responsible for providing the nation with geologic, topographic, biologic, and hydrologic information. This information comprises maps, databases, and reports containing analyses and interpretations of water, energy, mineral, and biological resources, land surfaces, marine environments, geologic structures, natural hazards, and the dynamic processes of the earth. The USGS National Mapping Division administers the National Mapping Program, which distributes maps, images, spatial data, remote sensing data, and related information. Funds are available for partnership arrangements to develop geospatial information that meets USGS and partnering agency requirements.

USGS also coordinates federal topographic mapping and survey activities and the development of the NSDI through executive leadership of the FGDC. Besides providing Secretariat support for FGDC, they have federal leadership for the geospatial theme categories of base cartographic (including digital orthoimagery), elevation, and hydrography. The USDA will continue to work closely with USGS to foster the development of these data themes to meet SCA needs.

A.2.2 Forest Service

The Forest Service (FS) manages public lands in 155 national forests and 20 national grasslands. National forests encompass 191 million acres of land (an area equivalent to the size of Texas). A forest supervisor and several ranger districts manage each forest. GIS technology is being implemented at the forest supervisor and ranger district level. The FS continues to migrate all national forests to a common GIS environment. Common or “core” geospatial themes have been identified as required themes for effective GIS implementation. Many of these themes coincide with SCA themes. Whenever projects cut across the geographic boundaries of public and private lands, SCAs will continue to collaborate with the FS so that geospatial information is compatible and in accordance with standards.

A.2.3 Bureau of Land Management

The Bureau of Land Management (BLM) manages approximately 265 million acres of public lands and 300 million acres of mineral resources found under lands administered by government agencies or owned by private interest. These lands are located primarily in the 11 western states and Alaska. Each of these states has a state office and a number of sub-offices to administer programs such as resource management planning, energy and mineral leasing, land sales and acquisition, grazing and range management, and cadastral survey. The BLM is implementing GIS technology as part of their National Integrated Land System (NILS) project. The goal of NILS is to provide a process to collect, maintain, and store parcel-based land and survey information that meets the common, shared business needs of land title and land resource management. USDA’s coordination efforts will include ensuring that projects that cut across geographic boundaries of public and private lands have geospatial information that is compatible and in accordance with standards.

A.3 Key State and Local Partners

State- and county-level partnerships will be important to the success of this GIS strategy. Many of the state agencies are actively using GIS technology, and they develop and maintain some of the geospatial data themes useful for the SCAs. A number of county governments are also actively using GIS technology and many are developing and maintaining geospatial data themes at a higher level of resolution. USDA cost-share and work-share agreements with state and county governments will be very important for acquiring and maintaining many of the common geospatial data themes identified in the strategy.

At the national level, SCAs will partner with several organizations representing state and county-level entities. The key organizations we will partner with are:

- the National States Geographic Information Council (NSGIC)
- the National Association of Counties (NACo)
- the National Association of Conservation Districts (NACD)
- National Association of Resource Conservation and Development Councils (NARC&DC)

The support and collaborative efforts of these organizations and the local entities they represent are critical to the successful implementation of GIS in the SCAs.

A.3.1 National States Geographic Information Council

The National States Geographic Information Council (NSGIC) is an organization of states committed to efficient and effective government through the adoption of geospatial information technology. Members of NSGIC include delegations of senior state GIS managers from across the U.S. The NSGIC membership includes nationally and internationally recognized experts in GIS, as well as data and information technology policy. The NSGIC is a member of the FGDC Coordination Group and provides leadership and a voice for state GIS concerns and policy implications.

A.3.2 National Association of Counties

The National Association of Counties (NACo) is a national organization representing the counties across the country. NACo serves as a national advocate for the 3,200 counties and is active in various interests such as the environment, sustainable communities, volunteerism, and information technology. County government provides most public services such as schools, hospitals, emergency 911 assistance, crime prevention, courts, roads, parks, and recreation. To administer these and other programs, county governments have mapping programs and many have GIS capabilities and experience. The SCAs consider county government a critical partner in the development and sharing of geospatial information and the development of collaborative mutually beneficial GIS projects.

NACo is an active member of the FGDC Coordination Group. NACo recently formed a Geospatial Information Systems Committee to help coordinate the increasing county GIS activities.

A.3.3 Conservation Districts

Conservation Districts are local units of government responsible for the soil and water conservation work within their boundary of approximately 778 million acres of private land. The districts' role is to increase voluntary conservation practices among farmers, ranchers, and other land users. Volunteers and ongoing partnerships with USDA and state and local agencies are the key to enhancing natural resources. Districts obtain funding from federal, state, and local sources as well as fundraisers.

Though less than half of the district offices are using GIS technology, primarily owing to resource limitations, their continued support and partnership with USDA is critical to the success of programs and resource management at the local level. Where available, districts use the technology for farm planning, application of watershed models, developing soil interpretations, urban planning, developing best management practices, water quality analysis, forest management, and wildlife management. To support the implementation and use of technology, NRCS is working with district staff to ensure access to hardware, data, and applications.

The Conservation Districts are represented by a national organization called the National Association of Conservation Districts (NACD). Districts also work with various other organizations such as the National Association of State Conservation Agencies (NASCA) and the National Association of Resource Conservation and Development Councils (NARC&DC).

A.3.4 Resource Conservation and Development Councils

Resource Conservation and Development (RC&D) Councils are local units of government that encourage land conservation and utilization, accelerated economic development, and improvement of social conditions to foster a strong local economy. The Councils' resource committees, with assistance from federal, state, and local agencies, collect information about community concerns and recommend solutions to achieve goals and objectives.

The NARC&DC has recently been formed to represent the interests of local and state Councils at the national level. The USDA RC&D Working Group and the NRCS RC&D staff works closely with NARC&DC to assure good communication and cooperation of all program activities.

A.4 Key Industry Partners

Successful GIS implementation will require the efforts of private industry partners, as described in the following sections. The SCAs will continue to actively seek out these partnerships where it is mutually beneficial, with appropriate consideration to open access and competition.

A.4.1 Open GIS Consortium (OGC)

The need for the OGC grew out of widespread recognition that geographic data were very difficult to share among systems, and that customer application geoprocessing software would not inter-operate among systems. To help resolve this problem, geoprocessing specifications are developed through a consensus-building process that is open to the industry. All the major GIS, database, and information technology vendors are members of OGC and, as a result, industry develops software in compliance with specifications and subsequently achieves interoperability. USDA SCAs are supportive of these geoprocessing interoperability goals and will continue to participate with OGC and industry representatives.

A.4.2 Environmental System Research Institute (ESRI)

The SCAs have established a business relationship with Environmental System Research Institute (ESRI) as the GIS software vendor for all of USDA to facilitate GIS implementation.

A.4.3 Private Sector

Private-sector GIS and related technology companies continue to grow and increase. The SCAs are using private-sector expertise in a number of areas including data development, application development, architecture development, and infrastructure development. The Resource Data Gateway (Lighthouse) Project is a prime example of an application created in a partnership between the public and private sectors, in this case, NRCS, Microsoft, and Compaq. Neither the public nor the private sector has the lead in understanding how to deliver GIS solutions, and thus close partnerships are required. The SCAs must continue to explore innovative ways to partner. These could include sharing the costs, risks, and cost-recovery means for the SCAs to generate revenue from GIS data that are created in partnership with private industry.

A.4.4 Universities

The SCAs have a long history of cooperative efforts with universities. These early efforts included research and development in digitizing and data capture, application development, and training. Land Grant Universities were heavily involved in the Soil Survey digitizing through the National Cooperative Soil Survey. Universities continue their involvement in these efforts today.

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Appendix B. Results of Business Process Reengineering (BPR) and Improvement Projects

Business Process Reengineering (BPR) was a significant effort to improve customer service and customer satisfaction by Service Center staff. USDA began implementing BPR projects to support the needs of the Service Center Strategic Plan, National Performance Review/Government Performance Results Act (NPR/GPRA), and the Clinger-Cohen Act of 1996.

By exploring areas where Service Centers can support customer needs with reduced staff, and implement new technologies, the SCAs have begun to streamline operations. Projects supporting GIS activities or influences by geodata are listed in the following sections.

B.1 Commodity Reporting Project (Sponsor - Farm Service Agency)

This project will be will be used to collect commodity data for SCA programs. FSA currently collects this information through its acreage reporting system (FSA-578). The system will enable commodity reporting through the selection of producer/customer and their associated CLU's. Staffs record reported commodity by CLU. Up front the user chooses program(s) for which the report is intended. This program selection determines the required commodity attributes to be reported.

The Commodity Reporting Project will provide a national commodity reporting database that can be queried by the Service Center agencies, and other USDA agencies and their partners and thus reduce the customers reporting requirements. This national commodity reporting database will include land cover, land use, compliance, and partnership activity. National deployment will be phased in with the delivery of CLU's to Service Centers.

B.2 Common Land Unit Maintenance Tool (Sponsor - Farm Service Agency)

The most critical component in the successful implementation of GIS for FSA is development of the common land unit (CLU) data layer. The CLU layer will ultimately include all farm fields, rangeland, and pastureland in the United States. Data are currently maintained at the Service Centers with annotations on hardcopy aerial photography. In conjunction with digital imagery and other data, FSA will use the CLU to manage Farm Service programs, monitor compliance, and respond to natural disasters, among other tasks.

Because of the dynamic nature of CLU, it is imperative that the data be maintained. FSA has been developing user-friendly tools to allow the Service Centers to maintain and use these data. These tools customize and enhance ESRI ArcView, and include tools for editing CLU boundaries, adding wetland point data, adding CRP contract information, labeling polygons, and creating maps for producers. Additional tools are being developed to automate the 35-mm slide compliance function. Future development will involve linking the tools to the SCIMS and national commodity reporting databases.

B.3 Compliance Project (Sponsor - Farm Service Agency)

The purpose of the Compliance Project is to reengineer the way FSA completes compliance activities. The project looks at how FSA obtains an image to do compliance work, how it does ground compliance, and how it selects farms for spot checks. FSA is looking at several methods of obtaining an image; satellite, digital image (digital camera), 35mm scanned image, rectified digital image (1 meter and 2 meter), and color infrared digital images. The selection process for spot checks and using GPS for ground measurement will be analyzed in early 2002. The initial testing of imagery and digital compliance methods were completed in 2001 and are being analyzed. A national compliance plan of work is being developed for 2002. National deployment will be phased in with the delivery of CLU's to Service Centers.

B.4 Customer Service Toolkit (Sponsor - Natural Resources Conservation Service)

The Customer Service Toolkit (CST) provides NRCS and other USDA SCA employees with tools to manage our customer information, conservation plans, plan maps, and soils inventories. CST uses functions provided in commercial software applications such as Microsoft Outlook, Microsoft Access, Microsoft Excel, and ESRI ArcView. Toolkit programming loosely couples these commercial packages and extends their utility.

The CST is customer focused to provide high quality conservation plans and plan maps. It can be used in the field or in the office. It makes use of available GIS data and displays it in a very usable format. Conservation plans are produced in Microsoft Excel, which provides compatibility with most of our customer's technology. Products can be delivered via disk, paper, or E-mail.

B.5 Demographic and Business Analysis Project (Sponsor - Rural Development)

The purpose of the Demographic and Business Analysis business process reengineering (BPR) project is to provide USDA Service Center, State Office, and National Office staffs and partner organizations with easy access to current, up-to-date demographic data integrated with programmatic data for analysis and mapping. This BPR project includes the development of a system of demographic information and automated tools that can be used nationwide to analyze customer information, agency facilities, services needed, services provided, and other business management activities. This project was piloted in five RD state offices (California, Texas, North Carolina, Pennsylvania, and Vermont).

RD loaded its single-family housing data, both direct and guaranteed, into a data warehouse for the pilot. These data are refreshed daily. Census data are also stored in the data warehouse. These data were not useful in their raw format, so RD created its own tools to transform the data into "data cubes." This transformation has enabled the census data to be integrated with the program data for easy analysis and reporting. This will assist RD in determining the demographics of who is being served and how well it is serving them. RD plans to expand its data warehouse to include comprehensive demographic data and related information of interest to all SCAs.

B.6 Easements Toolkit (Sponsor - Natural Resources Conservation Service)

The NRCS's Easements Toolkit leveraged the functions developed for Customer Service Toolkit (CST) to provide a suite of tools that can be used in developing conservation products for easements, and monitoring easements for various agency programs. An additional product, the Environmental Easements Web Toolkit, is under development for Web implementation in February 2002.

The Easements Toolkit assists field conservationists in developing preliminary and final wetland restoration plans and contracts for the Wetland Restoration Program (WRP). The Easements Web Toolkit is in the design and development stage. The product will enable users to digitize WRP easements on the Web, enter wetland and habitat data, and create custom maps and reports.

B.7 Land Cover Project (Sponsor - Farm Service Agency)

The Land Cover project has been completed and is in deployment. This project selected 10 standard federal land cover types to be used by the Service Centers in association with CLU boundaries. These land cover types are defined in FSA handbook 8-CM and are provided to the Service Centers where CLU's have been digitized. USGS data are used to initially attribute the CLU with these land cover types. A maintenance tool has been developed by FSA to allow Service Center staff to easily update these land cover types with more accurate information.

B.8 Resource Data Gateway - Lighthouse Project (Sponsor - Natural Resources Conservation Service)

The Lighthouse Project is a cooperative research agreement between Microsoft, Compaq, and USDA-NRCS with the intent to build a "proof-of-concept" enterprise-class geospatial data delivery system and to implement Web-based geospatial software applications. The Lighthouse Project brings together three ongoing business process reengineering (BPR) projects to manage and deliver large-scale enterprise data from USDA and other federal data providers using commercial off-the-shelf technology.

The vision of the Gateway is to provide easy access and delivery of geospatial environmental data to NRCS customers and the general public. The goal is to deliver geospatial data to anyone, anywhere, anytime. Soil Data Viewer is a Web-based geospatial application that uses the Gateway to provide NRCS personnel and the public with the ability to create custom soils maps and reports over the Internet for natural resource assessment and planning. The Lighthouse is currently operational, and users can locate their area of interest and order data through an interactive process, then download geospatial datasets onto their local hard drive. The Gateway is fully integrated with the National Cartographic and Geospatial Center in Fort Worth, TX where the data are stored.

B.9 Service Center Information Management System –(Sponsor - Farm Service Agency)

The Service Center Information Management System (SCIMS) is an effort to implement an agency-independent database to capture and store core customer information to be used by the SCAs. The database contains name and address information for each customer, plus other information determined to be common to all SCAs. This system will provide a single point of access for information on SCA customers.

In addition to the name and address information, customer-to-land relationships will also be supported by this system. Customer relationships to basic farm and tract information will be established along with ties to the CLU for those counties that have digitized data available. An interface will be provided to the CLU Maintenance Tool that will allow editing of CLU boundaries and attribute information resulting from farm maintenance and reconstitution activities in the Service Centers. This interface provides an interim method for updating these data until the Farm Maintenance and Reconstitution business processes are migrated to the CCE environment. The core implementation of SCIMS using customer applications will occur in late 2001.

B.10 Wetland Determinations Toolkit (Sponsor - Natural Resources Conservation Service)

The Wetland Determinations Toolkit leveraged the functions developed for Customer Service Toolkit (CST) to provide a suite of tools that can be used in wetland compliance programs. The Toolkit uses many of the same tools as CST, including GIS. The Wetland Determinations Toolkit was released in November 2000.

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