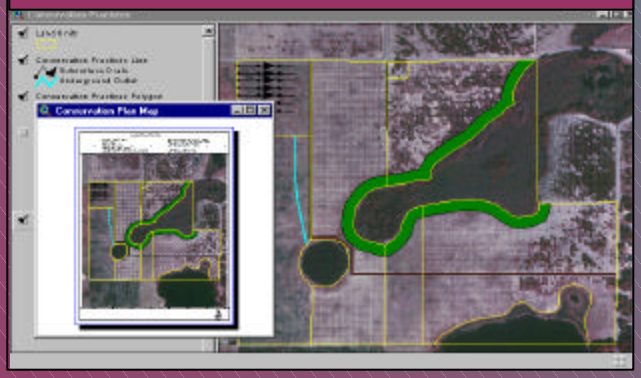
United States Department of Agriculture

USDA Service Center
Geographic Information System (GIS) Strategy

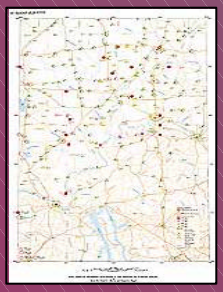
August 18, 1998

Natural Resources Conservation Service
Conservation Plan



Farm Service Agency
Common Land Units and Orthophoto

Rural Development



Housing Loans

+

Flood Zones

+

Customer Database

Product = Flood Insurance Letter

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EXECUTIVE SUMMARY

The U.S. Department of Agriculture (USDA) Service Center Geographic Information System (GIS) Strategy establishes a common agreement and understanding between service center agencies and provides a direction for all levels (i.e., field, state, and national offices) to implement GIS technology in service centers.

GIS use is on the rise among local governments. **According to the April 1998 edition of *GIS World,* 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.** In order to best serve their customers and be in line with modern business practices, USDA service centers must begin implementing GIS.

Integrating GIS technology into service center 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 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 (NSDI) "digital earth" for rural America
- Helping improve the quality of life for America

Additionally, of all the program delivery Business Process Reengineering (BPR) projects, GIS has the highest potential return on investment. Over 34 percent (or $168 million) of the calculated BPR savings comes from GIS implementation. For example, it is estimated that $34.5 million in annual savings can be realized by using GIS for land eligibility determinations and $38.1 million in savings can be achieved by using GIS to manipulate spatial data. (See Section 13 for detailed information.) Final cost savings may be even higher because current calculations only consider redesign of some service center business processes.

The GIS project savings will be achieved by satisfying the following implementation objectives:

- Reengineering time consuming processes to take advantage of GIS
- Establishing a national program to digitize common land units
- Completing development of digital orthophoto quadrangles (DOQs) and the Soil Survey Geographic Database (SSURGO)

- Piloting before deployment to ensure successful nationwide implementation and make efficient use of service center staff time
- Acquiring, integrating, and delivering data so it makes it easy for service center staff
- Providing cost effective and efficient training in GIS and new business processes
- Measuring and documenting the benefits

Using GIS to conduct service center business is dependent on the availability of accurate geospatial information. The GIS community commonly refers to the various types of data categories as data layers or themes. The USDA community has identified 19 themes which are common and desirable to successfully administer programs and service customers into the next century.

Four of these 19 themes have been identified by one or more service center agencies as **critical** for GIS technology to support the service centers' mission. The following four data themes are the most important; without them, service center agencies cannot effectively use GIS technology to create products for customer, partner, or internal use:

- Orthoimagery
- Common land unit
- Soils
- Cultural and demographic data

Although the critical data themes are not scheduled to be completely implemented until the year 2004, incremental data and GIS capability will provide large business benefits to service centers and their customers. Some of these benefits have already been documented in the USDA Geospatial BPR Report dated August 29, 1997. These benefits will accrue immediately to those counties with the implementation of reengineered business processes with GIS capabilities, even before full implementation, and include:

- Ability to use geospatial information to make informed business decisions
- Access to current, accurate geospatial information 80 percent faster than traditional manual methods
- 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
- Improved map quality

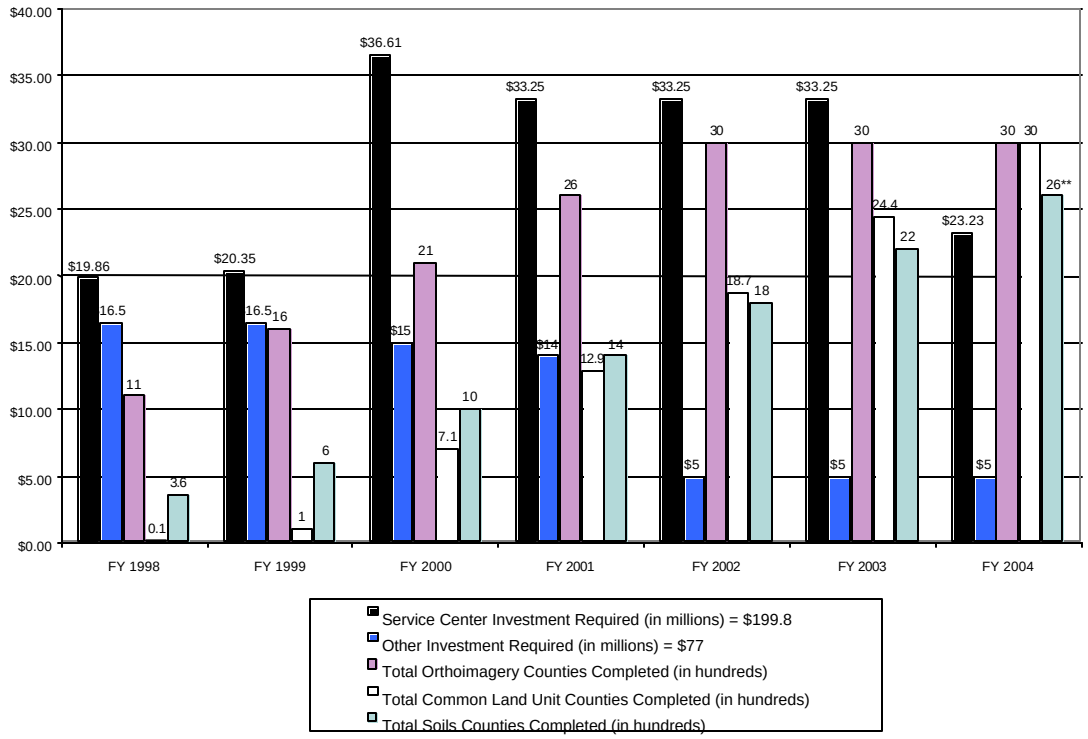
Refer to Section 3, Incremental Implementation of desktop GIS at the Service Center, for detailed business benefits and cost savings associated with GIS implementation.

The chart on the following page, Projected Completion of Critical GIS Themes, identifies the number of counties (out of 3,141 total[1]) completed per fiscal year and the total costs to implement orthoimagery, common land unit, and soils. Cultural and demographic data

[1] Per the Bureau of Census Internet home page.

has already been acquired by Rural Development (RD) and, therefore, is not included in the chart.

PROJECTED COMPLETION OF CRITICAL GIS THEMES*



* These numbers include the entire U.S. and its territories and affiliated nations.
** Some counties, particularly Federal lands, may not have digitized soils.

The total investment required from USDA and other Federal, state, and local partners to implement the critical themes is listed below.

USDA investment required = $199.8 million
Other Federal, state, and local investment required = $77 million
Total investment required = $276.8 million

This translates into the following average USDA costs per county to implement each of the critical themes:

- Orthoimagery - $17,356
- Common land unit - $18,879
- Soils - $23,878

To ensure GIS is successfully implemented in service centers, geospatial information must be acquired and/or developed using a prioritization process, as well as integrated and packaged prior to delivery to service centers. Geospatial information will be acquired from, and may be developed and maintained at, various locations in agencies and institutions. Service centers may acquire other data from local sources. These data are at various levels of resolution, scale, age, and geographic coverage. Some data may overlap or have missing components. Additionally, the acquired data will be in various formats, projections, datums, and media and will need to be converted before delivery to service centers. Significant effort will be needed to integrate and deliver data themes and achieve a useful product for service center use.

This effort will include developing, adopting, and maintaining data standards. A service center Shared Information System perspective will be developed and geospatial information will be integrated with other data and managed in a database management system (DBMS). Close coordination with the Service Center Implementation Team (SCIT) Data Management Team will be required in order to be successful.

These and other issues will be resolved through the efforts of SCIT BPR projects. Information collected during pilot testing of reengineered business applications will be used to refine the strategy for a phased, national deployment. The USDA Service Center Geographic Information System (GIS) Strategy will be updated to reflect changes that result from pilot testing.

This strategy is dependent on the implementation of the Common Computing Environment (CCE) in service centers. The current computing systems of the agencies are unable to support the use of GIS and the required geospatial data. This strategy recommends an incremental implementation of desktop GIS starting in fiscal year (FY) 1999 to enable service centers to take full advantage of digital soil and orthoimagery investments.

LIST OF ACRONYMS

ALMRS	Automated Land and Mineral Record System
BLM	Bureau of Land Management
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
CRP	Conservation Reserve Program
DBMS	Database Management Systems
DEMs	Digital Elevation Models
DOQs	Digital Orthophoto Quadrangles
DOT	Department of Transportation
DRG	Digital Raster Graphics
DVD	Digital Video Disk
ECWG	Earth Cover Working Group
EDP	Employee Development Plan
EEOC	Equal Employment Opportunity Commission
EPA	Environmental Protection Agency
FAC	Food and Agricultural Council
FAQ	Frequently Asked Questions
FEMA	Federal Emergency Management Agency
FGDC	Federal Geographic Data Committee
FISs	Flood Insurance Studies
FOIA	Freedom of Information Act
FS	Forest Service
FSA	Farm Service Agency
FTEs	Full-time Equivalents
FTP	File Transfer Protocol
FWS	Fish and Wildlife Service
FY	Fiscal Year
GIS	Geographic Information System
GNIS	Geographic Names Information System
GPS	Global Positioning System
HEL	Highly Erodible Land
HR	Human Resources

LIST OF ACRONYMS (Cont'd)

IDP	Individual Development Plan
I/O	Input/output
IT	Information Technology
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
NCSS	National Cooperative Soil Survey
NDOP	National Digital Orthophoto Program
NFIP	National Flood Insurance Program
NID	National Inventory of Dams
NMAS	National Map Accuracy Standard
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
SCIT	Service Center Implementation Team
SSURGO	Soil Survey Geographic Database
UCAN	Unified Climate Access Network
USACE	United States Army Corps of Engineers

LIST OF ACRONYMS (Cont'd)

USDA	United States Department of Agriculture
USGS	United States Geological Survey
WAN	Wide Area Network
WRP	Wetlands Reserve Program

1. Introduction

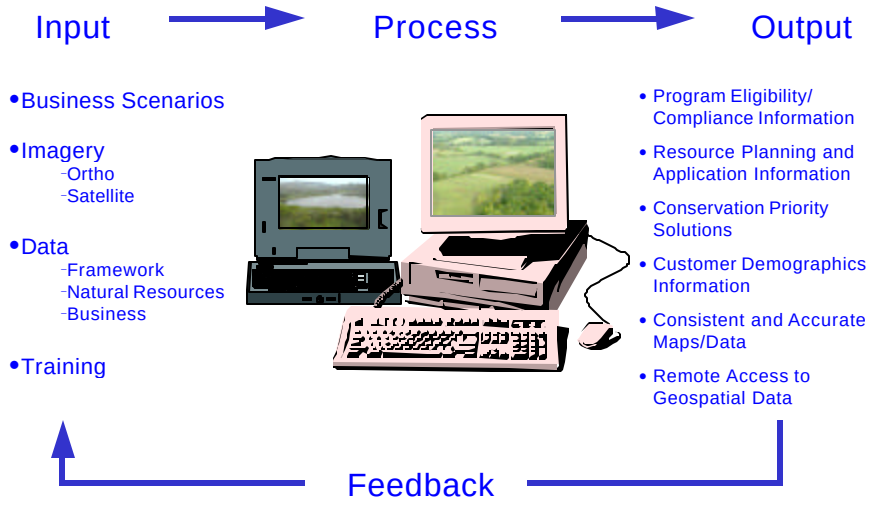
The U.S. Department of Agriculture (USDA) service center concept is a cornerstone of reorganization efforts begun under the Reorganization Act of 1994. USDA service centers will offer high-quality "one-stop" service to customers of all service center agencies—the Farm Service Agency (FSA), the Natural Resources Conservation Service (NRCS), and Rural Development (RD).

For the concept of "one-stop" service centers to succeed, the Geographic Information System (GIS) and geospatial information need to be available across service center agencies as one integrated system. This system must service all agencies by providing common access to consistent data and geospatial business processes among service center locations and service center agencies.

GIS will most directly benefit four business areas: (1) Farm and Community Programs, (2) Eligibility/Compliance, (3) Conservation, and (4) Resource Inventory and Assessment. However, because GIS will immensely improve service center operations and program delivery, the impact of GIS will be experienced in all service center business areas.

GIS improves service center operations by eliminating spatially inaccurate and expensive paper-based maps and information, eliminating duplicate sets of information and processes, and providing easy online access to geospatial information. These improvements and the service center GIS system will enable the development of reengineered business processes that improve customer service and reduce agency costs. Exhibit 1-1, Service Center Operations with GIS, depicts the potential outputs of applying GIS to daily service center operations.

SERVICE CENTER OPERATIONS WITH GIS
Exhibit 1-1



GIS will automate numerous business processes and enable service centers to:

- Access common customer land unit information
- Access framework data (e.g., orthoimagery, streams, roads, political boundaries, etc.)
- Access natural resource data (e.g., soil, vegetation, climate, wetlands, watershed boundaries, etc.)
- Assess natural resource status and trends more accurately
- Combine partner agency business processes into shared processes and information
- Identify areas where service center programs have been applied
- Identify conservation priority areas more accurately
- Identify customer base demographics
- Identify disaster and risk areas quickly and accurately
- Identify office locations to best serve customers
- Identify under-served areas
- Improve customer service
- Provide a comprehensive conservation options analysis for landowners and communities
- Report conservation application results more accurately

GIS is expected to result in the customer receiving data (i.e., maps) in a more accurate and timely fashion, spending less unproductive time at the service center, and receiving quicker USDA response. GIS will also affect significant data sharing between various local, state, and Federal Governments and private entities. This will enable the construction of a geospatial information infrastructure on which other local community activities such as search and rescue operations, environmental protection, community

planning, county sanitation activities, tax equalization, and natural resource assessment and management can be based.

GIS will also capitalize on the major investments in digital soils and orthoimagery that FSA and NRCS are currently making. The service centers have not yet been able to realize investment benefits because they lack desktop GIS. This strategy recommends an incremental implementation of desktop GIS starting in fiscal year (FY) 1999 to enable service centers to take full advantage of digital soil and orthoimagery investments.

Of all the program delivery Business Process Reengineering (BPR) projects, GIS has the highest potential return on investment. Over 34 percent (or $168 million) of the calculated BPR savings comes from GIS implementation. Final cost savings may be even higher because current calculations only consider redesign of some service center business processes.

The GIS project savings will be achieved by satisfying the following implementation objectives:

- Reengineering time-consuming business processes, such as the Conservation Reserve Program (CRP)
- Establishing a national program to digitize common land units
- Completing the development of digital soils and orthoimagery
- Piloting before deployment to ensure successful nationwide implementation and efficient use of service center staff time
- Establishing a process to acquire, integrate, and deliver geospatial information to service centers without adversely impacting employee time
- Partnering with other Federal, state, and local agencies and the private sector to build required data themes and geospatial information access tools
- Providing effective and cost-efficient training in the use of GIS and new geospatial processes
- Measuring implementation benefits

The GIS implementation strategy provides a plan to meet these objectives and improve GIS program delivery processes and customer service by implementing desktop GIS at over 2,500 service centers. The strategy builds on the USDA and service center strategic plans, the Service Center Business Integration Strategy, the USDA Geospatial BPR Report, and prior GIS pilot projects. It lays out a GIS implementation strategy that is consistent across agencies and provides the spending goals for acquiring geospatial themes, and an infrastructure for establishing priorities for data acquisition and development. The strategy further identifies technical issues involved with implementation, major milestones, and potential GIS BPR projects. Finally, the implementation strategy furnishes a direction for improvement that will be flexible to the changing business envisioned over the next five to seven years.

2. Business Requirements for GIS

Integrating GIS technology into service center 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 processes, be able to change business operations and deliver quality products and services.

Service centers make a significant contribution to USDA's ability to achieve success in the following mission areas:

- Farm and Foreign Agricultural Services
- Natural Resources and Environment
- Rural Development

Each mission area has a set of associated core processes. A core process is a high level view of the activities an organization performs to conduct its business. Not surprisingly, there is a direct link between improving performance at the service center process level and achieving USDA strategic goals and objectives. In acknowledgment of core process management, the Office of Management and Budget (OMB) requires Federal agencies to ensure proposed investments in major information systems will support core process functions. GIS will support the following core processes.

- For the FSA mission area—Farm and Foreign Agricultural Services:
  - Farm income support (loans/payments)
  - Stewardship of soil, water, air, and wildlife resources
  - Manage Commodity Credit Corporation's (CCC) commodity acquisition, procurement, and storage activities

- For the Risk Management Agency (RMA) mission area - Farm and Foreign Agricultural Services:
  - Risk management tools development
  - Program delivery evaluation

- For the NRCS mission area—Natural Resources and Environment:
  - Stewardship of natural resources
  - Resource inventory and assessment
  - Resource planning and application
  - Research and development
  - Results evaluation and outcome measurement

- For the RD mission area —Rural Development:
  - Assessing
  - Investing

- Servicing
- Value reporting

To satisfy customer needs and achieve success in their respective mission areas, service center agencies administer programs and provide information to a diverse customer population that includes farmers, landowners, community representatives, and local governments. According to the USDA Strategic Plan 1997-2002, the Department's "Mandatory programs, which include the majority of the food assistance programs, farm commodity programs, and a number of conservation programs, account for three-fourths of the USDA [$60 billion operating] budget."[2] The value of program benefits that are delivered, distributed, or awarded through service centers nationwide is an estimated $26 to $28 billion annually.

Service centers administer programs by performing specific business processes requiring geospatial information to be used, analyzed, updated, and maintained. Exhibit 2-1, Geospatial Data Usage[3], presents examples of geospatial information used by some representative agency programs. This is not a complete list of programs or data.

GEOSPATIAL DATA USAGE
Exhibit 2-1

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

[2] USDA Strategic Plan 1997-2002, page 1-3.
[3] USDA Geospatial BPR Report, August 29, 1997, Appendix L.

GEOSPATIAL DATA USAGE
Exhibit 2-1 (Cont'd)

Programs	EXAMPLES – Geospatial Data							
	Soils	**Land Units**	**Wetlands**	**Tracts**	**Easements**	**Conservation Practice Location**	**Conservation Priority Areas**	**Watershed Boundaries**
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 Relending 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 Business Enterprise Grants								
Rural Business Opportunity Grants								
Rural Cooperative Development Grant	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

In addition to using geospatial information to administer programs, service centers can also use GIS to perform distinct enterprise activities. These activities are not specific to any one program; rather they may be performed as part of several different programs. For example, many programs require eligibility determination.

Exhibit 2-2 on the following page presents the Enterprise Model that is being used by the Service Center Implementation Team (SCIT) as the baseline for cost and business analysis. The activities GIS will help service center employees perform are listed in bold. As shown, GIS will help service centers perform multiple customer service activities more effectively.

The use of geospatial information is an integral part of providing customers with information, benefits, and services. Most service centers currently record and maintain geospatial information manually on paper maps. Over time, maps become cluttered with essential information each agency uses to service customers. In many cases, map information is not readily available to all agencies. The current method for sharing information is to photocopy the paper maps. This not only obscures the land features and distorts scale, but also makes determining the most recent version extremely difficult. Service center staff may also be required to cut and paste paper together to create items such as soil maps or show an entire farm.

There are three major consequences of continuing to operate in the current manual environment:

- Customers and partners will continue to receive inconsistent information from service centers and will potentially use incorrect information as the basis for business decisions
- The pressures to maintain staffing levels at some service centers will make it increasingly difficult to administer legislatively mandated programs
- For certain services, customers must continue to visit the service center where the source photography/maps are stored

ENTERPRISE MODEL
Exhibit 2-2

Provide Integrated USDA Support

- **A1 Provide Customer Services**
  - **A11 Provide Information**
    - **A111 Conduct Outreach and Community Relations**
      - **A1111 Provide Customer with Information**
      - **A1112 Provide Technical Assistance to Communities**
      - A1113 Publicize Programs
    - A112 Provide Program Information
      - A1121 Determine Customer Needs
      - A1122 Refer Customers
      - A1123 Schedule Customers
      - A1124 Explain Program Requirements
      - A1125 Provide Special Assistance
    - **A113 Provide Geospatial Information**
      - **A1131 Soils Information**
      - **A1132 Manage Common Land Unit**
      - **A1133 Provide Digital Orthoimagery**
    - **A114 Provide Information to Partnering Agencies**
      - **A1141 Process FOIA Request**
      - **A1142 Disaster Assessment**
      - A1143 Conduct Economic Research/Analysis
      - **A1144 Conduct and Share Resource Inventories**
  - **A12 Deliver Customer Benefits**
    - A121 Verify/Record Customer Information
    - **A122 Determine Eligibility**
      - **A1221 Determine Customer Eligibility**
        - A12211 Verify Ownership
        - **A12212 Determine Customer Status**
        - A12213 Verify Insurance
        - A12214 Make Person Determination
      - **A1222 Determine Land Eligibility**
        - **A12221 Determine Area**
        - **A12222 Determine Cropping History**
        - **A12223 Determine Erodibility Index**
        - **A12224 Determine Environmental Rankings**
      - A1223 Determine Loan Eligibility
        - A12231 Obtain Credit Information
        - A12232 Analyze Information
        - A12233 Verify Assets
      - A1224 Determine Feasibility
    - A123 Develop Contract
      - A1231 Process Application
      - A1232 Provide Loan and Grant Packaging Assistance
    - **A124 Provide Benefits**
      - A1241 Determine Payment Eligibility
      - A1242 Issue Payments
      - A1243 Provide Loans/Grants/Subsidies
      - **A1244 Provide Counseling**
    - **A125 Provide Emergency/Disaster Aid**
    - **A126 Provide Technical Assistance**
      - **A1261 Develop Conservation Plan**
      - **A1262 Assist Customer with Implementation of Plan**
      - **A1263 Validate and Maintain Conservation Practices**
      - **A1264 Make Wetland Determination**
  - **A13 Service Customer Benefits**
    - A131 Manage Appeals
    - A132 Service Direct Loans
      - A1321 Service Delinquent Accounts
      - A1322 Administer Payment Agreement
      - A1323 Settle Accounts
      - A1324 Administer Tenant Certifications
    - A133 Service Guaranteed Loans
      - A1331 Service Delinquent Accounts
      - A1332 Confer with Lender
      - A1333 Meet with Potential Lenders
    - **A134 Conduct Review**
      - A1341 Conduct Site Visit
      - **A1342 Ensure Compliance**
    - **A135 Manage Inventory Property**
      - **A1351 Assess Conditions of Property**
      - A1352 Dispose of Inventory
    - A136 Manage Project Funding
- A2 Provide Service Center Support
  - A21 Provide Service Center Management
    - A211 Evaluate Programs
      - A2111 Manage Directives
      - A2112 Analyze Program Requirements
    - A212 Provide Operational Support
    - A213 Provide Administrative Support
    - A214 Provide Logistics Support
      - A2141 Fleet Management
    - **A215 Support County Committee**
    - A216 Award/Manage Contracts
    - **A217 Support Local Conservation Districts**
    - **A218 Support Local Resource Conservation & Development Councils**
    - **A219 Support State Conservation Commission (or Committee)**
  - A22 Provide HR & Training
    - A221 Manage Human Resources Actions
      - A2211 Hiring Actions
      - A2212 Promotion Actions
      - A2213 Out-processing Actions
      - A2214 Manage Changes
    - A222 Respond to Employees
      - A2221 Address EEOC Activities
    - A223 Administer Training
      - A2231 Develop and Maintain Individual Development Plans (IDP/EDP)
      - A2232 Execute IDP
      - A2233 Implement Training
      - A2234 Evaluate Training
    - A224 Manage Performance
      - A2241 Develop Performance Policy
      - A2242 Develop Performance Plan
      - A2243 Deliver Performance Plan
      - A2244 Appraise Performance
      - A2245 Perform Employee Relations
      - A2246 Manage Awards
    - A225 Manage Employee Travel
    - A226 Manage Time and Attendance
    - A227 Attend Training
  - A23 Manage Facilities
    - A231 Set up Service Center
    - A232 Property Management
    - A233 Provide IT Support
  - A24 Provide Financial Support
    - A241 Manage Budget
    - A242 Manage Accounting
    - A243 Manage Payroll

3. Incremental Implementation of Desktop GIS at the Service Center

GIS use is on the rise among local governments. **According to the April 1998 edition of *GIS World,* 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.** In order to best serve their customers and be in line with modern business practices, USDA service centers must begin implementing GIS.

Although the critical data themes are not scheduled to be completely implemented until the year 2004, incremental data and GIS capability will provide large business benefits to service centers and their customers. Some of these benefits have already been documented in the USDA Geospatial BPR Report dated August 29, 1997. These benefits will accrue immediately to those counties with the implementation of reengineered business processes with GIS capabilities, even before full implementation, and include:

- Ability to use geospatial information to make informed business decisions
- Access to current, accurate geospatial information 80 percent faster than traditional manual methods
- 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
- Improved map quality

Additionally, there are cost benefits to incremental GIS implementation. Exhibit 3-1, Benefits of Critical Themes, presents the estimated savings associated with incremental implementation of three of the critical themes. The savings shown assume that the corresponding hardware and software is in place. Benefits accrue as additional counties receive orthoimagery, common land unit, soils, GIS, and hardware. For example, at the beginning of fiscal year 2000 approximately 100 counties have common land unit and 710 counties will be complete at the beginning of fiscal year 2001, resulting in an additional benefit of $7.45 million.

BENEFITS OF CRITICAL THEMES[4]
Exhibit 3-1

($ millions)

Theme	FY00	FY01	FY02	FY03	FY04	FY05
Orthoimagery[5]	$19.43	$25.51	$31.58	$36.44	$36.44	$36.44
Common Land Unit[6]	$1.22	$8.67	$15.75	$22.83	$29.79	$36.63
Soils[7]	$3.06	$5.10	$7.14	$9.18	$11.22	$13.26
Total	$23.71	$39.28	$54.47	$68.45	$77.45	$86.33

The following sections discuss the business benefits of implementing GIS data themes in service centers. The critical themes are listed in the order service centers will most likely receive them.

3.1 Orthoimagery

Orthoimagery will provide service centers with the base map layer that other themes build upon and will enable employees to provide customers with high-quality and professional maps. Exhibit 3-2, Orthoimagery Map, provides a sample orthoimagery map.

[4] Benefits begin accruing in FY 2000 once the layers, reengineered business processes, hardware, and software are in place.

[5] Benefits of orthoimagery are estimated from an average benefit, based on time savings, of $12,146 per county per year. This number is calculated from the USDA Service Center Business Case, October 9, 1997.

[6] Benefits of common land unit are estimated at 50 percent of the total time savings presented in Appendix III-B of the Farm Service Agency GIS Business Case, September, 1996. Estimated benefits will continue to be refined, as additional information becomes available.

[7] Soils benefits are estimated based on an average benefit of $5,100 per service center per year to produce interpretative maps. Very few of these interpretative maps are being completed manually. However, if we estimate that each service center office is manually developing 1/2 county interpretative map, 1 watershed interpretative map, and 10 individual interpretative maps per year, the savings would be approximately $5,100 per year by using GIS. Additional service center office surveys will need to be conducted to validate the current number of interpretative maps being manually prepared.

ORTHOIMAGERY MAP
Exhibit 3-2

Orthoimagery enables service center agencies to complete activities such as digitizing and maintaining the common land unit and soils themes. Without orthoimagery these activities are not possible.

Orthoimagery will also allow for on-screen viewing capabilities that will help employees complete "what if", compliance, and eligibility analyses with customers. Employees will be 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 print-out specifying those decisions.

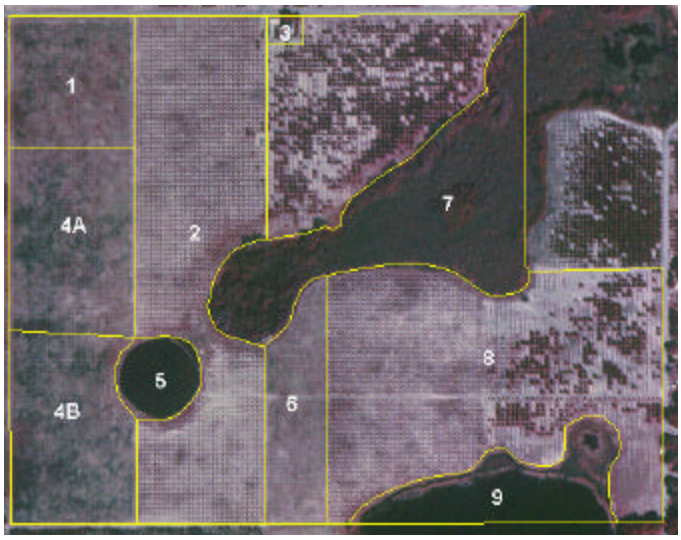
With the delivery and implementation of orthoimagery, service centers will have shared access to digital orthophoto maps. They will no longer need to use photocopies of photographs. The current photocopies can be difficult to read due to multiple manual corrections and photocopy quality.

3.2 Orthoimagery and Common Land Unit

Adding a common land unit theme to the orthoimagery base will provide employees with additional GIS analysis capabilities and a more professional map to deliver to customers. Service center employees will no longer need to manually draw boundaries on hard copy maps; field boundaries will be spatially linked to tabular databases which will provide attributes about the land unit and annotations for map display. Employees and customers can view and use accurate position information for farms, tracts, fields, and storage facilities. This information will allow 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 3-3, Orthoimagery and Common Land Unit Map, is an example of an orthoimagery map with delineated common land unit boundaries.

ORTHOIMAGERY AND COMMON LAND UNIT MAP
Exhibit 3-3



Service centers can use orthoimagery and common land unit to:

- Digitize and maintain common land units
- 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 and numerous other business processes
- Create farm maps for farmers to use for spraying, etc.
- Map cropping histories to common land units and tracts
- Determine which farms were affected by disaster conditions

3.3 Soils

Currently, service centers provide customers with hard copy soils maps that are not customized to specific needs. For this reason, these data may not be considered in the decision making process and employees and customers spend a great deal of time analyzing and manipulating these maps. Using the digital soil survey will eliminate these constraints.

NRCS and users of soil surveys develop soil interpretative maps to support specific agency programs and customer conservation planning requests. Maps such as highly erodible soils, prime farmland, crop and forest productivity maps, soils suitable for septic systems, and hydrologic soil class maps are frequently requested and are developed using manual cartographic methods.

The NRCS used to develop hundreds of county and watershed soil interpretative maps using manual cartographic methods and thousands of manually colored soil interpretative maps in support of individual conservation planning. Because of the labor-intensive nature of making manual soil interpretative maps, reduced staff, and other program priorities, these important products have not been produced as they should be for farmers, ranchers, and watershed planners and county planners. As the soil surveys become available in digital form, these soil interpretative maps plus many new soil interpretative maps will be developed using GIS technology in order to meet customer demand. DOQs provide an excellent base map for the portrayal of individual farm and ranch soil interpretative maps and watershed and sub-watershed soil interpretative maps. The digital county base map data are available from the Bureau of Census TIGER database as other sources which can be used for the county soil interpretative maps.

The soils theme can be used with nationally available transportation and hydrography as a stand alone, without either common land unit or orthoimagery, for numerous service center business processes.

For example, the addition of the soils theme will help eliminate the need for service center agencies to exchange program related soil information such as highly erodible land (HEL) determination forms since all agencies will have shared data access and can query the soil surveys. Service center employees can also use soil surveys to create interpretive maps and reclassify/group soils. Some examples 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

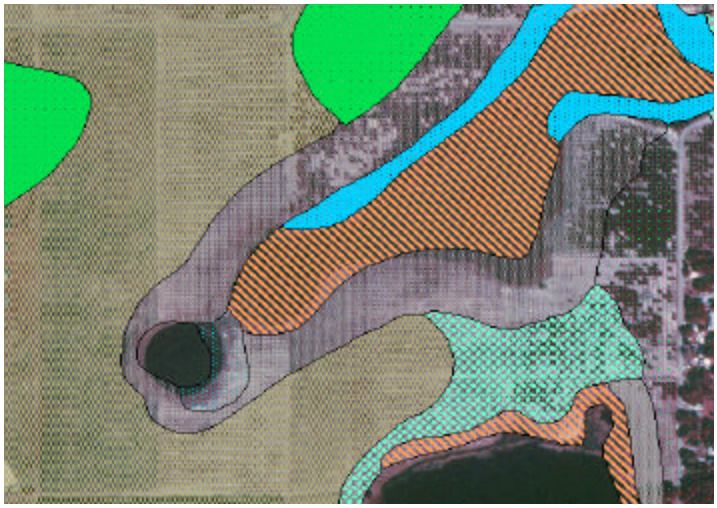
Soil data and these interpretations are key components of community-wide locally led land use planning activities. The digital soil survey used for these activities reduces risk of project failure and environmental degradation.

These new processes will greatly reduce the time employees spend producing maps and analyzing customer and community planning options. Hence, service centers will be able to provide customers with improved information and more alternatives at a reduced cost. When the soil survey is available in digital form and loaded into a GIS, NRCS will develop an average of five county interpretative maps, 10 watershed interpretative maps, and 200 individual conservation interpretative maps per year. If you consider the benefit of each of these interpretations is the savings that would have accrued if they had been done manually as opposed to using GIS, the benefits per year, per digital soil survey to NRCS customers is $59,000.

3.4 Orthoimagery and Soils

Once service centers are able to superimpose soils data over the orthoimagery, they can more efficiently display soils information to show the location of various soil type and soil interpretations. This will provide professional maps with up-to-date imagery, for any area selected, that customers could use to better visualize alternatives. This will also enable 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 3-4 shows a sample soil map displayed over orthoimagery.

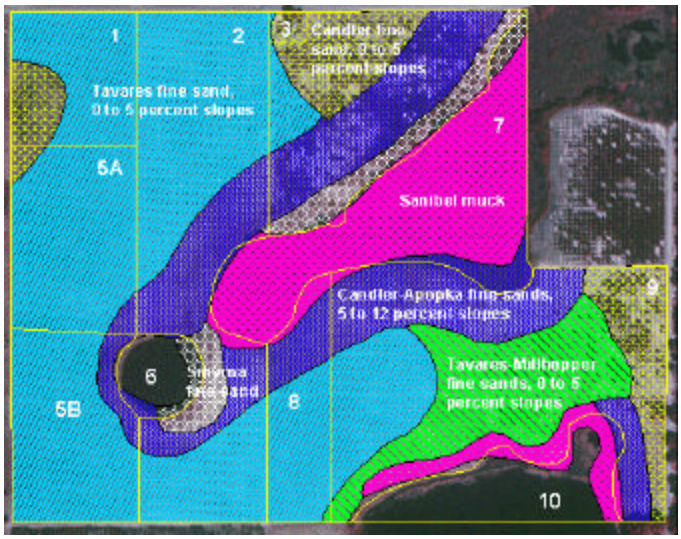
ORTHOIMAGERY AND SOILS MAP
Exhibit 3-4



3.5 Orthoimagery, Common Land Unit, and Soils

Adding the common land unit theme to soil and orthoimagery allows service center staff to provide details, interpretations, etc. by individual farm field. It also allows service center staff to determine eligibility by individual field for HEL and other similar programs. This combined and complete set of digital data provides the maximum benefit to the service centers and their customers. Exhibit 3-5 is an example of a combined orthoimagery, common land unit, and soils map.

ORTHOIMAGERY, COMMON LAND UNIT, AND SOILS MAP
Exhibit 3-5



3.6 Cultural and Demographic Data

Adding the cultural and demographic data theme will further strengthen service center GIS capabilities. The cultural and demographic information will help service centers identify customers and their attributes, 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.

RD has already proven the benefits of the cultural and demographic data theme. Existing data will be distributed to other service center agencies through a BPR project.

3.7 Benefits of Common Themes

The four critical themes are not the only data that will benefit service centers and customers. Service centers can also begin utilizing digital information obtained from partners and others. In order to improve GIS analysis capabilities and provide customers

with more professional and detailed information, service centers may use the common themes identified in this strategy. Some examples of data theme benefits include:

- The administrative/governmental units and place names theme will assist service center employees with inquiries and making geospatial products for farmers, ranchers, agriculture industry, school districts, or county planners
- The watershed boundaries theme will 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
- The Federal Emergency Management Agency (FEMA) flood hazard theme will provide information for rural housing, facilities, and building site locations, waste, nutrient, and pesticide management
- The applied conservation practices theme will help service centers identify the level of source treatment in counties to determine priorities for directing assistance and funding
- Additional state and county themes can help service centers maintain and update utilities maps which 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

Finally, if the orthoimagery, common land unit, and soils themes are available, either individually or in any combination, it allows service center staff to be trained in GIS at the same time as the Microsoft Windows environment. This training will allow them to start developing the skills they will need in order to function in the future.

4. Geospatial Data Requirements

Using GIS to conduct service center business is dependent on the availability of accurate geospatial information. The GIS community commonly refers to the various types of data categories as data layers or themes. This strategy identifies 19 themes needed to administer programs and service customers. Not all of these themes are needed by all service center agencies.

The responsible agency or data steward for each theme will be responsible for determining the kind of historical records to be stored and maintained. BPR projects, specifically for Common Land Unit and Risk and Productivity Assessment, will address these issues.

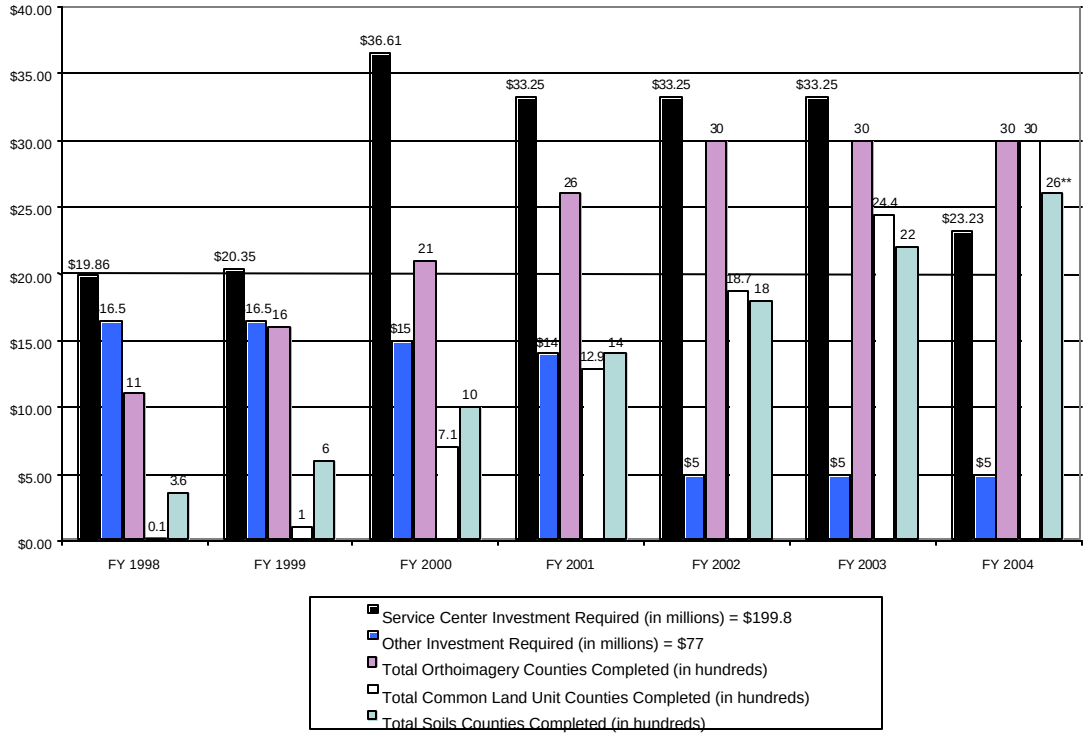
Four of these 19 themes have been identified by one or more service center agencies as **critical** for GIS technology to support the service centers' mission. The following four data themes are the most important; without them, service center agencies cannot effectively use GIS technology to create products for customer, partner, or internal use:

- Orthoimagery
- Common land unit
- Soils
- Cultural and demographic data

The critical data themes provide the foundation for GIS operation in service centers. Exhibit 4-1, Projected Completion of Critical GIS Themes, identifies the number of counties (out of 3,141[8] total) completed per fiscal year and the total costs to implement orthoimagery, common land unit, and soils. Cultural and demographic data has already been acquired by RD and, therefore, is not included in the chart.

[8] Per the Bureau of Census Internet home page.

PROJECTED COMPLETION OF CRITICAL GIS THEMES*
Exhibit 4-1



* These numbers include the entire U.S. and its territories and affiliated nations.
** Some counties, particularly Federal lands, may not have digitized soils.

The total investment required from USDA and other Federal, state, and local partners to implement the critical themes is listed below.

USDA investment required = $199.8 million
Other Federal, state, and local investment required = $77 million
Total investment required = $276.8 million

This translates into the following average USDA costs per county to implement each of the critical themes:

- Orthoimagery - $17,356
- Common land unit - $18,879
- Soils - $23,878

The critical themes are described in detail in the following sections. Additionally, the projected completion by number of counties and implementation costs is provided for orthoimagery, common land unit, and soils.

4.1 Orthoimagery

For more than 50 years, service center agencies 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 are inappropriate for GIS.

A digital orthoimage is a digital representation of an aerial photograph or satellite imagery with ground features located in their true map positions meeting NMAS. Currently, there is not a civilian satellite that meets the service centers' resolution 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 conterminous U.S. over a seven-year period. As a result of the Easy Access GIS pilot, it was recommended that a national program be established to create digital orthoimagery that meets service center requirements.

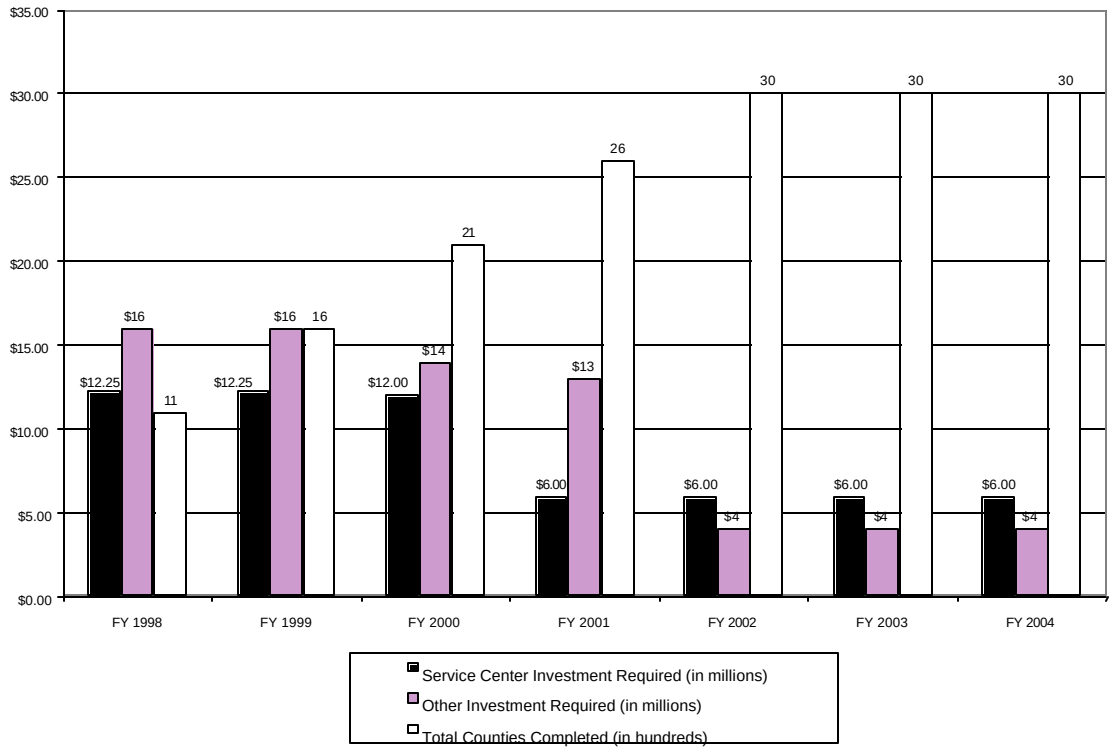
To support the acquisition and development of orthoimagery, a Steering Committee was formed which includes NRCS, FSA, the Forest Service (FS), U.S. Geological Survey (USGS), and the National States Geographic Information Council (NSGIC). The Steering Committee established and operates the National Digital Orthophoto Program (NDOP) by providing program and technical leadership in the acquisition of DOQs.

A technical standard which 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 agencies have been very successful in getting state agencies to share the costs of developing DOQs through cooperative partnerships including product enhancements when they are funded by the state agencies.

The NDOP partners and cooperators have funded approximately 75 percent of the conterminous U.S., completing approximately 35 percent, and have an additional 40 percent in-work. Approximately 1,100 and 1,600 counties will be complete by the end of fiscal years 1998 and 1999, respectively. The program is scheduled to complete national coverage of private lands by year 2002, and national coverage of Federal lands by year 2004. The maintenance and updating of digital orthoimagery will begin in year 2000. Exhibit 4-2, Projected Completion of First-Time Digital Orthophoto Quadrangles Coverage, shows the annual investments required by USDA, Federal, and state participants to achieve this schedule.

Exhibits 14.1 and 14.3 (in Section 14) provide a more detailed explanation of this investment. The total service center agency cost for completion of DOQs is approximately $54.5 million. The annual service center agency maintenance cost is approximately $6 million.

PROJECTED COMPLETION OF FIRST-TIME DIGITAL ORTHOPHOTO QUADRANGLES COVERAGE*
Exhibit 4-2



* These numbers include the entire U.S. and its territories and affiliated nations.

FSA is incurring additional costs to reformat DOQs to facilitate their use in the field service center. Visible seam lines between separate DOQs, due to different dates of source photography within a county, misalignment between DOQs, and other factors will be removed. The actual pixel locations, and the coordinate system they are cast upon, will not be altered. The orthoimagery may be delivered in alternative coverage formats, such as a single image file covering a county, or individual townships in regions that are part of the Public Land Survey System (PLSS). The service center GIS standards working group and the Geospatial Data Acquisition, Integration, and Delivery BPR project will develop a common standard for orthoimagery.

USDA has already invested approximately $59 million in cost-sharing for the production of DOQs. Approximately $30 million more is needed by USDA to complete the conterminous U.S. DOQ coverage. It is estimated that an annual cost of approximately $10 million ($6 million from USDA and $4 million from USGS and other partners) will be needed to update DOQs. Updating 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.

4.2 Common Land Unit

To administer USDA programs, service centers have been drawing, and continue to 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. A new name for these land areas, fields, and pastures is common land unit. Recent efforts are underway to standardize the process of defining, mapping, numbering, digitizing, and maintaining common land unit. A draft standard exists which will be finalized as part of a BPR project.

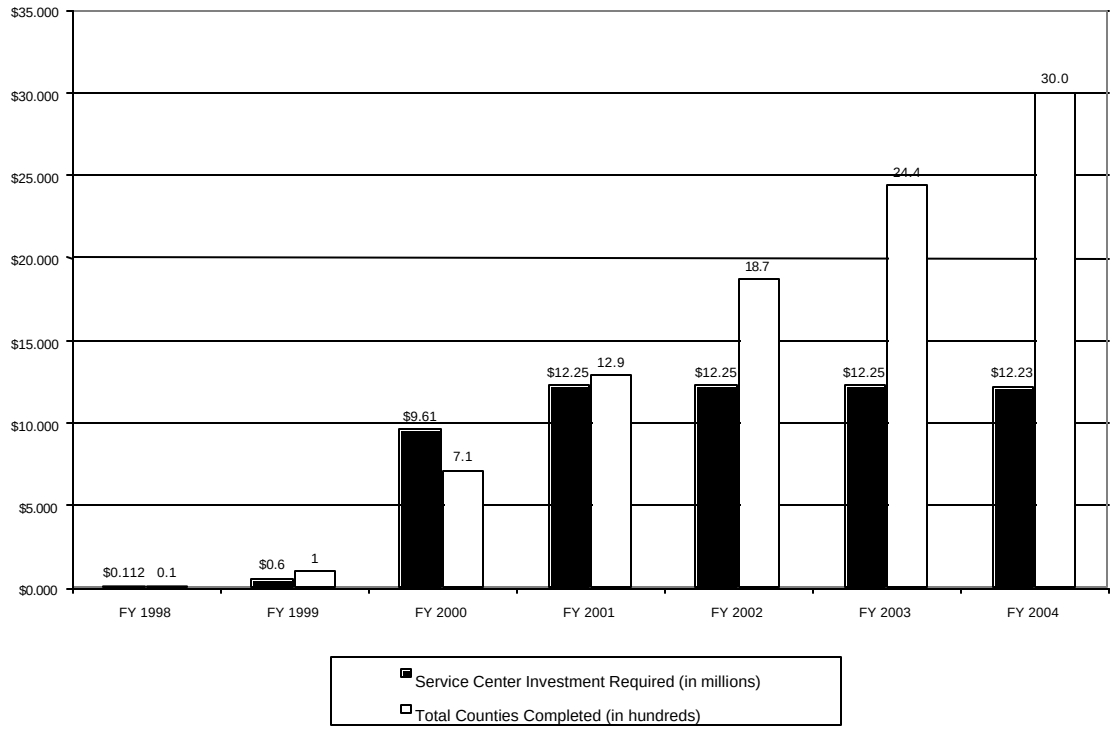
The common land unit theme defines the critical relationship between customers (e.g., landowners/managers, borrowers, etc.) and land (e.g., farm, tracts, fields, pastures, etc.). The common land unit theme will be used to link most business information to a unique geographic location. The theme will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

- Improve communication and data flow between service center agencies and customers
- Improve communication between information system applications
- Facilitate creation of a single service center agency database
- Provide for analysis of service center business data using outside spatial data such as demographic data, satellite imagery showing crop residue after planting, or elevation data
- Provide for 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 common land units are key to successful GIS implementation. USDA will not be able to offer "one-stop" service to customers without this digital theme. An estimate to develop common land unit over the private land in the conterminous U.S. by fiscal year 2004 is shown in Exhibit 4-3, Projected Completion of Common Land Unit Themes. 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 or digitized by service centers on an "as needed" basis.

Exhibits 14.1 and 14.3 (in Section 14) provide a more detailed explanation of this investment. The total cost for completion of common land unit is approximately $59.3 million. The annual maintenance cost is approximately $4 million.

PROJECTED COMPLETION OF COMMON LAND UNIT THEME*
Exhibit 4-3



* These numbers include the entire U.S. and its territories and affiliated nations.

Digitizing equipment is necessary to provide incremental implementation of common land unit. Without this equipment, service centers will not be able to take advantage of common land unit capabilities until full GIS implementation in fiscal year 2004. As discussed in Section 3, incremental implementation of common land unit provides multiple business benefits to the service centers, including high-quality maps, GIS analysis capabilities, and automatic acreage measurements.

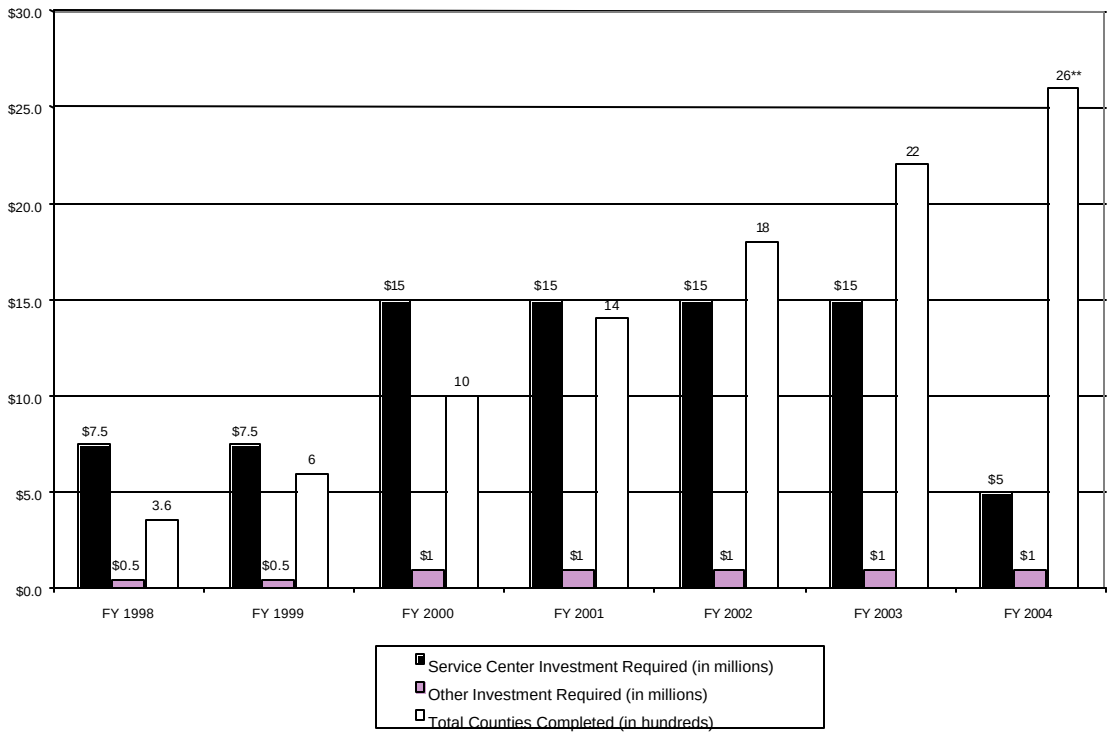
4.3 Soils

The soils data theme consists of the Soil Survey Geographic Database (SSURGO), a county/project level digitized version of the National Cooperative Soil Survey (NCSS). NRCS and NCSS have partnered to complete soil surveys for 100 percent of U.S. cropland, 91 percent of private lands, and 76 percent of all lands. Most surveys were mapped and published using rectified photography or photo mosaics as the base map and not the more accurate orthoimagery. These surveys need to be recompiled to the new DOQ base map. Some older surveys published on orthoimagery are also being recompiled and updated to the new DOQ.

The NCSS developed standards for SSURGO that are in the process of being submitted for review and adoption by the FGDC. By the end of fiscal year 1998 approximately 360 counties will be digitized using this standard. Current estimates project that 240 to 400 additional counties per year will be digitized in subsequent years, with all counties complete in fiscal year 2004. Exhibit 4-4, Projected Completion of SSURGO, shows the annual investments required by all partners to achieve this schedule.

Exhibits 14.1 and 14.3 (in Section 14) provide a more detailed explanation of this investment. The total service center cost for completion of SSURGO is $75 million. The annual service center maintenance cost is approximately $5 million.

PROJECTED COMPLETION OF SOIL SURVEY GEOGRAPHIC DATABASE*
Exhibit 4-4



* These numbers include the entire U.S. and its territories and affiliated nations.
** Some counties, particularly Federal lands, may not have digitized soils.

4.4 Cultural and Demographic Data

Cultural and Demographic Data consists of data from the U.S. Bureau of Census and Census of Agriculture. The U.S. Bureau of Census provides such information as the distribution of people in the U.S., age, gender, race, and cultural and economic information. Census of Agriculture data provides county-level information such as kind

and amount of crops grown, number and kind of livestock, and other cultural and economic information. U.S. Census data is collected at 10-year intervals and has already been acquired by RD. A BPR project has been established to make this data available to other service center agencies.

4.5 Other Common Geospatial Data Themes

There are 15 additional common themes that build on the four critical data themes to improve the way business is done. The combined 19 themes are divided into three broad categories—Framework, Natural Resources, and Business—and listed in Exhibit 4-5, Geospatial Data Themes. For each category, the 19 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.

GEOSPATIAL DATA THEMES
Exhibit 4-5

Geospatial Data Themes Required 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. 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
3. Elevation			X
4. Hydrography			X
5. Cadastral			X
• Public Land Survey System (PLSS)			X
• Military installations			X
• National forests			X
• Bureau of Land Management (BLM) lands			X
• National parks			X
6. Transportation			
• Roads			X
7. Digital Raster Graphic (DRG)			X
Natural Resources			
1. Soils—SSURGO **(Critical)**	X		
2. Land cover/vegetation/plants	X	X	X
3. Watershed boundaries (11-14 digit hydrologic units)	X	X	
4. Wetlands		X	X
5. Wetland and floodplain easements	X	X	
6. Climate—precipitation and temperature	X	X	X

GEOSPATIAL DATA THEMES
Exhibit 4-5 (Cont'd)

Geospatial Data Themes Required for USDA Service Centers	Create With USDA Agency Funds	Create With Other Federal/ State/ County Partners	Acquire Existing Data
7. 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		

In addition to the 19 themes identified in Exhibit 4-5, other state and local data will be created with Federal/state/county partners or acquired as needed. Descriptions for the 15 common themes are provided in the following sections. The service center agencies will establish how each theme is maintained and stored.

4.5.1 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 have coordinates linked to each name so they can be displayed on digital maps. The resolution of the name coordinates should be adequate for service center use.

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

4.5.2 Elevation

Elevation data provides information about terrain. Land surfaces are often represented using a matrix of elevation points at regular spacings called a DEM. USGS has Federal leadership for developing this data theme and plans to have complete national coverage of DEMs at 30-meter spacings or better by the end of 1999. Approximately 99 percent of the U.S. is already finished or in progress. USDA is funding the creation of DEMs under NDOP.

A growing percentage of DEM coverage (and the bulk of recent demand) is at a 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 and all 10-meter DEMs at USGS have a vertical accuracy equal to ½ the interval of the 1:24,000 contours from which they were derived.

The resolution of existing DEMs is generally adequate to meet service center 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 photogrametric techniques is too great to justify a national program. The service centers will use existing data or complete site-specific elevation surveys as required. As new technologies are developed to enable the collection of 2-foot contour accuracy data in a cost-effective manner, service center agencies encourage FGDC efforts for a national initiative to enhance the existing DEM database.

4.5.3 Hydrography

Hydrography data includes surface water features such as lakes, ponds, streams, rivers, canals, oceans, and shorelines. USGS has responsibility for this data theme and is working with the Environmental Protection Agency (EPA) to create the hydrography data layer at a 1:100,000 scale resolution. Streams are being attributed using EPA's River Reach schema. This is an important effort and the resulting data can probably be used by service centers in the interim. However, service center agencies need to have the hydrography feature registered to DOQs. Some states, such as Kansas, have taken the initiative to recompile the hydrography from a USGS 7-½ minute quadrangle map to the DOQ and then digitize these water features. Service center agencies encourage FGDC efforts for a national initiative to complete this work.

4.5.4 Cadastral

Cadastral information from the Federal framework perspective includes the PLSS and publicly administered parcels, such as military installations, national forests, BLM lands, national parks, and state parks.

BLM has completed the PLSS database for 11 western states and Alaska. The resolution is generally adequate to meet service center needs. However, BLM has not coordinated the work of state PLSS databases to create a national database. It is desirable that BLM collaborate with these states to develop a national PLSS database with well-defined standards.

The FS has developed a digital database of their national forest boundaries at a 1:24,000 scale resolution. This should be adequate for service center use.

USDA is aware of several national programs to create geospatial databases at the 1:24,000 scale or better for military installations, BLM lands, or national and state parks. Service centers desire this level of accuracy. USDA will coordinate with the U.S. Army

Corps of Engineers (USACE), BLM, and the National Park Service (NPS) to acquire the best available boundary data as it becomes available.

4.5.5 Transportation

Transportation data include roads, trails, railroads, waterways, airports, ports, bridges, and tunnels. The Department of Transportation (DOT) has responsibility for this data theme. TIGER provides most transportation features, but does not register to the DOQ. Some state and county governments have more accurate databases which service centers will acquire and use instead of TIGER. Although this data theme is not as critical as some other framework themes, and roads can be plainly seen on the DOQs, USDA would like a roads and railroads database at a 1:12,000 scale resolution.

4.5.6 Digital Raster Graphics

The digital raster graphics (DRGs) are graphic representations of USGS 7-½ minute 1:24,000 scale quadrangles. These can be viewed and used by service centers as orientation for several thematic data and as a guide for digitizing features. This database has already been purchased for service center agencies.

4.5.7 Land Cover/Vegetation/Plants

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. This information can be developed using remote sensing tools such as aerial photography or satellite imagery. The FGDC has tasked the Earth Cover Working Group (ECWG) to define the classification and mapping standards for this theme. The ECWG has adopted the Vegetation Subcommittee's classification schema and has defined additional categories such as water, bare soil, and artificial surfaces.

Federal, state, and county Governments collect land cover and related land use data in support of various programs. However, these are not part of an effort to develop a national land cover database. Service center agencies support the ECWG work to define a uniform classification and mapping standard and coordinate programs to achieve a national land cover database. The new earth cover standard may be used as part of the common land unit for those areas that do not have cultural field boundaries. The earth cover classification may become attributes to the common land unit. However, in some instances, service centers may require a county-wide or watershed land cover database that was developed using image classification techniques to more completely portray land cover features. Once the ECWG defines a standard, USDA encourages FGDC efforts for a national initiative to develop land cover maps for the U.S. using 5-meter or better satellite imagery.

4.5.8 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 1970's 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 (5th level, 11-digit) and subwatershed (6th level, 14-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.

A delineating and digitizing standard was originally distributed in 1992 and revised and redistributed in June 1995 as a working draft. The working draft continues to be updated and is being coordinated with other agencies.

The effort to delineate and digitize levels 5 and 6 is handled through the NRCS state offices in partnership with local, state, and Federal agencies, and other organizations interested in the effort.

4.5.9 Wetlands

The Fish and Wildlife Service (FWS) is responsible for the wetland data theme. Standards have been adopted by the FGDC for the classification of wetlands and FWS mapping standards have been developed for 1:24,000 mapping and digitizing. The FWS has mapped and digitized over half of the country using the 1:24,000 National Wetland Inventory (NWI) conventions. This digital database is available via the Internet and can be downloaded and used at no expense to USDA. However, USDA uses the more accurate DOQ base map for service centers and when the NWI wetland boundaries are superimposed over DOQs they will often appear misregistered. If service center offices provide such a product to customers, an explanatory note will need to appear on maps stating that the NWI wetland delineations are approximate locations, are not necessarily current or complete, and cannot be used directly for USDA wetland program determinations.

It would be desirable if FWS lead a coordinated effort with other Federal, state, and local Government to recompile, update, and maintain the NWI maps using DOQ as a base map. This will significantly reduce and/or eliminate misunderstandings of wetland locations.

At the request of the landowner/operator, USDA certifies a small number of wetlands as meeting the criteria. The boundaries are mapped using professional mapping and georeferencing procedures. These wetlands will be maintained in a geospatial database by service centers as a specific category of certified wetlands.

4.5.10 Wetland and Floodplain Easements

The service center administers several programs which 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 PLSS 40 acre parcel) is made part of the easement contract and these boundaries are also identified. The USDA needs to maintain a geospatial database of these wetland and floodplain easements. 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 is being drafted and should be available for review by the end of this fiscal year.

4.5.11 Climate

The Office of the Chief Economist/World Agricultural Outlook Board (OCE/WAOB) is responsible for evaluating the impact of weather and climate on agricultural productivity, including crop yield potential, range and livestock conditions, and fire weather surveillance.

These assessments are formed using analysis of real-time data from a strategically important climate network in rural crop areas around the nation. This data is essential for not only specific crop-weather analyses and crop modeling but also for input into geospatial analyses that are an integral part of GIS technology. The weather and climate data are necessary for ground-truth in mapping procedures and for verification of GIS product results.

Significant cutbacks in the National Weather Service (NWS) budget during the past few years have caused the termination or reduction of data available from rural networks. USDA has directed efforts to re-establish the flow of weather and climate data from these rural networks into strategic regional centers that would serve local climate and agricultural needs. New stations will also be sited in data-sparse areas to complete the "Climate Observations in Rural America" (CORA) network. CORA would serve all of the climate data requirements for service center initiatives. Full implementation includes linkage of rural data networks to both state climatology programs and regional weather and climate application centers to maximize the efficient delivery of information through the Unified Climate Access Network (UCAN).

NRCS, in cooperation with the NWS and Oregon State University, has recently developed geospatial precipitation and temperature databases for all states (except Alaska) using the Parameter-elevation Regressions on Independent Slopes Model (PRISM). The 40-year average annual monthly precipitation and temperature values are calculated at a 2-kilometer grid resolution. The precipitation database is complete and will be online in a few months. The temperature database has been developed, is under review, and will be complete by the end of fiscal year 1998.

4.5.12 Flood Hazard Maps

FEMA performs hydrologic and hydraulic studies that identify flood-prone areas and provide flood risk data. Using this data, FEMA prepares flood hazard maps and other thematic features related to flood risk assessment. The flood hazard maps are the basis for the floodplain management, mitigation, and insurance activities of the National Flood Insurance Program (NFIP).

Flood risks have been assessed in approximately 20,400 communities nationwide, resulting in the publication of more than 100,000 individual maps. 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 through physical map revisions and letters of map change.

Many of these maps are aging and were developed using traditional cartographic practices. In order to provide flood hazard map data in electronic form for use in GIS, FEMA has embarked on a modernization program. Plans call for the flood hazard data to be recompiled and portrayed onto base maps that meet NMAS requirements such as DOQs. The information will be updated, maintained, and provided to the public in an electronic format, such as Internet-based technology. The flood hazard information and the base map will be assessed for currency and accuracy at least every five years.

4.5.13 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 service center partner agencies of FSA, NRCS, and RD. 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. In the near future other agency and SCIT automation efforts requiring office information will directly interface with the OIP repository 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 (i.e., 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.

4.5.14 Applied Conservation Practices

Applied conservation practices is 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 includes tabular attributes linked to field boundaries such as conservation tillage. Examples of program data are certified wetlands and CRP and Wetlands Reserve Program (WRP) easements. These data will be developed by service center agencies as they work with landowners and managers.

4.5.15 Water Control Infrastructure/National Inventory of Dams

The National Inventory of Dams (NID) was authorized by Congress, is the comprehensive source of U.S. dams information, and is maintained by the USACE in collaboration with other Federal agencies and states. USDA maintains inventory of approximately 26,000 dams that were built with NRCS assistance. The inventory currently contains 59 data fields on over 75,000 dams which meet a 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.

5. Prioritizing Core Geospatial Database Development and Delivery

Three core geospatial databases are critical to the implementation and use of GIS at service centers. These are 1) orthoimagery, 2) soils, and 3) common land unit. Orthoimagery is the preferred and best base map for mapping and digitizing soils, and must be completed and used to map and digitize the common land unit. Orthoimagery keeps geospatial layers like common land unit, soils, and others linked together by serving as the common image base map (i.e., framework) on which land and cultural information is georeferenced.

The prioritization criteria are different for each of the three core databases. The differences are primarily attributed to the uniqueness of each database, staff resources, funding, administrative considerations, hardware/software availability, individual agency needs, and participation of multiple agencies. This section will briefly describe the considerations that exist in determining priorities for developing the three core databases. This section will also explain how FSA and NRCS will coordinate and devise a prioritization plan for creating and delivering orthoimagery, common land unit, and soils to service centers. The prioritization plan can be used to help determine the priority for delivering GIS to service centers.

5.1 Orthoimagery Criteria

FSA and NRCS both participate in the NDOP, a Federal and state agency program to develop orthoimagery (i.e., DOQ) for the nation. NDOP agencies have established prioritization criteria for DOQ acquisition, and have been following the 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 due to 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

5.2 Common Land Unit Criteria

Service center agencies have identified common land unit as a critical geospatial database needed to carry out business applications and administer conservation and farm programs. To date the re-compilation of common land units from aerial photographs to DOQs, and the digitization of common land units is complete for a small number of counties. FSA is leading efforts to convert common land units from analog to digital form. A draft set of mapping and digitizing standards is near completion. FSA is investigating and testing approaches and methods for performing the digitization.

To assist in determining the priority for digitizing common land units, FSA requested each State Executive Director to provide a priority list for implementing GIS in their state. Each state's priority list is based on conservation and farm program workload, predominance of agricultural activities, technical expertise, staffing resources, equipment, software, and space availability. The FSA national office will compare state priorities against the availability of orthoimagery and soils to determine priorities for digitizing common land units.

5.3 Soils Criteria

NRCS began an initiative to digitize high priority published soil surveys in fiscal year 1995. Since this time, the method for selecting surveys to be digitized has varied. However, the goal—to provide internal and external customers with a high quality, consistent, and usable digital soil survey—has remained the same. NRCS intends to have digital soils data available for two-thirds of the nation by 2004. In fiscal years 1997 and 1998, NRCS received Congressional-earmarked funds to expedite development and delivery of digital soils. Increased funding and full-time equivalents (FTEs) are needed in future years to meet the digitizing objective.

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 of the 50 state soil scientists is intimately familiar with the status of the soil survey program, local cooperative partnerships, and resource issues for their state. The 17 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 that 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 includes:

- Status of soil survey; published surveys which 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.

5.4 Future Prioritization

To ensure geospatial information is acquired, developed, and delivered to service centers in the appropriate order, FSA and NRCS will establish a prioritization process for orthoimagery, common land unit, and soils. There are many opportunities to precisely identify service center priority needs for geospatial development and delivery. Software tools and national databases with status information can be used to develop priority lists which meet specific criteria. Representatives from each state will be contacted to determine the priorities for their state. These priorities will be used along with the availability of data sets to implement desktop GIS.

Orthoimagery development is well under way; by the end of fiscal year 1998 approximately 1,100 counties will be complete. About 10 common land unit and 360 soils counties will be completed by the end of fiscal year 1998. Where common land unit and soils data do not exist, FSA and NRCS may be able to identify future priorities by state, taking into consideration funding, partnerships, etc.

6. Geospatial Data Integration and Delivery

Integrating, packaging, and delivering geospatial information and related attributes is an essential set of tasks that must be accomplished for GIS to be successfully implemented in service centers. Geospatial information will be acquired from, and may be developed and maintained at, various locations in agencies and institutions. Service centers may acquire other data from local sources. These data are at various levels of resolution, scale, age, and geographic coverage. Some data may overlap or have missing components. Additionally, the acquired data will be in various formats, projections, datums, and media and will need to be converted before delivery to service centers. Significant effort will be needed to integrate and deliver data themes and achieve a useful product for service centers. Equally important are efforts to optimize data storage and delivery to minimize costs and redundancy while maximizing data integrity, delivery efficiency, and system performance.

The Geospatial Data Acquisition, Integration, and Delivery BPR Project will address the issues outlined in the preceding paragraph. Information on this project, as well as others, is contained in Section 11, Business Process Reengineering Projects.

6.1 Integration

Integration must be accomplished in a spatial sense, both horizontally across jurisdictions, and vertically among data themes. This GIS strategy calls for integration to be accomplished in phases.

In the first phase, geospatial information is acquired from various sources and accepted "as is". This data may not be as accurate as the DOQ base map, resulting in registration errors. Many data themes such as elevation, climate, census tracts, and geographic names may be adequate for immediate use. Less spatially accurate databases such as TIGER roads, hydrography, and political boundaries will be used until more accurate information becomes available during subsequent integration phases. Guidelines for the use and integration of these data will be developed and delivered to service centers.

The next phase will recompile data themes to fit the DOQ in order to achieve integration with the base map. For example, most soil surveys are being recompiled and updated to the DOQ image. The Soil Survey Division in NRCS currently requires that all new/updated surveys use DOQs. Soil boundaries and hydrography will be moved as appropriate to fit the DOQ image. Other themes such as wetlands call for recompiled DOQs. There will be some data themes that will achieve a higher level of horizontal accuracy than the DOQ, such as data collected using Global Positioning System (GPS) technology. Other data themes will be at a lower level of horizontal accuracy than the DOQ. These data, created at a larger map scale in combination with DOQs, can provide valuable contextual information.

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. Other geospatial data themes such as roads and steams should be aligned to the DOQ base map and integrated horizontally as well; however, this effort would need to be accomplished by the Federal, state, or county organization that has responsibility for that data theme. Cost estimates shown in Exhibit 14-3 include the cost of horizontal integration.

Vertical integration of data themes is the highest level of integration. It is required to ensure that coincident boundaries are identical or duplicates. Although soil and wetland boundaries, hydrography, and elevation may all be registered to the DOQ, they may not coincide where they should due to 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. Service center agencies will need to assess the need for this level of integration. If this level is deemed necessary, it will be accomplished on a project-by-project basis.

6.2 Access and Delivery

USDA acquires and integrates geospatial data for one purpose—to support access and delivery of this data for use in meeting the agencies' program mission.

Access and delivery of geospatial data to service center offices, internal customers, and external customers in support of business needs encompasses four major areas: data warehousing, data selection, packaging, and delivery. The goals of access and delivery in the context of this GIS Strategy include:

- Support more efficient and timely program delivery
- Supply greater quantity and variety of products and services for the customer
- Improve quality of products and services for the customer
- 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

Accessing and displaying various geospatial databases in a distributed environment requires a level of interoperability among systems. Standards for interoperability are evolving and software functionality is being developed and tested by the GIS industry in concert with the Open GIS Consortium (OGC). These standards will facilitate the acquisition, integration, management, and use of geospatial information.

To facilitate access, browsing, retrieval, and use of GIS data, integrated data themes are stored in or linked to a data warehouse or geospatial data servers inside or outside of USDA. As part of the data warehouse, tools are provided to improve access. Data contained in these warehouses may originate from agency-collected information such as

soils, be purchased for use by USDA customers, as is the case for orthoimagery, or be linked to some data partner such as USGS. Some components of the data warehouse include metadata catalogs, security, metrics on content and use, quality control, data cleansing, and database optimization.

There are as many ways to accomplish data selection as there are ways to use the data. Technologies that enable data access and selection include the Web, local and wide area networks (LAN/WAN), Online Analytical Processing (OLAP), and natural language query tools.

Generally speaking, existing resource databases are not user friendly, are not available in similar formats, and are difficult for employees and customers to access. The Geospatial Data Acquisition, Integration, and Delivery BPR Project will develop a delivery solution.

Data packaging incorporates two components. Data is stored in the data warehouse in a structure that optimizes information retrieval or data mining. After the user selects data, the data must be retrieved from the storage locations and packaged for delivery. This packaging may involve data transformations, integration, and formatting. Once packaged, the data is ready for delivery. During the BPR process, as part of the data management effort, issues with data packaging will be identified and resolved.

Actual data delivery may be accomplished using multiple delivery methods. These methods may include:

- Compact Disc Read-Only Memory (CD-ROM)/Digital Video Disk (DVD)
- Internet Web and data servers
- File Transfer Protocol (FTP) sites
- Cartridge tapes and traditional magnetic media

The measure of success for data access and delivery will be based on how "seamless" and efficient the delivery process is for internal and external customers. Field personnel have consistently indicated the current level of effort associated with locating, obtaining, formatting, and using geospatial data is unreasonable. Likewise, the field has indicated how beneficial the use of GIS can or could be if the agencies can streamline the access and delivery process.

7. Data Management

USDA service center agencies are proposing to spend $199.8 million to acquire digital orthoimagery, common land unit, and digital soils data. In addition, one recent Blue Ribbon Panel estimated the enterprise-level value of natural resource data for just NRCS at over $8 billion. With this magnitude of investment, it is important that data standards be developed, adopted, and maintained. A service center Shared Information System perspective must be developed and geospatial information must be integrated with other data and managed in a database management system (DBMS). Close coordination with the SCIT Data Management Team will be required in order to be successful.

7.1 Standards

In the USDA's acquisition or development of the 19 data themes, data content and geospatial accuracy standards are essential to foster access, use, and integration of the data. If standards do not exist, theme owners will develop standards with input from other Federal and service center agencies. For example, the NRCS will lead the development of and maintain the SSURGO standard, and FSA will lead the development of and maintain the common land unit standard. The theme owners will also be responsible for ensuring quality control of their respective theme(s). This will include incorporating data updates and corrections.

Data standards currently exist for some themes; however, many more theme standards still need to be developed. The USDA is currently working, and will continue to work, with the FGDC to establish the necessary new standards. Exhibit 7-1, Status of Geospatial Data Standards, shows the level of work that has been accomplished to establish the standard for each theme.

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

STATUS OF GEOSPATIAL DATA STANDARDS
Exhibit 7-1

Geospatial Data Themes Required for USDA Service Centers	Adopted Standard or final stages	Working Draft or Partially Complete	Work not begun or early stages
Framework			
1. Orthoimagery **(Critical)**	X		
2. 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		
3. Elevation	X		
4. Hydrography		X	
5. Cadastral			
• Public Land Survey System (PLSS)	X	X	
• Military installations		X	
• National forests		X	
• Bureau of Land Management (BLM) lands		X	
• National parks		X	
6. Transportation			
• Roads			X
7. Digital Raster Graphic (DRG)	X		
Natural Resources			
1. Soils—SSURGO **(Critical)**	X	X	
2. Land cover/vegetation/plants		X	
3. Watershed boundaries (11-14 digit hydrologic units)		X	
4. Wetlands		X	X
5. Wetland and floodplain easements			X
6. Climate—precipitation and temperature		X	
7. 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

7.2 Shared Information System GIS

Technologies for managing geospatial data will be part of the overall service center Shared Information System architecture. The service center Shared Information System includes BPR projects, the technical architecture that establishes a Common Computing

Environment (CCE), the LAN/WAN/Voice that establishes the telecommunications network, and Data Management which established the architecture for sharing data. The vast majority of business applications using GIS technology will be deployed at the service center level using personal computers. GIS software at this level will be highly integrated with other software such as office automation and spreadsheet applications. The software will be designed to support service center business processes and to maximize user-friendliness. GPS and Personal Digital Assistants (PDAs) may be used to collect data in the field and integrate with the GIS software. LAN servers will provide a shared GIS software application environment as well as a shared database environment for the service center.

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 service center business applications requires a more sophisticated GIS and database management capability at the state, regional, national, and development center offices. 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 costs, both in terms of hardware/software and training costs would be prohibitively high to outfit every service center to do these specialized functions. Geospatial centers of expertise may be set up or contracts written to perform these services. These centers would allow for map publishing services, large area or complex spatial modeling and analysis, image processing, integrated computer aided design (CAD) engineering software, and integrated spatial and tabular transaction based DBMS technology. A full suite of data management software integrated with personal computer software is needed to maximize effectiveness of specialized functions.

The modern enterprise-wide GIS model accesses geospatial information in a widely distributed environment. Relatively stable geospatial databases and data sets such as DOQs, elevation, hydrography, and soils for the area served by a service center may be stored locally. However, a number of themes will change frequently and require a more complex database management approach. Some of these databases may reside on state, regional, or national servers and require shared distributed access. Geospatial data facilities will be established outside the service centers. The size of service center files, the number of transmissions within a given period, the network speed, and the transmission cost will be factors considered in establishing these enterprise-wide geospatial information servers.

Technologies for managing geospatial information are part of the overall service center Shared Information System architecture.

7.3 Shared Information System GIS Integration with Database Management System

Integration of desktop GIS software with a DBMS is crucial to implementation of the Shared Information System GIS. This integration will need to occur at service center, state, and national levels. Data used for GIS applications will be both static (i.e., DOQ

coverage) and dynamic (i.e., common land units). In addition, large quantities of data exist which can be linked to GIS maps using common identifiers. Given the current "state of the art" for GIS tools, this tabular or attribute data is best managed within a DBMS.

Thus, GIS data actually has, and must be managed as, a hybrid structure. The spatial component includes vector (i.e., common land units) or raster (i.e., DOQ) data and the tabular component includes associated attribute data (i.e., tract number) in tabular or DBMS format. Specific data management requirements for integrated, enterprise GIS with DBMS include:

- Availability of spatial and attribute data sets to every service center
- Large database support
- Timely retrieval, analysis, and graphic display of queried data
- Consistent and integrated data management strategies
- Data security and data ownership

Many entities within USDA (e.g., FSA) have large volumes of invaluable data held in legacy systems. Typically, these data sets have a relationship to geographic features and can thus be linked to GIS. Often, however, these data sets are based on non-relational database formats that may not be easily or directly compatible with GIS software. The service center Shared Information System, which combines the BPR, LAN/WAN/Voice, CCE, and Data Management efforts, needs to provide solutions for migrating and integrating the legacy data (e.g., System 36 data) within the new environment. This data will be used more efficiently and produce value-added products when integrated with GIS.

Another crucial aspect of implementation is the networking capabilities to connect databases at service center, state, and national levels. Access to GIS and DBMS data sets needs to be efficient and support wide communications bandwidths due to large file sizes and substantial anticipated transactions to and from databases. Accessing, analyzing, displaying, and updating the various geospatial and relational databases in a distributed environment requires full interoperability among systems.

One emerging strategy, which should be carefully considered, is the capability that database vendors have developed for the storage and manipulation of spatial components within a DBMS to supplement traditional DBMS attribute data. Thus, the DBMS can handle complex geospatial data and store both spatial and tabular data within the database. This allows both types of data to be managed within a single software environment and also provides traditional database management capabilities, such as rollback, security, and transaction processing, to be applied to spatial data.

Database vendors are developing spatial components to supplement the traditional DBMS. These components are being designed to handle geospatial information and data structures. Integration of GIS software and DBMS will be a challenge and the enabling technologies will be evolving through the life cycle of this implementation. While

several DBMS and GIS vendors have developed the capability of storing and querying the data with rapid Input/Output (I/O) and graphic display, it remains a challenge to integrate a multi-user environment and especially to be able to manage data updates. Vendors are working to "seamlessly" integrate desktop and professional GIS directly with DBMS and to include all aspects of data management within this common environment. While this technology is clearly emerging, it does deserve consideration for the potential data management benefits which can be derived. For example, GIS/DBMS tools, such as feature locking, are helpful to avoid more than one employee updating the same data at the same time. In some instances, advanced security features are desired to provide cleared employees restricted access to sign up clients for programs and historical tracking to preserve data integrity in case of failure.

It is a requirement that the spatial data stored in the DBMS be "seamlessly" linked to the business data stored in the DBMS. Tools need to be developed that allow service center employees to point to a field/farm using the associated GIS interface and access their business data.

7.4 Geospatial Database Maintenance/Warehousing

An important aspect of the total equation for managing geospatial data is the maintenance of the physical databases. Database maintenance includes maintaining the authoritative copy of the data online or near online. This includes all aspects of online management including performance tuning, database archival, backup, and recovery, maintaining communication links, security, and disaster recovery. Once the data has been acquired and integrated, it is warehoused and linked to the delivery efforts. This warehouse will be a virtual warehouse with some data collocated physically and other non-USDA created data linked using existing nodes on the FGDC Data Clearinghouse.

8. GIS Software and Application Training

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

The GIS Software and Application Training Team is developing strategies for delivering GIS training to ensure that service centers are provided with a standardized and comprehensive GIS training package. This training strategy will include recommendations for:

- Providing service center staff with GIS training and support to include:
  - GIS Concepts and Terms Training
  - GIS Core Training
  - GIS Customized Training (using live USDA data)
- Determining and recommending the most cost effective way to provide GIS training to all service centers during full implementation
- Identifying USDA business applications and business processes improved by GIS

To meet these needs, the GIS Software and Application Software project team is currently developing:

- The customized portion of the Core Service Center GIS Training that will be used for the pilots and with full GIS implementation
- A service center GIS training strategy for both pilot sites and full implementation
- Effective and inexpensive GIS training methods
- A GIS support plan which includes help desk support during piloting and full implementation

The GIS training initiative will be further refined and developed based on pilot test results and lessons learned.

9. Support Structure

To support GIS implementation, a combination of the following Government and contractor personnel will be required:

- State. GIS and business support will be provided within the state by service center agencies. Typical assistance will include coordination with state and Federal agencies, National Headquarters, National Centers, contractors, and the business help desk. State service center agencies will also provide assistance for systems and programs using GIS as well as significant resources and expertise, such as regional planning and analysis.

- National Centers. National centers are expected to provide assistance in the coordination of data development, data integration, data packaging, and delivery. These sites will also assist in developing geospatial standards and business application software.

- National Headquarters. Service center agencies, other Federal agencies, and the FGDC develop geospatial information standards, plans, and strategies and develop and issue GIS and geospatial information policy. There is a potential need to have an intra-agency data oversight group to provide guidance standards and answers to policy and implementation questions.

- Contractors. Contractors will be needed to help develop geospatial databases, integrate and package data, install GIS hardware and software at service center sites, provide training, and assist in the development of GIS application software.

- Help Desk. The centralized service center help desk will be enhanced to include an Internet-based GIS component which will be coordinated with the ongoing service center help desk teams. The GIS component will enable customers to obtain GIS assistance via the Internet. Depending on the complexity of support required, customers would be able to locate answers on an established Web page. For customers who require more detailed information or individualized attention, the help desk would list service center employee phone numbers and/or e-mail addresses.

  Since the GIS component of the help desk would be Internet-based, multiple customers could simultaneously request and receive assistance at any time of day, from any location. Categories of assistance will include, but not be limited to:

  - General GIS Learning. Novice users or customers with general questions could select this option to request vendor help or locate USDA points of contact for generic GIS and software questions. More advanced users or customers with more complex requests, such as detailed ArcView questions, would be directed to a GIS expert's phone number and/or e-mail address.

- GIS Systems Help. Customers with system configuration or other technical problems would be able to contact an employee who specializes in GIS system administration issues.

- GIS Data Help. Customers who are interested in data use, location, or formatting would choose this option to access the metadata repository. The customer could then access a data expert's phone number and/or e-mail address for additional questions.

- GIS Applications Help. Customers with GIS applications questions could contact a service center employee with expertise in how to use GIS and geospatial information to reach the proper conclusions.

Each assistance category would have a Frequently Asked Questions (FAQ) section to provide immediate answers to common customer questions. The answer would also include a point of contact for customers who wish to receive additional information.

10. Partnerships

The broad implementation of GIS technology, such as described in this strategy, 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 similar 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, to foster joint funding and data sharing. Information technology interoperability standards must be developed, primarily by private industry, to facilitate geospatial data sharing among information systems.

10.1 The Federal Geographic Data Committee

The FGDC is an interagency committee that promotes the coordinated use, sharing, and dissemination of geospatial information on a national basis. 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 15 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 cross-cutting 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 NRCS and FS are represented at the Coordination Group level. The NRCS, the FS, and other 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 USDA intends to follow the FGDC standards development process for the 19 geospatial themes identified in this strategy. USDA will also continue to coordinate with FGDC in the development of data themes for which other Federal agencies have leadership responsibility. Through the FGDC, USDA will encourage agencies to actively develop geospatial information that meets service center agency and other local needs.

10.2 Key Federal Agency Partners

Although a number of Federal agencies are important to the GIS Strategy's success, coordination with three agencies—USGS, FS, and BLM—is essential to successful GIS implementation because of the data, funding, and standards they provide. Each of the key Federal agency's involvement is described in the following sections.

10.2.1 United States Geological Survey

The 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, hydrography, and co-leadership of earth cover. The USDA will continue to work closely with USGS to foster the development of these data themes to meet service center needs and coordinate FGDC activities.

10.2.2 Forest Service

The 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 expects all national forests will be operating in a GIS environment by year 2000. Common or "core" geospatial themes have been identified as required themes for effective GIS implementation. Many of these themes coincide with the service center themes. Whenever projects cut across the geographic boundaries of public and private lands, service center agencies will be collaborating with the FS so that geospatial information is compatible and in accordance with standards.

10.2.3 Bureau of Land Management

The 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 suboffices 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 Automated Land and Mineral Record System (ALMRS) modernization project. Full deployment of release one is scheduled for completion by the end of fiscal year 1998. The BLM also has identified a number of geospatial themes required by their offices to effectively implement GIS technology. USDA will coordinate data theme development with BLM in order to avoid duplication and incompatibilities. USDA's coordination efforts will include ensuring that projects which cut across geographic boundaries of public and private lands have geospatial information that is compatible and in accordance with standards.

10.3 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 service centers. A number of county governments are also actively using GIS technology and they may be developing and maintaining geospatial data themes at a better level of resolution than the state agencies. USDA cost share and workshare agreements with state and county government will be very important for acquiring and maintaining many of the common geospatial data themes identified in the strategy.

At the national level, service center agencies will partner with several organizations representing state and county-level entities. The key organizations service centers will partner with are: the NSGIC, the National Association of Counties (NACo) the National Association of Conservation Districts (NACD), and the 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 service centers.

10.3.1 National States Geographic Information Council

The NSGIC is an organization of states committed to efficient and effective government through the prudent adoption of geospatial information technology. Members of NSGIC include delegations of senior state GIS managers from across the U.S. Other members include representatives from Federal agencies, local government, the private sector, academia, and other professional organizations. 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. Through a cooperative agreement with the FGDC, NSGIC is providing leadership for a GIS and mapping survey of thousands of agencies at the local/county government level. The goal of the survey is to create a "snapshot" of the U.S. digital geographic data status, especially the framework data layers from a state and local perspective. The results of this survey will be useful in coordinating geospatial information development and data sharing among county, state, and Federal agencies.

10.3.2 National Association of Counties

NACo is a national organization for the 3,141 counties across the country. NACo serves as a national advocate for these 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 USDA service center agencies 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 national survey is being conducted by the NSGIC to better understand the nature of county mapping, GIS, and geospatial information activities. Preliminary estimates indicate that nearly one-fourth of U.S. counties have some operational GIS capability. USDA will closely coordinate with NACo and counties actively involved in GIS in order to acquire the data themes needed by service centers, avoid duplication, and minimize costs.

10.3.3 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. NRCS has agreed to work with conservation districts in the procurement and use of CCE and the shared information system. Like the service centers, conservation districts will be using GIS technology in the office and out in the field.

The conservation districts are represented by a national organization called the NACD. Districts also work with various other organizations such as the National Association of State Conservation Agencies and the NARC&DC.

10.3.4 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 where needed to foster a sound local economy. Councils hold community meetings to identify concerns, needs, and problems within a community. The Council's resource committees, with assistance from Federal, state, and local agencies, collect information about identified problems, develop alternatives, 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.

10.4 Key Industry Partners

Successful GIS implementation will require the efforts of several private industry partners. These industry partners will work together within the bounds of the OGC to foster development of an open systems approach to geoprocessing.

10.4.1 Open GIS Consortium

The need for the OGC grew out of widespread recognition that geographic information was very difficult to share among systems and customer application geoprocessing software would not interoperate among systems. To help resolve this problem, geoprocessing specifications have been and are being developed through a consensus building process, which is open to the entire industry. All the major GIS, database, and information technology (IT) vendors are members of OGC. As specifications are adopted, industry develops software in compliance with these specifications and subsequently achieves a new level of interoperability. USDA service center agencies are supportive of these geoprocessing interoperability goals and will continue to participate with OGC and industry representatives at various levels.

10.5 Private Sector

As this project evolves, private sector companies may become partners in this effort.

11. Business Process Reengineering Projects

The business benefits of applying GIS technology within a service center have previously been demonstrated, to a limited extent, in pilot locations such as Osage County, Kansas. The coordinated efforts of the SCIT provide an opportunity to develop and test several BPR projects that will further identify business benefits of incorporating GIS into daily service center operations.

Information collected during pilot testing of reengineered business applications will be used to refine the strategy for a phased, national deployment. The USDA Service Center Geographic Information System (GIS) Strategy will be updated to reflect changes that result from pilot testing.

The following sections describe projects that have been identified as representative of activities required for successful GIS implementation. This is not intended to be an exhaustive list of all possible GIS-related projects. A full description of these projects can be found in the business plans for each SCIT business area. The business plans will be posted on the service center Web page once they receive final approval.

The projects are presented in two categories:

- Infrastructure
- Business Application

11.1 Infrastructure Projects

This category includes those projects which are fundamental to GIS implementation. It includes infrastructure initiatives to acquire, integrate, and deliver geospatial information to service centers, to establish a common framework, and to provide training on GIS software and applications.

11.1.1 Geospatial Data Acquisition, Integration, and Delivery

This project will establish a nationwide process for acquiring, integrating, managing, and delivering geospatial information to service centers staff and customers. Acquired data will be in various formats, scales, resolution, and media and will need to be converted before delivery to service centers. This project will integrate data themes and determine the best delivery mechanism (e.g., CD-ROM, LAN/WAN, Internet, etc.) to provide service centers with data that requires minimal reformatting and uploading prior to use.

An ongoing effort called the Natural Resource Data Gateway is being evaluated to be the delivery component of this project. The Natural Resource Data Gateway project will validate access and delivery requirements, and produce software and databases that allow internal and external customers easy and consistent access to natural resource data where, when, and how they need it. The Natural Resource Data Gateway will support the development, presentation, and dissemination of information by service center field staff working in the field with customers away from the office. The Natural Resource Data

Gateway will provide common access to consistent data and support business processes across service center locations, partner agencies, and USDA customers.

The Natural Resource Data Gateway was envisioned to operate within the service center CCE either in the service center or at some central location. The scope of the project is being expanded to include processes and data common and shared among the three service center agencies.

11.1.2 Common Land Unit

The development of boundaries that outline agricultural production or producer property areas are key to most FSA and NRCS GIS-related activities. As such, this project is key to the successful implementation of GIS at the service center. Of the four critical data layers, the least is known about the cost to implement common land unit. From experience gained in previous and ongoing digitizing efforts, it may not be efficient to have every service center digitize their own farm, tract, and field boundaries. Informal surveys have shown that limited resources can be made available in some states to begin a common land unit digitizing effort if appropriate hardware and software are available.

The focus of this project is to develop alternatives to obtain first time national common land unit themes. An early goal of this project is to obtain enough experience with common land unit digitization alternatives so that a suite of methods can be made available, and the most efficient solutions can be implemented. Concurrently, a set of tools will be developed to empower service center employees to digitize their own farm, tract, and field boundaries and incorporate their changes into the shared information resource of the service center agencies. Included in this BPR project is the development of mapping and digitizing standards.

The maintenance of common land unit within the context of business activities is described in Section 11.2.5, Farm Records Maintenance.

11.1.3 Wetlands and Easements

The Wetlands and Easements Project will reengineer how to develop and service a digital database of USDA certified wetlands and easements. This data will improve the quality and accuracy of current hard copy wetland and easement information, the ability to track wetland and easement data, and the ability to provide customers with timely and accurate information. Included in this BPR project is the development of mapping and digitizing standards.

11.1.4 GIS Software and Application Training

The GIS Software and Applications Training Project will provide strategies for GIS systems and applications training, as well as a GIS support strategy, involving (1) a training process on the use of the software and (2) a training process on how to use GIS to conduct service center business effectively. This will enable service center staff to provide customers with the highest quality of service possible and reduce the burden on the customer.

11.1.5 Demographic and Business Analysis

This project will reengineer the process that agencies currently use to access demographic data. It will develop a nationwide system of demographic information and analysis tools that enable analysis of customers, agency facilities, services needed/provided, and other business management activities. The project will build on existing RD demographic and cultural data and databases.

11.2 Business Applications

Business Application projects apply GIS technology to specific business processes that are performed within service centers. All reengineered business processes will be tested at one or more pilot locations prior to national deployment.

11.2.1 Common Eligibility and Compliance Application

This project provides a series of standard application processes by program areas that link to all common information and eligibility requirements and use GIS capability. It will reengineer processes so that common information will be collected only once and reused in a consistent format that reflects commonality in software application support.

11.2.2 Land Use

This project will reengineer how service center employees will report land uses. It will provide service center employees with efficient and accurate methods for determining land uses. It provides the capability to produce crop reports and historical crop data. Standard reports will be developed and used to assist service center employees determine producer and land eligibility.

11.2.3 Customer Service Toolkit Reengineered Processes

This project will reengineer how the conservation planning process is done at the service center. It will provide support to transfer customer files between a service center application server and a remote (standalone) computing laptop. This includes enabling the service center staff to display and share agency program and technical information, such as, conservation plans, standards and specifications, soils interpretations, ecological site descriptions, and soil erosion analysis.

11.2.4 Conservation Area Resource Assessment Analysis

This project will reengineer how conservation area resource assessment analysis is performed by service center staff. This project will document and demonstrate the use of GIS technology for resource assessment. The resulting assessment will be used to establish a quantitative process which will identify and communicate high priority conservation areas. This will result in more consistent data, more equitable consideration and fair distribution of tax/program dollars, and treatment of the most critical natural resource concerns.

11.2.5 Farm Records Maintenance

This project will reengineer how farm records are created and maintained at the service center. One part of this project is the business application component of the Common Land Unit project as described in Section 11.1.2. In addition to the national effort to digitize first time coverage of common land unit (which includes farm tract and field boundaries), business applications will be reengineered to maintain these layers. The ability to link common land unit themes with tabular business data and to perform farm reconstitutions will be implemented through this project.

11.2.6 Risk and Productivity Assessment

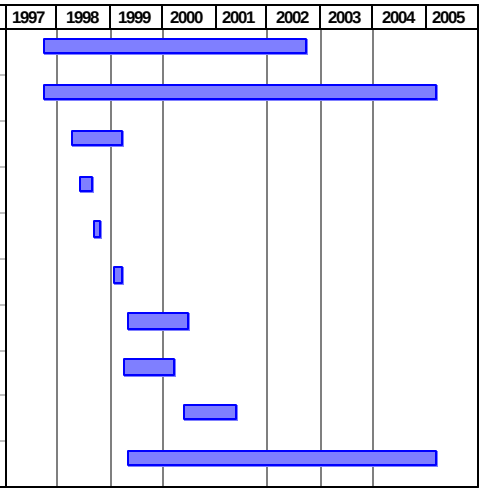
This project will reengineer business processes associated with the determination, evaluation, and use of crop yield and risk information. The project will integrate processes to use topography, soils, common land units, weather data, crop growth models, and program experience to determine crop risk appraisals and yield estimates. Products will be used to evaluate individual farm productivity potentials, examine conservation program effects, improve disaster area designations and impact estimates, and improve risk management programs.

12. GIS Milestones

The GIS strategy will be implemented in phases. Exhibit 12-1, GIS Milestones, presents a high-level implementation schedule. This schedule will be revised as new information becomes available.

GIS MILESTONES
Exhibit 12-1

ID	Task Name
1	Provide Orthoimagery
2	Acquire Data
3	Develop GIS Training
4	Buy and Deploy Desktop GIS for Pilots
5	Conduct Training and Support for Pilots
6	Evaluate Business Impact of GIS in Pilots
7	Buy and Deploy Desktop GIS for Service Centers
8	Develop GIS Enterprise Solution
9	Buy and Deploy Enterprise GIS for Service Centers
10	Conduct Training and Support for Service Centers



13. Financial Justification for GIS

In 1997, the National Food and Agricultural Council (FAC) identified activities common to every service center. These were grouped into four BPR projects focusing on the following business areas: (1) interfacing with customers, (2) serving customers and delivering programs, (3) using geospatial information in program delivery, and (4) managing internal resources (administrative management). These BPR projects developed a business case[9] that identifies the potential for over $4 billion in process/business savings and provides strong justification for initial investments in the CCE for partner agencies.

Exhibit 13-1, Annual Savings from GIS Usage, presents the estimated annual savings of conducting business operations with enabling GIS technology. For example, it is estimated that $34.5 million in annual savings can be realized by using GIS for land eligibility determinations.

ANNUAL SAVINGS FROM GIS USAGE
Exhibit 13-1

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
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

[9] USDA Service Center Business Case, October 9, 1997.

14. Investments for GIS

This section identifies the USDA and other Federal/state/local investment levels necessary to support geospatial information acquisition and development.

Exhibit 14-1, USDA Investment Required to Develop Critical Geospatial Data Themes, identifies the funds required by USDA to create or acquire the four critical geospatial themes.

USDA INVESMENT REQUIRED TO DEVELOP CRITICAL GEOSPATIAL DATA THEMES
Exhibit 14-1

($ millions)

Critical Geospatial Data Themes for USDA Service Centers	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04	Total
1. Orthoimagery	12.25	12.25	12.00	6.00	6.00	6.00	6.00	60.50
2. Common land unit	0.112	0.60	9.61	12.25	12.25	12.25	12.23	59.30
3. Soils—SSURGO	7.50	7.50	15.00	15.00	15.00	15.00	5.00	80.00
4. Cultural and demographics	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTALS	19.86	20.35	36.61	33.25	33.25	33.25	23.23	199.80

Exhibit 14-2, NRCS, RD, and RMA Investment Required to Develop Common Geospatial Data Themes, shows the NRCS, RD, and RMA funds necessary to create or acquire the additional 15 data themes.

NRCS, RD, AND RMA INVESTMENT REQUIRED TO DEVELOP COMMON GEOSPATIAL DATA THEMES
Exhibit 14-2

($ millions)

Common Geospatial Data Themes for USDA Service Centers	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04	Total
Framework								
1. Governmental units and place names								
• State and county boundaries	0.20	0.20	0.00	0.00	0.00	0.00	0.00	0.40
• Minor civil divisions	0.00	00.0	00.0	00.0	00.0	0.00	0.00	0.00
• Incorporated places and consolidated cities	0.00	00.0	00.0	00.0	00.0	0.00	0.00	0.00
• Indian lands	0.00	00.0	00.0	00.0	00.0	0.00	0.00	0.00
• Geographic Names Information System (GNIS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

NRCS, RD, AND RMA INVESTMENT REQUIRED TO DEVELOP COMMON GEOSPATIAL DATA THEMES
Exhibit 14-2 (Cont'd)

($ millions)

Common Geospatial Data Themes for USDA Service Centers	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04	Total
2. Elevation	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.20
3. Hydrography	0.30	0.30	0.00	0.00	0.00	0.00	0.00	0.60
4. Cadastral								
• Public Land Survey System (PLSS)	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.20
• Military installations	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
• National forests	00.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
• Bureau of Land Management (BLM) lands	00.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
• National parks	00.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5. Transportation								
• Roads	0.20	0.20	0.00	0.00	0.00	0.00	0.00	0.40
6. Digital Raster Graphic (DRG)	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.10
Natural Resources								
1. Land cover/vegetation/ plants	0.20	0.20	0.50	1.00	1.00	1.00	1.00	4.90
2. Watershed boundaries (11-14 digit hydrologic units)	0.90	1.80	1.80	1.20	0.30	0.30	0.30	6.60
3. Wetlands	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4. Wetland and floodplain easements	0.00	0.10	1.00	1.00	1.00	1.00	1.00	5.10
5. Climate—precipitation and temperature	0.25	0.25	7.10	7.10	7.10	7.10	7.10	36.00
6. Flood hazard maps	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Business								
1. USDA Office Information Profile (OIP)	0.40	0.30	0.30	0.20	0.20	0.20	0.20	1.80
2. Applied conservation practices	0.10	1.00	5.00	7.50	7.50	7.50	7.50	36.10
3. Water control infrastructure/National Inventory of Dams	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.70
TOTALS	2.95	4.65	15.80	18.10	17.20	17.20	17.20	93.10

Exhibit 14-3, Other Federal, State, and Local Investments Required to Develop Geospatial Data Themes, shows the investment levels required by other agencies to create both the critical and additional data themes.

The FY 98 column represents the estimated base level of activity for this geospatial data theme. In most instances, this does not represent an effort to develop the data theme in accordance with the minimum level of accuracy needed for the USDA service center

agencies, which is either the 1:24,000 or 1:12,000 scale. Beginning in fiscal year 2000, investment levels are increased for a four year period to represent the funding required to develop and complete (for the conterminous U.S.), the geospatial data for use in conjunction with a 1:12,000 scale, 1-meter resolution digital orthoimage map. This funding increase would either be part of a Year 2000 budget initiative by the appropriate Federal agency of part of the four-year cross-cut FGDC/White House budget initiative for geospatial data and GIS at the local level.

The investment levels shown in this exhibit have been discussed with the appropriate agencies that have leadership for this data theme. However, they are general estimates based on the best available information at this time.

OTHER FEDERAL, STATE, AND LOCAL INVESTMENT REQUIRED TO DEVELOP GEOSPATIAL DATA THEMES
Exhibit 14-3

($ millions)

Common Geospatial Data Themes for USDA Service Centers	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04	Total
Framework								
1. Orthoimagery **(Critical)**	16.00	16.00	14.00	13.00	4.00	4.00	4.00	71.00
2. Governmental units and place names								
• State and county boundaries	0.50	0.50	1.25	1.25	1.25	1.25	0.10	6.10
• Minor civil divisions	0.50	0.50	2.50	2.50	2.50	2.50	0.20	11.20
• Incorporated places and consolidated cities	0.50	0.50	3.75	3.75	3.75	3.75	0.30	16.30
• Indian lands	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.70
• Geographic Names Information System (GNIS)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	7.00
3. Elevation	4.00	4.00	12.00	12.00	12.00	12.00	4.00	60.00
4. Hydrography	1.00	1.00	8.25	8.25	8.25	8.25	1.00	36.00
5. Cadastral								
• Public Land Survey System (PLSS)	3.00	3.00	12.00	12.00	12.00	12.00	1.00	55.00
• Military installations	0.10	0.10	0.30	0.30	0.30	0.30	0.10	1.50
• National forests	0.20	0.20	0.20	0.20	0.20	0.20	0.20	1.40
• Bureau of Land Management (BLM) lands	0.50	0.50	0.50	0.50	0.50	0.50	0.50	3.50
• National Parks	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.70
6. Transportation								
• Roads	1.00	1.00	6.25	6.25	6.25	6.25	1.00	28.00
7. Digital Raster Graphic (DRG)	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.70

OTHER FEDERAL, STATE, AND LOCAL INVESTMENT REQUIRED TO DEVELOP GEOSPATIAL DATA THEMES
Exhibit 14-3 (Cont'd)

($ millions)

Common Geospatial Data Themes for USDA Service Centers	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04	Total
Natural Resources								
1. Soils—SSURGO **(Critical)**	0.50	0.50	1.00	1.00	1.00	1.00	1.00	6.00
2. Land cover/vegetation/ plants	2.00	2.00	2.00	5.00	5.00	5.00	2.00	23.00
3. Watershed boundaries (11-14 digit hydrologic units)	0.20	0.20	0.20	0.20	0.20	0.20	0.20	1.40
4. Wetlands	0.00	0.00	10.00	10.00	10.00	10.00	10.00	50.00
5. Wetland and floodplain easements	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6. Climate—precipitation and temperature	0.50	0.50	0.50	0.50	0.50	0.50	0.50	3.50
7. Flood hazard maps	50.00	50.00	100.00	100.00	100.00	100.00	100.00	600.00
Business Data								
1. Common land unit **(Critical)**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2. Cultural and demographics **(Critical)**								
• Census of Population and Housing*	300.00	400.00	1000.00	400.00	200.00	100.00	100.00	2500.00
• Census of Agriculture	36.00	26.00	15.00	15.00	18.00	36.00	15.00	161.00
3. USDA Office Information Profile (OIP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4. Applied conservation practices	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5. Water control infrastructure/National Inventory of Dams	0.20	0.50	0.50	0.50	0.50	0.50	0.50	3.20
TOTALS*	118.00	108.30	191.50	193.50	187.50	205.50	142.90	1147.20

* Census of Population and Housing figures are not included in the total.

Exhibit 14-4, USDA Investment Required for Geospatial Data, presents a summary of the estimated USDA costs for the various categories of GIS implementation.

USDA INVESTMENT REQUIRED FOR GIS AND GEOSPATIAL DATA
Exhibit 14-4

($ millions)

Category	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04	Total
Critical Data Acquisition and Development	19.86	20.35	36.61	33.25	33.25	33.25	23.23	199.80
Other Data Acquisition and Development	2.95	4.65	15.80	18.10	17.20	17.20	17.20	93.10
Data Integration and Delivery and Maintenance (including warehouse functions)			3.00	3.00	3.00	3.00	3.00	15.00
TOTALS	22.81	25.00	55.41	54.35	53.45	53.45	43.43	307.90

GIS-related hardware, software, and data servers are not part of this investment table. These are built into the CCE investments. Investments for business application software and training are also part of the CCE investments and not part of this table.

15. Conclusion

Integrating GIS technology into service center 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 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 NSDI "digital earth" for rural America
- Helping improve the quality of life for America