

**GAO**

Report to the Chairman, Subcommittee on  
Interior, Committee on Appropriations,  
House of Representatives

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March 1989

# FOREST SERVICE

## Status of Geographic Information System Acquisition



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**Information Management and  
Technology Division**

B-230723

March 6, 1989

The Honorable Sidney R. Yates  
Chairman, Subcommittee on  
Interior  
Committee on Appropriations  
House of Representatives

Dear Mr. Chairman:

As agreed with your office on January 18, 1989, we are providing you with information on the planned Geographic Information System (GIS) of the Forest Service, Department of Agriculture. The information includes a general description of the system and its intended uses, the Forest Service's estimated system costs, a summary of the Service's major actions to date, and key steps the Forest Service must take before it can begin to acquire the planned system. Also, as arranged previously with your office, we will provide you later this year a report further analyzing this GIS procurement.

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**The Forest Service's  
Planned Geographic  
Information System**

The Forest Service's GIS is to be a computer-based system to store, retrieve, analyze, and present spatially referenced information<sup>1</sup> about the nearly 200 million acres of national forests and grasslands that it manages. Such information has historically been found on maps and other types of data records. The kinds of information that the Forest Service could store in its GIS include land ownership data; vegetation types, such as tree species; soil types; water location; and land elevation.

Forest Service program documents state that the Service's ability to accomplish its mission depends on the rapid retrieval, analysis, and communication of consistent, accurate information about the resources it manages. A GIS that can electronically store, analyze, and display geographic data is seen by officials as a more effective, efficient way to manage this kind of information. The Service believes that with a GIS it will be able to rapidly and accurately analyze and display information, possibly in a map format, about such items as proposed timber sales or the habitat of an endangered species. For example, the Service could use the GIS to determine the types, number, age, and estimated value of trees in any given area of any national forest, or for an entire forest.

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<sup>1</sup>Spatially referenced information is information that can be associated with a specific place on the earth's surface, such as the exact geographic location of a lake, road, or stand of trees.

According to its planning documents, the Service intends to place GIS workstations in its 123 forest supervisors' offices and in 653 ranger districts. About 3,200 workstations may be purchased and installed in these offices over a 5-year implementation period extending from 1991 through 1995.

## Estimated System Costs

In its Information Resources Management plan for fiscal years 1989 through 1993, the Service estimated that its costs of developing, implementing, and operating a GIS will be \$167.6 million (see table 1). However, Forest Service officials told us that additional implementation and operating costs of \$44 million a year will be needed for fiscal years 1994 and 1995. Further, the estimate does not include costs to gather and convert data for the GIS. The estimated costs of this latter effort range up to \$1 billion.

**Table 1: Estimated GIS Costs, Through Fiscal Year 1993**

Dollars in millions							
	1988	1989	1990	1991	1992	1993	Total
Staff costs <sup>a</sup>	\$0.7	\$8.6	\$14.4	\$17.3	\$19.2	\$19.2	\$79.4
Other costs <sup>b</sup>	0.7	6.0	6.5	25.0	25.0	25.0	88.2
<b>Total costs</b>	<b>\$1.4</b>	<b>\$14.6</b>	<b>\$20.9</b>	<b>\$42.3</b>	<b>\$44.2</b>	<b>\$44.2</b>	<b>\$167.6</b>

<sup>a</sup>Staff costs cover such items as developing information requirements; preparing for the GIS procurement; establishing GIS policy and guidelines; implementation during fiscal years 1991, 1992, and 1993; and support and maintenance for these systems when installed.

<sup>b</sup>Other costs cover such items as equipment, software packages, and equipment maintenance.

Inclusion of the implementing and operating costs for fiscal years 1994 and 1995 would bring the planned total costs to about \$255 million plus the costs to convert the data for the GIS data base.

Concerning the costs to convert the data for the GIS data base, the Service does not have any good estimates, except that it will be costly. For example, a regional Forest Service GIS coordinator said that such costs could be four times more than the total estimated system costs of \$255 million. The Forest Service Acting Director of Engineering, in response to an official Forest Service request for information on the GIS proposal, stated that the costs for gathering data could be nearly \$500 million. The Director of Timber Management placed the estimate at \$1 billion.

In commenting on a draft of this report, the Associate Deputy Chief of Administration noted that the current costs associated with collecting data may be reduced as a result of the more systematic data collection

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effort required for a GIS, and that new technologies may also reduce data collection costs. He added that these considerations would be included in the cost and benefit analysis, which is being prepared by the Service.

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## Forest Service GIS Activities to Date

In 1984 the Deputy Chief for the National Forest System, recognizing that technical developments have created new powerful GISs and that the Service must look more closely at this new technology, chartered an interdisciplinary team. The team was to develop recommendations about the Service's current policy for identifying information needs, the responsibilities of various organizational levels, centralized methods for services, and future hardware and software acquisitions to support geographic information processing. The team's final report, issued in September 1984, noted that the Forest Service should develop a strategy for acquiring and implementing a GIS. The team also recommended that GIS work load analyses be conducted to identify the potential advantages of this technology, and the ramifications of its adoption on Forest Service operations.

In 1985 the Service sponsored a consulting geographer to conduct work load analyses. Six national forests were selected; the resulting conclusion was that a GIS could assist the Forest Service in carrying out planned objectives more efficiently and effectively. The contractor recommended that the Forest Service procure one or more GISs to be used in a controlled environment to (1) collect detailed cost and benefit information, (2) refine functional requirements and work load estimates, (3) help develop better data standards and information structures, and (4) assess the organizational impact resulting from the integration of GIS technology into the Service's daily management activities.

The national GIS coordinator told us that the controlled evaluation was implemented in 1987. Six Forest Service offices are designated as controlled evaluation sites and authorized to purchase and install GIS hardware and software for evaluation purposes. According to the national GIS coordinator, the controlled evaluations will continue until at least May 1990.

Prior to completion of the controlled analysis, in January 1988 the Chief of the Forest Service approved a national strategy to implement a GIS. The strategy consists of five major components: information base and structure, field unit preparation, technology procurement, external coordination and oversight, and implementation. Forest Service plans call for installation of GIS hardware and software beginning in 1991.

The strategy includes two basic principles: (1) use an existing computer network used by Forest Service for word processing, electronic mail, and other applications; and (2) GIS must be available at the Forest Service district level.

In September 1988 the Forest Service is planning a GIS relating to the planned GIS. The purpose of the comments from industry and Forest Service refine its GIS specifications to be described the present Forest Service computer requirements, and functional description requirements. The Service received 250 comments for information. As of November 25, 1988, the Service received over 40 comments from industry.

Currently, the Forest Service is planning a GIS data base and determine the kinds of data available on national forests. It is also determining what data are available on national forests, and digitize these data for entry into the GIS. The Forest Service's Geomatics Service (GMS) is an effort to digitize certain base layers of ownership and boundaries, that will be used in all offices. In addition, the Service is conducting a training program intended to acquaint its personnel with GIS. The program is used to manage national forest resources. The program includes presentations, brochures, and briefing papers. The program objectives associated with implementing a GIS are:

## Key Steps Required Before Forest Service Can Acquire a GIS

Several steps must be taken before the Forest Service can obtain approval from the Department of Agriculture Administration to request vendors to submit proposals. The actions<sup>2</sup> include documenting functional requirements, conducting a feasibility study, and preparing a cost and benefit analysis.

Functional requirements include an inventory of existing GIS, a description of the existing operational procedures, a summary of improvements sought, and a description of the proposed system.

<sup>2</sup>The actions noted are required by the Department of Agriculture Approval for IRM Products and Services.

required of the new system, data sources and outputs, and data characteristics. The document is to provide a basis for mutual understanding between users and designers of the functions to be performed by the system, its operating environment, and the systems development plan. The functional requirements were originally scheduled for completion in September 1988. However, according to the Director, Computer Science and Telecommunications, the requirements will not be completed until June 1989.

The feasibility study should provide an analysis of the objectives, requirements, and system concepts; an evaluation of alternatives for reasonably achieving objectives; and an identification of proposed approaches. The feasibility study was originally scheduled for completion in February 1989. This study will not be completed until June 1989, however, according to the Director, Computer Science and Telecommunications.

The cost and benefit analysis is to provide managers, users, designers, and auditors with adequate cost and benefit information to analyze and evaluate alternative approaches to developing the system. The cost and benefit analysis was originally scheduled to be completed in January 1989, but is now planned for completion in June 1989, according to the Director, Computer Science and Telecommunications.

The request for proposals, the document required to obtain vendor offers on the GIS, was initially scheduled for release in June 1989. However, according to the Director, Computer Science and Telecommunications, this document will not be released until October 1989.

The Forest Service had laid out an ambitious schedule for completing key studies required before issuing its request for proposals. On the basis of our evaluations of these activities at other agencies, we have found that agencies generally have difficulty in maintaining such schedules. The Forest Service has already begun to experience this difficulty with its GIS.

Completion of these studies is critical to making informed decisions about such items as whether proposed systems are worth the cost, and if the appropriate and most cost effective approach for developing such systems has been determined. To move into a procurement cycle before these studies are prepared and appropriately analyzed may lead to actions which, in the long run, may not be in the best interest of the government in terms of expenditures and efficient operations.

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The Associate Deputy Chief of Administration, in commenting on a draft of this report, agreed that the Service had laid out an ambitious schedule. He added that a reason for the schedule slippages was the recognition of the importance of these studies and the Service's interest in completing the studies accurately and completely.

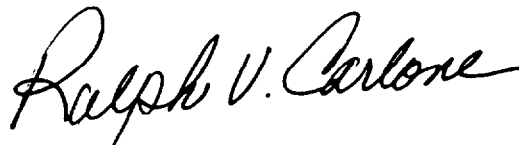
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Forest Service officials reviewed a draft of this report and their comments have been incorporated where appropriate. The information in this report is based on documents obtained from the Forest Service and the Department of Agriculture, and interviews with Forest Service and Department of Agriculture officials. We did not analyze the documents to determine whether they were prepared in accordance with applicable federal and agency requirements. This report was developed in accordance with generally accepted government auditing standards and is based on audit work conducted primarily between September 1988 and January 1989.

We are sending copies of this report to the Chairmen, Senate Committee on Appropriations, House Committee on Government Operations, and Senate Committee on Governmental Affairs; the Director, Office of Management and Budget; the Secretary of Agriculture; and the Chief of the Forest Service. We will also make copies available to others upon request.

This report was prepared under the direction of Howard G. Rhile, Associate Director. Other major contributors are listed in the appendix.

Sincerely yours,



Ralph V. Carlone  
Assistant Comptroller General





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