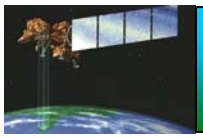


Chapter 7
Conclusions and Opportunities

States have crucial positions within our nation's form of governance for many reasons. The federal form of government in the United States ensures that state forestry organizations (SFOs) will continue to have several unique roles and challenges based on both state and federal direction and needs, changing and often conflicting societal values and interests, and growing financial limitations. At the same time, state foresters have new opportunities to help adapt to change and lead their organizations to effectively meet the challenges and needs ahead. Remote sensing and other geographic information technology (GIT) provide resources and capabilities to help state foresters develop new approaches to meet multiple missions and needs in the future.

7.1 Summary of Report Findings

This report provides summary, details and analysis about the presence and adoption of remote sensing and other GIT in SFOs. The findings show that GIT adoption in SFOs is quite advanced, and particularly for GIS. Over two thirds of the SFOs are found to be active or advanced users of GIS, while less than half as many are as active or advanced for remote sensing and GPS. However, approximately two thirds of the SFOs indicate use of digital aerial data and just over half have used satellite data.

Applications range across virtually all SFO program functions in several states. Fourteen categories of GIT applications were identified among the SFOs, with innovative projects underway in virtually every category. The summary results indicate that the most common uses of GIS, GPS and RS by SFOs are for Fire and Emergencies, State Lands, and Private Lands. These applications were also the strongest for use of digital aerial data, and in the case of Fire and Emergencies, for satellite data as well.

Given this widespread GIT use among most SFOs, non-technological issues become leading determinants of successful and beneficial GIT utilization.

The results indicate that SFOs have many different institutional approaches and conditions concerning GIT. The non-technological matters analyzed in this report focus on overall institutional approaches, organizational structures, GIT staffing in headquarters and field/regional offices, coordination of GIT activities with internal and external entities, relationship with parental and other organizations and groups, and GIT policies, issues, and benefits. Overall assessment of these results reveals that SFOs are active and enthusiastic GIT users. However, limited institutional approaches can impede the ability to take full advantage of GIT, and particularly all three technologies considered in this report – GIS, GPS, and RS. Key findings include:

- While some good examples exist otherwise, several SFOs have an individual, and even ad hoc, approach to GIT implementation and use. Enterprise approaches that support organizational missions and functions in a comprehensive and integrated manner are seldom employed, although advantages of such an approach are well recognized by many SFOs. Defined policy and planning direction for GIT exists in few SFOs, but existing documents in this regard serve as useful models for other states.

- There is clear intent among most SFOs to provide internal expertise, coordination, communication, and management concerning GIT. Middle management seems to be at the best level in administrative hierarchies within SFOs to serve as key GIT contacts and coordinators. Headquarters staffing for GIT is crucial. GIT focal points and coordinators exist in the majority of SFOs, but few of the indicated GIT contacts and

staff are fully dedicated to GIT. Many of these individuals have difficulties balancing GIT and other non-GIT activities, particularly with increasing demands for data and technology by SFO users.

- Assistance is sought and available from outside organizations, primarily the departments in which 40 SFOs organizationally reside ("parents"), and particularly to help in early GIT implementation. Other forms of more advanced relationships and assistance in data development and applications are also pursued with a variety of organizations, including universities, the U.S. Forest Service, and other federal and state agencies. The analyses point to intensive contacts with statewide GI/GIT coordination entities as the most crucial relationships to facilitate diffusion and growth of GIT in SFOs. It is likely that such connections are also needed to maximize existing resources and investments, as well as to promote data sharing and collaboration to enhance cost effective and beneficial GIT adoption in SFOs.

- Several obstacles exist to fully institutionalize GIT in SFOs. Beyond inherent internal and external coordination difficulties, lack of professional expertise, staffing, training, and funding are the most common challenges identified by GIT developers and users in SFOs.

The findings reveal that state foresters have several needs and opportunities to pursue to take full advantage of existing internal investments, activities and capabilities; technological capabilities today and on the horizon; and external resources to help accomplish internal needs.

7.2 External Coordination and Assistance Opportunities

The federal government is facing many of the same issues facing state foresters. Several agencies are involved in GI/GIT today and are active in data creation, usage and coordination, both internally and with others, including state governments. Several opportunities are possible including for example the efforts and activities described below. Several additional examples are also available but are not included here.

7.2.1 Federal Interagency GI/GIT Coordination

The leading coordination effort is led by the Federal Geographic Data Committee (FGDC), which is an interagency committee organized in 1990 under Office of Management of Budget (OMB) Circular A-16 (http://www.fgdc.gov/fgdc/fgdc.html). The circular promotes the coordinated use, sharing, and dissemination of GI on a national basis. FGDC is composed of representatives from seventeen Cabinet level and independent federal agencies, including the U.S. Department of Agriculture which represents the Forest Service. Several non federal representatives also participate in FGDC. Representing states are the Western Governors' Association (which has a GI Council) and the National States Geographic Information Council (NSGIC) described above. Additional associations, such as NASF, could become members upon request.

The FGDC Steering Committee is co-chaired by the deputy director of the Department of Interior and the director of information management at OMB. The Steering Committee sets high-level strategic direction for the FGDC as a whole. FGDC also has a Coordination Group which provides advice on the day-to day business of the FGDC. Staff support for FGDC committees is provided by the FGDC Secretariat staff which

is located at the U.S. Geological Survey. FGDC efforts focus on the development of data standards, metadata and data clearinghouses to facilitate data sharing. These resources are increasingly use by states, including SFOs. Several interagency subcommittees are organized by data themes. Several interagency working groups also exist and include representatives of several federal agencies and others.

7.2.2 NASA Approach to State Governments

The National Aeronautics and Space Administration (NASA), through the Office of Earth Science and its predecessors, has supported applications projects and programs in the states since the late 1970s. Currently, NASA funds state projects through four mechanisms described below: 1) a Broad Agency Announcement (BAA) specifically designed for state, local and tribal organizations; 2) other program solicitations and Congressionally mandated projects that may include state participation; 3) national and regional associations of state governments; and 4) federal agencies.

The goal of the NASA Applications Program in the Office of Earth Science is to extend the benefits of NASA data, science and technology to the nation and maximize the social and economic impact of the investment in earth science research. The interest in applications and focus on state and local governments dates back to 1976 when efforts were initiated to determine potential state and local satellite data needs and applications, inform these officials about Landsat resources and opportunities, and to assist governments in using satellite data. An important feature of the approach was to build internal state and local capacities through associations and education (Warnecke 1997, p. 9) In addition to projects with national associations such as the National Conference of State Legislatures (NCSL) and the former Council of State Planning Agencies (CSPA), NASA conducted the Regional Applications Program (RAP) to conduct technology transfer and assistance efforts in all 50 states between 1977 and 1982. Regional efforts such as the Western Regional Applications Program (WRAP) were established as part of RAP. These programs were successful in initiating state efforts to develop in-house capabilities and use these capabilities to address statewide issues. Through the 1980s and the first half of the 1990s, NASA support of state programs and projects using remote sensing and related technology was continuous but at a reduced level.

Outreach efforts with states were reinvigorated in the mid 1990s with a report about the 50 states entitled *NASA as a Catalyst: Use of Satellite Data in the States* (Warnecke 1997), and the beginning of a series of meetings and national and regional workshops involving representatives of several states and other governments. These workshops helped to educate state, local and tribal representatives, and at the same time evaluate NASA's applications program. The workshops have helped to provide NASA with recommendations on the structure of an applications program that will best meet the needs of the user community.

Information from the workshops provided the basis for an applications program with five elements – pilot projects, regional infrastructure, common products, capacity building and workforce development, and information workshops. A series of follow up state-based workshops were subsequently initiated in 2001 and are continuing today. The pilot projects element evolved into a Broad Agency Announcement (BAA) issued in April 2001, entitled “Opportunities for State, Local, Regional and Tribal Governments to Utilize NASA and Commercially Developed Data and Capabilities in Operations and Decision

Support" (BAA-01-OES-01). Information about the BAA is available at: http://research.hq.nasa.gov/code_y/nra/current/BAA-01-OES-01/index.html. The BAA drew responses from 48 states, and 15 awards were made following a two-step, peer-reviewed process. Work began on each of the projects in January 2002. Of these awards, seven were to state, and two to regional organizations. Seven of the awards were to projects related to the functionality of SFOs, including six about resources management and one on disaster management. The BAA project in Kentucky includes the direct involvement of the SFO as described in the profile in Appendix C. Each of the 15 projects is receiving up to three years of NASA support.

BAA recipients are responsible for dissemination of information on the applications developed through the community. NASA hopes that the 15 projects will have an impact on the user community far beyond the immediate project areas. To assure distribution of information about the projects, NASA is working with national associations of states such as the National States Geographic Information Council (NSGIC) to distribute information about the BAA and the results of funded projects. While the intent has been to continue the BAA program, the next round of awards has been postponed because of budget limitations in FY 03.

NASA also sponsors projects created through other program solicitations and Congressional mandates. The topics, sizes, number and duration of these projects vary from year to year. Some of them respond to forestry issues either directly or indirectly through block grants for earth science related projects, and some include SFO participation. For example, the California Resources Agency, in which the SFO is located, is the recipient of funding through a NASA program known as Earth Science Information Partnerships (ESIPs). In addition, Maryland's Department of Natural Resources, in which the SFO is located, recently received NASA funding that will address forestry issues. NASA is also funding a forest health project in Alaska with the SFO. Remote sensing and other GIT are being used to monitor the impact of Spruce Bark Beetle on the Kenai Peninsula. The New Mexico SFO is working with the University of New Mexico on a project to use LIDAR and other remote sensing in wildland fire applications. These projects are described in the profiles in Appendix C.

NASA maintains contact with regional and national associations concerned with broad governing issues, including the Western Governors' Association, the National Association of Counties, and NSGIC. Forestry is an important issue in some of their efforts. The nature of the cooperative relationship between NASA and these associations varies, but in all instances, the motive for NASA participation is to increase the use of NASA capabilities by the user community.

Federal agencies are significant users of NASA capabilities. NASA has recently been increasing its efforts with the federal agencies to develop decision support systems. These collaborations focus NASA's limited resources in applications on issues of known national importance. The U.S. Forest Service is one of the federal agencies that NASA works with on specific projects and is now focusing more effort on decision support. NASA also has a Memoranda of Understanding (MOU) with the U.S. Department of Agriculture to enhance remote sensing usage. Efforts are underway to establish a MOU between NASA and USFS in 2003. As described in Chapter 2, NASA sponsored development of a response system for wildfire based on MODIS data from the NASA Terra satellite. The system allows the Forest Service to view the location of wildfires over a regional area at almost real time intervals as needed for allocating fire fighting resources. The MODIS

Rapid Response system is being incorporated into the operational decision support structure of the Forest Service.

NASA's focused efforts on states, localities and tribal governments will look toward federal agencies and national and regional associations to channel NASA capabilities to the states rather than support individual state projects directly. This approach will likely help the states respond to state and federal issues, and assure that NASA resources are used on issues of nationwide importance.

7.2.3 U.S. Forest Service Approach to Remote Sensing and other GIT

GIT is used by several parts of the U.S. Forest Service (USFS), including the National Forest System (NFS), Research, State and Private Forestry, and International programs. It is used extensively at the field level in most National Forests, several research stations and in other program areas.

USFS coordination of GIT activities are led by the Geospatial Executive Board (GEB). It provides oversight and coordination of related programs and activities, ensures policies and programs are integrated and responsive to business needs, and articulates a corporate vision for an enterprise geospatial environment. GEB created a Geospatial Advisory Committee (GAC) to identify, monitor, and address issues regarding related programs and activities; develop and make recommendations to meet agency needs; and communicate observations, findings and recommendations. Issues of attention include standards, conversion of legacy data, coordination of natural resource applications, training and awareness, data access, mapping requirements and GIS tools, and technology deployment. Efforts are underway to develop a clearinghouse of geodata that is expected to be deployed by the end of 2002.

Many remote sensing activities occur at the Remote Sensing Applications Center (RSAC), which is a detached technical center of the Washington Office's NFS's Engineering Unit that is located in Salt Lake City. It is co-located with the Geospatial Services and Technology Center (GSTC), formerly known as Geometronics, which also is a technical center of the Engineering Unit. RSAC and GSTC each have about 40 staff. GSTC provides GIS project support as assistance, applications and tools development, training, clearinghouse services, and map and data production.

RSAC has three defined missions, including to provide technical support in evaluating and developing RS, GPS, imaging processing and other GIT; provide project support and assistance in the use of RS and related technology, and provide technology transfer and training. Staff are organized in one of five areas, including Inventory Analysis and Accuracy Assessment, training and technology awareness, RS integration, operations, and Liaison and Special Projects. RSAC staff interact with various parts of the USFS and other agencies to accomplish its missions. Over half of RSAC's staff are contracted employees of various companies, both large and small. Through steady growth in projects, about 10 staff have been added to RSAC since 1998. Work is conducted in many project areas. The largest percentage of time now is spent on fire projects (approximately 25-30%), with related work done for forest health, which represents about 20-25% of RSAC work.

RSAC priorities and activities are directed by the FS Remote Sensing Steering Committee (RSSC). The mission of this group is to provide national leadership and guidance within the USFS for the efficient use and application of digital remote sensing and integration of RS into GIS for use in land management decision making. RSSC develops and sponsors projects to demonstrate the efficient use, application and integration of RS into GIS, with some of these

projects described in Appendix D. RSSC also attempts to fill gaps in existing knowledge, training and awareness through workshops, publications, and other technology transfer efforts, and preparing national guidelines for the effective use and integration of RS, GIS, and ground sampled information used in resource decision making.

Training and technology transfer are large and increasing components of the work being conducted at both RSAC and GSTC. Educational courses are offered in cartography, geospatial awareness, GIS, GPS, image processing and photo interpretation. Some courses are also specialized for specific application areas such as natural resources, pest management and archeology. However, training is largely only available within the Forest Service, and limited information is available about these offering on the web because most information is available on the USFS intranet.

A week long, annual USFS educational conference is sponsored each spring by RSAC and GSTC each year, with an alternating focus on GIS or RS. The conference programs are quite extensive with several concurrent sessions, and they are typically very well attended. The next conference will be held in Colorado Springs, Colorado during the week of April 8-12, 2003. Organizers indicate that state foresters and their representatives are welcome to participate.

RSAC produces useful hard copy publications and CDs about remote sensing. For example, a CD produced in Spring, 2002 is "Refresher Modules of ArcView and ERDAS Imagine" (for image processing). An informative video was produced a few years ago about integrating RS with GIS for forestry. Informative hard copy reports include Implementation of Remote Sensing for Ecosystem Management (Remote Sensing Advisory Team and Remote Sensing Applications Center 1998) and Guidelines for the Use of Digital Imagery for Vegetation Mapping (Lachowski et.al. 1996).

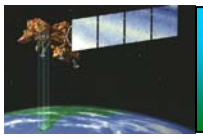
7.2.4 U.S. Environmental Protection Agency Information Integration Grants

While state foresters do not have a direct federal funding source to facilitate and encourage enterprise or integrated approaches to data or GI/GIT, an example of a related program exists at U.S. Environmental Protection Agency (EPA). The agency has a $25 million dollar per year grant program to encourage data sharing between EPA and state governments that was established in 2001. Grant funds are used for information projects that promote:

- Exchange of environmental information with other states and partners using common formats,
- Integration of different types of data within states,
- Reconciliation of inconsistencies between different data reporting sources, and
- Creation of a single state node for submission of data to EPA headquarters.

An important goal is to ensure that all environmental decision makers at all levels of government have the same quality, accurate and timely information to make effective decisions. The program is helping to establish a common model of how information can be linked within and among states, and others they work with.

While the program is designed particularly for state environmental management agencies that work with EPA, it provides an example of a federal program that invests funding to help both a federal agency and its partner states to perform more effectively, both now and in the future.



7.3 Conclusions, Implications and Future Research Efforts

This report was designed to provide fundamental information that can be useful to state foresters and others as new conditions and challenges face them each day. As government leaders are becoming increasingly aware, GI/GIT is indeed a critical resource and unique government success story that holds even greater promise in the future. To date, state foresters and their staff have initiated and developed many innovative GIT applications and projects. This level of adoption is an important strength and foundation with which to create and implement institutional approaches to maximize existing and future capabilities, investments and benefits.

As increasingly concluded in investigations about GI/GIT, institutional matters are key determinants of GIT success. The report reveals that SFOs are experiencing challenges facing many public organizations today. Information needs and activities can be managed across program missions and from an enterprise perspective in order to maximize data and technology investments and benefits. This need exists for information generally, particularly because many "stovepiped" data systems have existed for a long time. However, geography provides a unique focus and unifying perspective with which to catalyze an enterprise perspective and link various existing and potential data systems and activities, often simply because they occur at specific points or areas "on the ground."

Leadership focus and effective GI/GIT direction can help state foresters to effectively manage various disparate, and possibly redundant, and/or conflicting internal information resources. At the same time, such focus and direction can ensure that SFOs are able to embrace new technology such as remote sensing and other GIT, and effectively deploy new capabilities as needed in multiple parts of an organization. Effective management of information also can ensure the utility of these resources to strengthen SFO decision making capabilities at strategic, management, and operational levels. Institutionalized approaches can help ensure that SFOs are prepared, able and proactive to meet new challenges with a unifying and enterprise perspective and appropriate resources to meet these needs.

The synthesis and analysis provided in this report serve as an initial overview of GI/GIT conditions in SFOs. This project and report was designed to help, but clearly reveals the need for further investigation. The research has helped to identify many useful topics for further investigation to aid state foresters and others interested in understanding and strengthening the adoption of remote sensing and other GIT. Based on this research, further study will help to identify more specifically the determinants of successful GIT implementation for SFOs. While material presented in this report continues to be analyzed and interpreted to help design subsequent inquiry, some examples of issues to be explored and understood include:

- Internal institutional approaches and organizational structures of GIT activities within SFOs;
- Extent and impacts of GIT penetration in SFOs headquarters and field/regional offices;
- Policy and planning directives and strategies concerning GIT in SFOs, and associated outcomes;
- Nature, extent and impacts of GIT staff, their roles and responsibilities;
- Effective forms of coordination and assistance, particularly with parents, state GI/GIT offices and groups, and applicable federal agencies;
- Policy and institutional issues and challenges facing SFOs concerning GIT, and successful associated approaches;
- Implementation issues and factors associated with remote sensing adoption as compared to other GIT;

- Scope, extent, resources and impacts associated with GIT management activities; and
- Needs of SFO user communities and their access to technology, data, training, and support.

Many challenges exist within and outside SFOs to take full advantage of GIT investments and technological capabilities to date. Future opportunities posed by better technology promise even greater benefits, but associated implementation and policy challenges will face state foresters along with continuing government challenges. This report and future research is offered as a contribution to help along the way.