

## STRATEGIC PLAN FOR FOREST INVENTORY AND MONITORING

### EXECUTIVE SUMMARY

This Strategic Plan for Forest Inventory and Monitoring is written to comply with PL 105-185, the Agricultural Research, Extension, and Education Reform Act of 1998. The plan describes how the Forest Service will implement an annual forest inventory system which collects a wider array of data on 20% of all plots in every State every year, with reports for each State produced at five year intervals. This plan also addresses many of the "Recommendations of the Second Blue Ribbon Panel on Forest Inventory" review conducted in 1997-98.

We estimate that the program specified by Congress (20 percent of all plots every year) will cost \$82,089,000 per year in 1999 dollars, with annual increases required to keep pace with inflation. This is an increase of \$44,904,000 per year above the 1999 available funding of \$37,185,000. Much of the increase is due to the increased frequency and scope of sampling, especially in areas of difficult access and short field seasons in the western US and Alaska. These areas have historically been sampled at a much lower frequency, if at all. Some of the increase is due to the change from periodic to annual (continuous) forest inventory procedures which require covering the entire United States every year, rather than concentrating field operations in a few states at a time.

The budget estimate covers all costs associated with the program including planning, data collection, equipment, analysis, reporting, methods development, management, and overhead. Details on the budget are included on page 16 and in Appendix VI of the Plan, and greater detail is available on request. We understand that this is a significant increase above the current level of funding. We believe that there exist some less costly alternatives which would be nearly as satisfactory to our customers, and we would welcome the opportunity to discuss such alternatives further with Congress.

We estimate that the program specified by Congress will require a total of 837 person-years of effort to accomplish. This is an increase of 417 person-years above the current available staffing level of 420 person-years which includes both federal and State partners. Details on the staffing requirements are included on page 16 and in Appendix VI of the Plan, and greater detail is available on request.

We will integrate the Forest Inventory and Analysis (FIA) program with the field portion of the Forest Health Monitoring (FHM) program to create a new Forest Inventory and Monitoring (FIM) program. This will increase efficiency by eliminating duplication between these programs and will deliver a more integrated, easy-to-use database covering a wider array of ecological data about forests. Details on the merged program procedures are described on pages 3-7 of this plan.

The FIM program will be responsible for conducting consistent, strategic level forest inventory on all forest lands of the US, including National Forest lands. The FIM program will be guided by a Transition Team consisting of Forest Service Executives and State Foresters, who will resolve issues of policy and consistency for the FIM program. The Forest Service Deputy Chief for Research and Development will be the accountable line officer for delivering the FIM program. State and National Forest partners will be

represented on program management and technical teams at all levels. We will continue to

operate out of existing FIA (now FIM) field offices. Each FIM office will routinely engage regional customers and partners through participation in an open Users Group. The Transition Team will also engage national customers through continued interaction with the

Blue Ribbon Panel on Forest Inventory. Details on the proposed organizational structure are described on pages 9-11. We will implement the new program in a few states per year in each region of the country, with all States implemented within five years of receiving the necessary financial and staffing resources. Timing of implementation will depend on resources available, readiness of partners to collaborate, and the completion status of existing inventories. Analytical reports will be produced five years after a State enters the program, and will cover the period from 20 years in the past. The implementation and reporting schedules are shown on page 15-16 of the plan.

We have defined 107 core variables to be collected on all plots each year, and 36 extended core variables to be collected on a subsample of forested plots each year. These variables will be documented in a National Field Guide, and will be implemented in a consistent fashion across the country. Appendix II of this plan lists the proposed core variables, and Appendix III lists the proposed core tables. Core and other data will be made available on an annual basis.

Existing Forest Service inventory and monitoring programs already utilize advanced technology such as global positioning systems, geographic information systems, portable data recorders, and image processing systems for satellite imagery. We will continue to conduct applied research in the use of these and future tools towards the end of increasing the operational efficiency and effectiveness of our program. We will continue our cooperative work with other federal entities such as the NASA, Department of Energy, and Department of Defense to ensure that we are taking advantage of the latest technology. Use of technology is detailed further on pages 8-9 of this plan, and coordination with other entities is described on pages 12-14.

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## **BACKGROUND INFORMATION**

**Objective.** The objective of this strategic plan is to describe how the USDA Forest Service, Research & Development program will satisfy the forest inventory requirements stated in Section 253(c) of the Agricultural Research, Extension, and Education Reform Act of 1998, and recommendations of the Second Blue Ribbon Panel on the Forest Inventory and Analysis (FIA) Program. These requirements and recommendations call for annual measurement of 20 percent of all plots on all forest land in all States, with a nationally consistent, core set of measurements and analytical products, and production of State reports every 5 years. For the purposes of this strategic plan, the word 'inventory' refers to strategic-level, grid-based, forest inventory systems which yield meaningful information at the multi-county, State, and larger scales. The plan does not address the local-scale inventories, such as timber stand exams, or data collection that are part of planning or monitoring specific national forest projects.

The new legislation also requires an analysis of forest health information in each State report. Currently, forest health monitoring only occurs in 26 States. To fully integrate forest health monitoring data and analyses with forest inventory data and analyses and to do so at the lowest cost, this strategic plan integrates the FIA program and the detection monitoring phase of Forest Health Monitoring (FHM) program) on all public and private lands and expands the FHM program to cover all 50 States. This plan refers to the integrated program as the Forest Inventory and Monitoring (FIM) program.

The legislative direction to remeasure 20 percent of all plots every year will require a significant expansion of the existing FIA and FHM programs. To achieve the accuracy standards sought by users of FIA information, the program uses a two-phase stratified sampling system. Phase 1 consists of interpreting information from remotely sensed imagery. Phase 2 consists of sending field crews out to a sub-set of the Phase 1 points to validate the information obtained from interpreting the imagery and to collect additional, more detailed, data to determine the productivity and health condition of the forests. The accuracy standards endorsed by FIA and FHM customers require a Phase 1 sampling grid of over 3 million forested grid points across the United States (approximately 1 for every 240 acres of the 748 million acres of forest land in the United States) and sending field crews to visit 120,500 of those grid points during Phase 2. Measuring 20 percent of the plots each year implies interpreting imagery on 600,000 grid points per year and field crew visits to 24,100 grid points per year. Current funding levels enable us to interpret imagery on about 270,000 points and to visit about 11,000 points per year. Clearly the legislative mandate and Second Blue Ribbon Panel recommendations envision a major program expansion. This strategic plan describes the most cost-effective ways of meeting the legislative mandate within an FIM framework consistent with customer desires outlined in the Second Blue Ribbon Panel Report on FIA.

**Vision.** The Forest Service, in cooperation with our partners, delivers current, consistent, and credible information about the status and condition of all of America's forests. We summarize and report the most current information about forest health and productivity in each State every five years. We collect and analyze a consistent core set of ecological data on all forests so that comparable information and trends exist for all regions and ownership categories. In each region, we collect additional data beyond the core set and tailor analyses to address specific regional and local issues. Consequently, our information and trends are important indicators of the conservation status and sustainable management of America's forests.

We use the latest technologies to acquire data through remote sensing and field activities. We use experts from universities and elsewhere to augment our research and analytical capabilities and to help us develop new inventory and monitoring techniques. We use rigorous quality assurance procedures to verify the accuracy of our estimates and validate our analytical results. Consequently, State, Federal, and international agencies, industries, environmental organizations, private landowners and consultants can rely on the credibility of our information to make critical land management, policy, and investment decisions.

Our partners are an integral part of our forest inventory and monitoring activities. Without their contributions of personnel and funding and their continued support, this vision cannot be attained.

**Present Situation.** The Forest Service has systematically collected information on the status and condition of America's forests through a variety of programs for some 70 years. During most of this period the emphasis was on measuring forest product supplies at the State level. The FIA program divided the United States into regions and used a state-by-state cyclic approach within each region, completing fieldwork and reports for one State at a time. National Forests have been left free to implement their own local inventory systems. Over the past 20 years, differences emerged among regions in data definitions, measurement standards, analysis and compilation approaches, and information management practices. This resulted in a collection of regional inventory systems with limited consistency for drawing conclusions at the national level and for making comparisons among regions. More consistency is now needed to better serve customers' needs for comparable information across regions.

In 1967, the Forest Service set a target of conducting inventories on an 8 year cycle in the South and 10 years in the rest of the United States. This target was attained in 1983-84, but the cycle length increased in the late 1980s due to changes in costs and appropriations. In 1992, the First Blue Ribbon Panel on FIA, a collection of 30 different customers, recommended shortening the cycle length to 5 years throughout the United States. They concluded that America's forests were changing faster than could be captured with the longer cycle. Unfortunately, cycles lengthened further in the mid-1990s because of reductions in funding and staffing. In recent years the inventory cycle has been 8+ years in the South, 13+ years in the North, and 15+ years in the West. Despite the recent changes in funding and staffing, FIA research and development efforts have borne fruit. On each plot, the FIA

program today collects 20 percent more data than in the 1980s with 10 percent less funding (constant dollars).

In FY 1999, \$23.1 million was appropriated for the FIA program to conduct inventories of forested land outside of the National Forest System (NFS). There is no specific appropriation for strategic forest inventory or forest health monitoring within national forests. In some parts of the United States, NFS personnel collect strategic inventory data following their own protocols. Elsewhere, NFS offices contract with FIA field units to collect data following standard FIA protocols. In FY 1998, NFS provided \$3.3 million to Stations for data collection on NFS lands. The decision on which approach to use for NFS lands is at the discretion of the Regional Forester. Occasionally, competing priorities for NFS inventory and monitoring funding prevent collecting FIA data on NFS lands.

**Customer Needs.** Appendix I contains a brief description of our key customer groups, including what they want from the Forest Service strategic inventory and monitoring program. Key customer groups include:

- State and national forest policy decision makers
- State foresters
- Industry and consultants
- Environmental organizations
- Forest Service officials
- Researchers
- Journalists
- Interested private citizens

Taken together, the legislative mandate from Section 253 and recommendations of the Second Blue Ribbon Panel, identify the following needs:

- Data collected annually, analyzed promptly, and used to produce individual State Reports every 5 years;
- Consistent core data and analyses across political and administrative boundaries and different land ownerships;
- Current information that is consistent with historical information;
- Data sets and analytical results that include a wide array of forest ecosystem parameters that address the health status and condition of the forests in addition to traditional productivity measures;
- Data that can be post stratified and analyzed in numerous ways;
- Data that are readily available in elemental, summarized, and analyzed forms, targeted at different audiences;
- Data that are reliable and credible because data quality attributes are fully documented;
- Analyses and interpretations of trends in the data, including making projections that look ahead 20 years.

This strategic plan describes how the Forest Service intends to achieve its vision for conducting strategic forest inventories by moving from the present situation to satisfy the new legislative mandate and customers' information needs.

## **PROPOSED PROGRAM TO MEET LEGISLATIVE AND CUSTOMER REQUIREMENTS**

**Coverage.** The legislative mandate calls for a single inventory program to cover all forested lands in the United States, regardless of ownership or availability for forest harvesting. This plan includes all forest land in the lower 48 states plus Alaska, Hawaii, Puerto Rico, the US Virgin Islands, the Northern Mariana Islands, the Trust Territory of the Pacific Islands, and the territories and possessions of the United States. It covers all public and private forest land including reserved areas, wildernesses, national parks, and defense installations, as well as national forests.

Although we acknowledge the importance of grasslands and urban ecosystems, this strategic plan is focused on non-urban, tree-dominated ecosystems. Given the narrow focus of the legislation, we do not feel it is appropriate to include in this plan major new initiatives to seize the lead in addressing inventory of grasslands and urban trees. We intend to continue to collaborate with partners to address inventory and monitoring for grassland and urban tree populations. We do have some ideas and ongoing pilot projects on these topics, and would be pleased to share them with interested parties.

**Sampling Intensity.** The legislative mandate requires measurement of 20 percent of the plots in each state each year, except where lesser sample intensities are agreed to by the State Forester. After consultation with the State foresters and other local partners, we propose to sample Alaska, Hawaii, and other island territories at a reduced rate, making better use of remote sensing to address local issues of concern.

Visiting 20% of all plots in a state will undoubtedly provide a high level of information, but at a high cost. We believe that there are less expensive alternatives which would still address the needs of customers for consistent and timely information. We would welcome an opportunity to discuss these alternatives with Congress.

The plan assumes that we will measure enough plots to achieve standard errors of area and volume estimates which are consistent with historical levels of precision. Individual States or National Forest Regions may choose to increase the sample intensity by installing additional plots, at their own expense, in order to increase the precision of inventory estimates. Those costs and outcomes are not included in this plan. However, one of the advantages of the proposed annual inventory system is that it will provide maximum flexibility to States and National Forests to engage in such intensifications on short notice in response to local concerns. Whatever sampling mix is finally decided upon will reflect the needs and desires of State Foresters as provided for in the Conferees Notes to PI 105-185.

We will superimpose a nationally uniform cell grid over our existing set of sample locations, in order to provide a uniform basis for determining the annual set of measurement plots. This will eliminate existing discrepancies in the sample intensity between States and regions, and will provide a standard frame for integrating FIA and FHM and for linking the integrated program's other data sources such as satellite imagery, spatial models, and other existing surveys that occur at different scales.

**Core Variables.** The proposed inventory program includes a nationally consistent set of core measurements, collected on a standard ground plot, with data managed, processed, analyzed, and reported in a uniform fashion. The core set of measures (Appendix II) will address inventory and forest health monitoring objectives. The set includes ecological variables not previously collected consistently across all regions. Because a nationally consistent set of core variables is needed to respond to the legislative mandate and address customer information needs across scales, field units will use the national definitions and measurement protocols established for the core variables on all public and private forest land.<sup>1</sup> Field units may also add additional measures, conduct special analyses, and prepare reports that respond to specific customer needs, such as information to support the President's Northwest Forest Plan.

Forest health data will continue to be collected from subset of plots which maintains the present level of effort in the FHM program.

**Data Collection.** Data are collected in a variety of ways, including by permanent or temporary Federal employees; by State employees through cooperative agreements; or via contracts with non-government sources (universities, private contractors, etc.). We have experience with all these options, and in practice will use the most cost effective means of achieving the required quality level. The costs reported in Appendix VI are our best estimate of the total cost of delivering the program envisioned in the legislation. Actual staffing plans are developed by each field unit, providing flexibility to take advantage of local conditions. All field data collectors will receive standardized training and will pass a standard certification test before collecting data.

**Quality Assurance.** We will extend our present Quality Assurance/Quality Control (QA/QC) program, which includes documentation of methods, training for data collectors, field checks of data quality, field data entry software to allow real-time error checking, peer review of analysis products, and continuous feedback to ensure that the system evolves and improves over time. QA data and analyses will be included in publications and made available to interested users. Internal analysis of QA data will be used to adjust field procedures and to develop new methods as needed.

**Information Management.** We are developing a national information management system that serves both internal data management needs as well as external (public) data access needs. The information database will consist of a core set of tables, data validation

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<sup>1</sup> House Report language amplifying Section 253(c) specifically mentions that national forest inventories contributing data to the FIM program will use the same core variables and measurement protocols as used on private lands.



procedures, algorithms, analytical and compilation procedures, and data access tools to ensure that core data are treated identically across the country. Regional-specific data will also be made available when possible. The East-wide and West-wide data bases, which currently receive approximately 1000 on-line requests per month, are precursors to the next generation information management system currently under development. The next generation system will include all the data currently in the existing systems and will allow comparisons of current trends with past trends. Appropriate parts of this system will be accessible via multiple channels including the World Wide Web (WWW) and CD-ROMs.

**Analysis.** The FIM program will include several levels of analysis.

Annual Report. Each year, core data will be compiled into a standard set of core tables for each State which will be released in hard copy and electronic formats. See Appendix II for a proposed list of core tables. Data will be compiled and released once per year, on a schedule to be determined, but in any case with no more than six months elapsing between the end of the measurement period and the release of the data.

The job of analyzing and compiling annual data from each State is a larger task than the traditional analytical program. Additional staff and computing capacity are needed to simultaneously produce individual State-level reports.

Periodic Reports by State. Every 5 years, a complete analytical report will be produced for each State. To make most efficient use of analysts, approximately 10 State reports will be produced annually. Each State report will document the following:

- The current status of the forest based on the last 5 years of data;
- Trends in forest status and condition over the preceding 20 years, with emphasis on comparing the most recent data with data from the previous period;
- Timber product output (TPO) information for the State;
- Analysis and discussion of the probable forces causing the observed conditions; and
- Projection of the likely trends in key resource attributes over the next 20 years, under various scenarios.

The State reports will be prepared by the FIM program in collaboration with State, other federal, academic, and other knowledgeable individuals. Given the large amount of work this will entail for each State, State reports will be completed on a rotating basis (i.e. 10 states per year; see 'Schedules' section for year of first expected report by State). The analytical reports will include tabular analyses as well as spatial representation of key variables of interest. The report will address the core set of variables listed in Appendix II.

Periodic National Report. Starting 5 years after the program begins, FIM will prepare a National Summary report which includes the same elements described above but at the regional and national scales. The FIA program has historically prepared such summaries for the Resource Planning Act (RPA) Assessment. The National Summary will be prepared either as a part of the collection of

RPA Assessment reports or, if the RPA Assessment legislative mandate changes, as a separate FIM program document.

Special Studies. Over the past 20 years, a number of special studies have been conducted that relied, to some extent, on FIA and FHM data to provide regional context. Two examples are *The Southern Appalachian Assessment, published in 1996*, and *Private Forest-Land Owners of the United States, 1994*. Many of the past special studies have been sought by customers interested in multi-State or regional analysis of resource trends. Most special studies have relied heavily on the expertise of partners. This strategic plan includes only limited capacity to conduct special studies beyond the periodic reports mandated by the legislation. Any funds needed to conduct future special studies will need to be provided in addition to the funding needs outlined in Section 10.

**Research and Development.** Investments in research and development will focus on building practical, efficient methods to obtain and report information of interest to customers. Priority research areas include the following:

- Trend analysis - which estimation procedures are most appropriate for analyzing trends in forest inventory and forest health monitoring data over the past 20 years?
- Projections - using the present data as a starting point, how can likely future trends in resource status under different management and policy scenarios best be projected? What forms of collaboration with other researchers can be created to assure that FIM projections are consistent with other FS (e.g. RPA) projections?
- Remote Sensing - what techniques are most appropriate for detecting and measuring changes in resource extent, status, and condition from satellite imagery and available low-altitude imagery<sup>2</sup>. How can the FIM program make most efficient use of currently classified imagery and can declassified products that can be shared with partners be produced from classified imagery? What efficiencies and economies of scale can be gained from increased collaboration with the Natural Resources Conservation Service and NOAA's EROS Center?
- Geospatial Analysis and Display Tools - what new geostatistical techniques are most appropriate for analyzing data that are accurately referenced with Global Positioning Systems (GPS)? How can geographic data layers be most effectively populated and shared with partners? What new techniques can be developed to merge FIM geospatial data with similar data on other natural resources (e.g., water resource information from the U.S. Geological Survey ) to gain additional information and insights about resource interrelationships?
- Modeling - what new techniques can be developed to model changes expected over time in forests undisturbed by human, pathogenic, or atmospheric phenomena? Can the long-

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<sup>2</sup> Low altitude imagery is collected from instruments mounted on aircraft. It includes aerial photography, aerial videography, various types of radar, and other spectral sensors.

term effects of disturbances be modeled at the landscape scale using FIM data and do those models suggest that changes in current natural resource management strategies are needed to avoid or mitigate detrimental effects and improve sustainability? What changes in silvicultural treatment options need to be explored further to respond to disturbances? Most modeling research will be done by partners in close collaboration with FIM analysts.

These research and development needs will be addressed in several ways. We will increase the number of research and development staff in existing FIM units. We will also draw upon the capacity of other Forest Service Research and Development (R&D) units having missions allied with inventory and monitoring goals (e.g., silviculture research units). This will create a cadre of researchers and developers who are familiar with the capabilities of existing FIM systems.

Collaborative relationships with universities, industry research organizations, interest groups, and other Federal agencies will be strengthened. This will allow the Forest Service to gain increased experience in specialized areas, as well as gain access to creative scientists outside of the Forest Service. The full array of funding arrangements available to the Forest Service R&D program, such as competitively awarded contracts, cooperative research grants and agreements, and joint grant applications, will be used to foster the collaborative relationships and focus on specific FIM research and development needs.

## **PARTNERSHIPS**

Partnerships are key to establishing and implementing the Strategic Plan. Partners will help determine program direction; participate in data collection and analysis; facilitate external relationships; and conduct research and development work in support of the inventory program. All of the customer groups identified in Appendix I of this plan are potential partners. State Foresters, who share responsibility for the delivery of forest information and programs to our customers, are particularly important partners who will play a direct role in program oversight and implementation. The following partnerships will be implemented within 1 year of funding this plan:

**Program Direction.** Input from partners is critical in making sure that the FIM program stays responsive to customer needs. The following mechanisms will be used to ensure continuous customer feedback is obtained to help guide the FIM program:

1. Each Regional FIM program will participate in at least one open 'user group' meeting per year, inviting a cross section of FIM partners, cooperators, and customers to discuss program status and satisfaction. The meeting will be advertised and open to all interested parties, in compliance with the Federal Advisory Committee Act. The objective of

the meetings will be to share information and seek feedback about the status, performance, and challenges affecting the FIM program.

2. The Deputy Chief's Office will seek continued interaction with the Second Blue Ribbon Panel to provide feedback on progress in implementing their recommendations and to obtain additional views. This group will serve the same purpose at the national level that the regional interactions serve. To provide links between regional user groups which may form and the Second Blue Ribbon Panel or other national user group, the Deputy Chief for R&D will encourage some customers to participate in both the regional and national groups.

**Data Collection.** Partners will participate in data collection where they have the capacity and interest to do so, and where they can meet quality standards at equal or lower costs. Partners can also make landowner and mill owner contacts to gain permission for plot visits or to complete timber product surveys. Partners will have the opportunity to add resources to the program to gain increased information, for example additional measurements. If federal budgets fall short of requirements, an increased level of partner donation of in-kind services may be needed to help the FIM program meet the legislative mandate.<sup>3</sup>

**Analysis.** Partners will have a key role in analysis. Appropriate roles for partners include helping determine the elements, scenarios, and assumptions to be included in the analysis; providing their opinions as to the reasons for past trends, or probable assumptions for future projections; and serving as peer reviewers for draft products. Actual analysis may be completed by FIM analysts, university collaborators, or consultants; however, only analyses overseen by FIM staff will be published as FIM products.

University collaborators and consultants, as well as FIA researchers and developers, will be encouraged to publish results in peer-reviewed journals to validate the quality of their results. Peer review is necessary to assure top quality analyses, research, and development activities. They will also be encouraged to share their findings broadly afterwards through other means to assure rapid adoption and clear comprehension of the results.

**Marketing, Technology Transfer, and Public Relations.** Partners will use their networks to inform their local communities about ongoing FIM activities, and to make sure that knowledge of inventory reports and products reaches a variety of audiences. FIM results may be transformed by partners into news releases, popular articles, brochures, Internet web site links, and other means that best serve audience needs.

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<sup>3</sup> Currently, state partners contribute \$2.328 million per year in direct cash support of the base program, in addition to significant in-kind support. The primary means is through assigning State employees to serve on field crews. An increased level of State partner participation will smooth and accelerate the transition to the annualized FIM program envisioned in the legislation and Second Blue Ribbon Panel report. Some forest industry partners also contribute employees to assist in field measurements on their properties. Increased partnerships in other FIM phases, such as the analytical phase, will also hasten the transition to the annualized system.

## USE OF TECHNOLOGY

Forest Service Inventory programs are already taking advantage of advanced technology. All field crews presently use Global Positioning Systems (GPS) to document field sample locations. All crews are equipped with portable data recorders for on-site entry and checking of field data. The inventory offices routinely use Geographic Information Systems (GIS) for managing and analyzing spatial information. All inventory data will be managed and stored using a modern, off-the-shelf database management system. We already have made reports, analyses, maps, data, and analysis tools available on our Internet web sites, where usage has already grown to 1000 hits per month. We will continue to increase our activities in this area. We also have made our data available in digital form on compact disks, and we are planning enhancements such as custom tabular and geographical analysis tools.

There are several areas where we have been conducting research in the hopes of developing operational tools for inventory. These include:

- Use of commercially available satellite imagery to improve sample methods.
- Use of image analysis and spatial statistical analysis tools to produce maps and analyses of interest to customers.

Research in these areas will continue, with the objective of developing operational inventory tools and application technology. We will increase collaboration with NASA and with the Natural Resources Conservation Service (NRCS) to coordinate progress in these areas.

## ORGANIZATION STRUCTURE

**Current Structure.** The current Forest Service forest inventory and monitoring organizational structure consists of four major components:

- Five FIA units located at research Stations, responsible for forest inventories at a strategic level on all United States forest lands except national forest (609 million acres);
- Nine inventory staffs in NFS Regions, responsible for forest inventories at both the strategic and tactical levels (e.g. for specific plans and projects) on the 139 million acres of forest land that is part of the National Forest System (total NFS land ownership is 190 million acres) and for monitoring the effects of plans and projects as they are implemented on national forest; and
- Four regional Forest Health Monitoring programs led by Forest Service R&D, responsible for detection monitoring on both public and private forest in 32 States.
- One BLM State Office (Oregon) that inventories 3.2 million acres of forestland. BLM land outside Oregon is inventoried by FIA units.

This organization structure has allowed each entity maximum flexibility to address local inventory needs, at the expense of maintaining consistency in inventory approaches across different administrative units. Differences in approaches have led to cases where no data are available for some National Forests. There has been some duplication of efforts, as well as inconsistency, between FIA and FHM. There does not presently exist any mechanism for making decisions to assure consistency regarding methods, standards, and definitions within FIA, or between FIA, FHM, and NFS.

**Stakeholders outside the agency have two major criticisms of the current organizational structure. Although they see much funding allocated to inventory and monitoring, they are dissatisfied with the relatively small portion devoted to the strategic level FIA inventories that are their top priority. They also do not understand why the Forest Service cannot achieve more consistency in data across administrative boundaries.**

**New Organizational Structure.** Three fundamental changes are proposed to respond to the legislative mandate and the Second Blue Ribbon Panel report recommendations to restructure Forest Service inventory and monitoring programs.

1. Reassign Responsibilities and Funding for Strategic Inventories on National Forests to FIM Units. The FIM program will be formally given the responsibility and the necessary resources to implement the base FIM program across National Forest lands. This change in policy and funding will allow the swift transition to annualized inventories across all land ownership categories through out the United States in a consistent fashion. In addition, FIM will collaborate with national forests to augment the base program, as needed, to address regional or local national forest issues, using additional national forest resources. The budget requirements necessary to complete the proposed program on national forest lands - \$5.9 million - are included in Appendix VI. **The outcome of the change will be State reports that include consistent data of the same vintage for national forests as for private lands and analytical results and trends that are fully and directly comparable across regions and landownership categories.** This change will also assure that a fully consistent set of data will exist across all ownerships at landscape and bioregional scales for use in the future rounds of national forest land management planning. This will assure that national forests can accurately place themselves into the appropriate regional context. Pioneering reports for the State of Utah and Utah national forests are an early example of the outcomes anticipated.
2. Integrate FIA and FHM to Create FIM. The field plot portion of the FHM detection monitoring program will be merged with the FIA program to create a single program that gathers a wide array of ecological data in an efficient fashion. We will accomplish this by (1) combining the FIA and FHM samples to create a single national grid, with FHM as a subset of FIA; (2) collecting an extended suite of ecological measurements (including current FHM measurements plus additional measurements) on a subset of FIA plots each year, at no less sample intensity than the current FHM intensity; (3) maintain the FHM overlap and summer measurement window for the extended suite of measurements; and

(4) consolidate management and support functions into a single program which will maintain close ties with other FHM program components (evaluation monitoring and long term ecological monitoring). We expect that this will result in substantial savings through elimination of redundant field operations, and will allow better linkages between the data which are collected. **The outcome of this change will be increased efficiency and more and better ecological information collected on FIM plots.** The additional ecological information will better serve national forest information needs, and will also respond to the Second Blue Ribbon panel recommendations.

3. Create an FIM executive/management framework. This framework recognizes the large number of partnerships critical to successful implementation of the FIM program, as well as the decentralized organization structure of the Forest Service. At each level, the framework includes representatives of FIA and FHM programs, State Foresters (one representative for each of the northern southern, and western State Forester groups), and representatives from the National Forest System (NFS) and State and private Forestry (S&PF). All members will participate fully in all discussions and decisions, and will serve as a conduit for information between FIM and their respective organizations. **The outcome of this change will be improved accountability for delivery of a consistent strategic inventory and monitoring program.** The framework consists of three levels:
  - A. FIM Transition Team. This team consists of senior executives charged with making policy decisions for the FIM program. The team will be responsible for swiftly transitioning the somewhat separated strategic inventory and monitoring components into a fully integrated forest inventory and monitoring program that is implemented through the five Research Stations with FIA field units, with oversight and guidance provided by the Washington Office. Initial team membership includes five Station Directors, three Staff Directors, and three State Foresters.<sup>4</sup> The team derives its authority to make national policies for strategic inventories from the Deputy Chief for R&D. The FIM transition team will represent the agency in an annual program review, as requested by the Second Blue Ribbon panel.

The team will operate by consensus in creating the policies needed to facilitate the swift transition to an integrated FIM program. Where the team cannot reach consensus on policies, it forwards recommendations to the Deputy Chief for R&D for decision. Close consultative relationships are maintained with Deputy Chiefs for NFS and S&PF to assure support for policy decisions.

- B. Program Management Team. This team consists of managers responsible for the day-to-day operation of the FIM program. Team members include FIA unit program managers; national program managers for FIA, FHM, and NFS; three State representatives; and three NFS representatives (east, interior west, west

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<sup>4</sup> Forest Service Station Directors who oversee FIA units; Forest Service Staff Directors for Science Policy, Planning, Inventory, and Information (R&D); Ecosystem Management and Coordination (NFS); and Forest Health Management (S&PF); and State Foresters from Northern, Southern, and Western regions.

coast). State and NSF members should be management level employees with responsibility for inventory programs at the State or Regional level. This team meets regularly to make tactical decisions regarding implementation of the core FIM program, and to share information about other ongoing activities.

- C. Technical Bands. These bands consist of technical staff who make recommendations regarding program operations such as field methods, analysis algorithms, information management systems. These groups meet as needed to do staff work in response to requests from the Management team. Each Technical Band will include members from FIA and FHM units, three State representatives, and three NFS members. Band members should be individuals with advanced technical skills in some area relevant to the particular topic area for the given band. University and interest group experts are consulted as needed for participation or peer review.

**Additional Staff.** The core of the FIM program staff will come from existing FIA and FHM staff. In order to meet the legislative mandate, additional staff will be needed in a number of areas. The number of additional staff needed will be determined partly by the level of sampling which is funded and partly by the level of staff support contributed by FIM partners. In addition to needing more people to deliver an expanded program, new skills will also be needed to take advantage of recent advances in technology (e.g., remote sensing imagery). Some of these skills can be acquired by training existing employees. Other skills will need to be acquired by hiring new staff. Additional staffing needs are outlined in Appendix VI.

The Forest Service has extensive experience leading research and development programs involving partnerships with universities. The additional analyses required by customers will be accomplished most effectively if the talents of Forest Service researchers outside of existing FIA and FHM units are combined with the talents of university faculty, graduate students and other partners.

The use of contractors to assist in the various aspects of the FIM program is being evaluated. In recent years, commercial forestry consultants and contractors have conducted some inventory field work for national forests, Stations, and States. FIA units have also used contractors to provide specialized services (e.g., aircraft support and pack animals). Where contractors are more cost-efficient and can meet the same quality and timeliness standards as Forest Service crews, they will be used.

**National Centers.** While much of the FIM work will still be done in existing Station work units, there exist significant opportunities for increasing cost effectiveness through concentrating expertise to perform tasks serving the national program as a whole. We will create several National Service Centers to provide research, development, and applications tools and services for all the regional FIM units. Potential service centers include:

Information Management Service Center. This group will consist of experts in database design, and management, computer programming, and internet applications. They will lead the development of national



information management systems, including data recorder programs, data handling systems, core analysis algorithms, and data access tools. We will build on existing capabilities presently located in Starkville, MS and Las Vegas, NV.

All FIM data will also be made available to the Natural Resource Information System (NRIS), presently under development for managing data on National Forests. The NRIS is being developed to operate at multiple scales, from individual National Forests to State-wide. The NRIS will ultimately include all FIM information and metadata including core data and quality assurance data, at whatever spatial scale is supported by NFS for the area. FIM participation in NRIS is key to improving the linkage between NFS inventory data collected at sub-forest scales and GFIM data gathered at forest and larger scales. Together, the FIM national database and NRIS regional/forest databases will serve an extremely broad set of customers for inventory and monitoring data.

Forest Ownership Project. We propose to institutionalize the periodic national landowner surveys, conducting such surveys once every 10 years. The work will be handled by one of the FIM units (presently Northeastern Station). The next ownership study should be published by 2005.

## COORDINATION AND INTEGRATION

**Integration with Other Agency Reporting Activities.** The Forest Service is responsible for many periodic reporting products associated with status and trends in forested ecosystems. The following needs are presently important. It is expected that other reporting needs will arise in the future. A key attribute of the proposed inventory program is that it contains sufficient scope of data to enable us to respond to new data needs as they arise.

Resource Planning Act (RPA) Assessment. This Assessment is done on a 5 year cycle, with mandatory reporting to Congress at 10-year intervals. FIA provides the historic and current forest inventory data used to describe current resource status and provide the basis for future projections for the RPA analyses. The FIM Program will continue to provide information and analyses covering all lands covered by FIM, at the cycle needed, as well as to expand the scope of data available to include a core set of ecological attributes at the national level.

Chief's "Annual State of the Forest" Address. It has been proposed that the Chief of the Forest Service issue an annual "State of the Forest" report to describe progress

and challenges facing the Nation's forests. The FIM Program will provide the statistical information necessary to prepare such an address.

National Environmental Status and Trends Report (NESTR). This report is being developed for the White House Office of Science and Technology Policy by the John Heinz III Center for Science, Economics, and the Environment. Over 75 percent of the data for the forestry part of the report comes from the FIM program.

International Reporting. FIM will respond to all requests for national estimates of status, condition, and trends, in America's forests. Examples include the United Nations' Temperate and Boreal Forest Resource Assessment and the Criteria and Indicators for Conservation and Sustainable Management of Temperate and Boreal Forest (The Montreal Process). Where international information needs exist that assume different data protocols, FIM analysts and partners will adjust United States data. (e.g., volumes that include bark and different merchantability standards) to satisfy the needs.

The Forest Inventory and Monitoring Program is not being designed specifically to respond to all of the Montreal Process criteria and indicators. However, many of the criteria and indicators will be addressed by the proposed inventory program, at a scale of State-level or larger. Appendix IV includes a list of the criteria and indicators which the FIM program may address.

**Coordination with other Federal and State Partners.** FIA units are already using Global Positioning Systems (GPS) for field operations. The Forest Service has an agreement with the Department of Defense to use GPS receivers which take advantage of special frequencies to provide enhanced coverage and accuracy in obtaining locations. We will continue to coordinate with the Departments of Defense and Energy to improve our capabilities in this area.

We will continue our working relationship with NASA through participation in the Global Observation Earth Satellite (GOES) working group which is looking at new ways to characterize land cover, including forest cover, on a frequent basis. We also collaborate with United States Geological Survey (USGS) in several research and development projects, such as the North America Land Classification project.

We are engaged with other federal natural resource agencies including the National Park Service (NPS), Bureau of Land Management (BLM), USGS, and Natural Resource Conservation Service (NRCS) on a variety of initiatives such as:

- An existing Memorandum of Understanding with NPS for data collection on NPS lands;
- Existing arrangements with the BLM for data collection on BLM lands;
- Participation in joint projects with BLM and NRCS in Oregon, Colorado, and the Delaware Bay area. These projects are looking at ways of combining inventory procedures in areas of common interest including forest and rangelands.

- Pilot project with NRCS looking at ways to eliminate interagency disagreements regarding forest and range resource estimates.
- Collaboration with NRCS and BLM on a rangeland health monitoring initiative.
- Continued participation in and collaboration with the Gap Analysis Program (GAP).
- Partnerships with the U.S. Global Change Research Program to improve estimates of biomass and carbon relations in U.S. forests.

Every State forestry agency is consulted as a routine part of conducting forest inventory. As we move to a continuous annual inventory system, these contacts will occur more frequently as part of the partnerships and relationships described previously.

NFS regions enjoy a unique relationship with FIM. FIM data provide the essential landscape-level context for national forest planning. Having consistent and comparable data for private lands adjacent to national forests is vitally important for regional assessments and for implementing ecosystem management. Like other partners, NFS managers may choose to enhance the FIM sample by adding additional sample locations or measurements to meet additional information needs. FIM provides a nationally consistent framework of data for national forests which can be aggregated upwards for regional or national NFS reporting, avoiding the present problems with data which are incompatible across some regional or National Forest boundaries.

**Compliance with Privacy Act of 1974.** Private landowners are essential partners for the FIM program. Without a landowner's permission, the FIM program cannot collect data on private land. To protect the privacy of participating private landowners, the FIM program keeps confidential the exact latitude and longitude of FIM field sample locations and never links the identity of participating private landowners to plot data. These policies are long-standing and consistent with the Privacy Act of 1974. Further, exact plot coordinates are not included in data bases released outside of the FIM program.

## **MEASURING SUCCESS AND ESTABLISHING ACCOUNTABILITY**

Measuring and monitoring the success of the FIM program is critical both to making continuous improvements as well as maintaining accountability with our customers and Congress. Formal program accountability flows through the line: from Deputy Chief for R&D to Station/Staff Directors, and then from Station Directors to local FIM program staff, or from Staff Directors to national program staff. The Deputy Chief for R&D is the accountable officer for FIM program delivery. Washington Office Staff roles include ensuring programmatic and fiscal accountability.

A variety of program monitoring approaches are necessary to make available the information needed to measure success and establish accountability. The following types of program monitoring perspectives will be used:

1. Implementation monitoring - have we done what we said we would do? Examples of criteria include:

- Did we measure the planned number of plots by State by year?
- Did we produce databases and reports by the planned deadlines?
- Did we develop the internal systems that we promised, within budget?
- Did we achieve our quality assurance objectives?

2. Effectiveness monitoring - is our work having the desired effect? Examples of criteria include:

- What do our user groups think about the quality, usefulness, timing of our products?
- What do user groups think of the consistency, compatibility, and credibility of our results?
- How many and what kinds of customers are we serving? Are we answering their questions?
- What key management and policy decisions are being influenced by our data?

3. Validation monitoring - are our methods, approaches, and techniques scientifically defensible? This is most readily obtained through scientific peer review.

4. Fiscal accountability - How efficiently are appropriated funds and contributions from partners utilized to deliver the FIM program?

Program success will be evaluated continuously and reported via an annual business report, similar to a corporate annual report. It will serve as the annual Government Performance and Results Act report for the FIM program and will describe:

- Past year activities, products, outputs (success in implementation)
- Past year accomplishments, outcomes, and impacts (success in effectiveness)
- Results of any program peer reviews conducted in the past year (success in validation)
- Major changes expected in the coming year;
- A basic financial accounting balance statement (income, expenses)
- A basic statement of staffing resources (people involved, FS and other)

External accountability will be augmented by annual meetings of national and local users groups, where the annual business report will be presented and discussed.

Two types of internal Forest Service reviews will be performed. Formal Technical Assistance Visits (TAVs) will be limited to the Research Work Unit Description revision process for FIM field units. These will be focused on research and development aspects of the FIM unit. Less formal 'Directors Reviews' will take place, as needed. These will be sponsored jointly by the Transition Team to cover details relating to unit operations.

## **TRANSITION SCHEDULES**

The following tables outlines a 5 year transition plan for moving from the present system to an annual system in all parts of the country. Table 1 shows the year of implementation for

each state, and Table 2 shows the first year that a report is expected. Note that the initial reports are not always scheduled exactly five years after the initiation of fieldwork, due to the need to balance the reporting workload over a five year cycle. Subsequent reports for a given state will follow the initial report at five year intervals. This schedule is based on the FY 1999 appropriation level and assumes that increased funding becomes available as described in Appendix VI.

Table 1. Initiation of annual inventory systems, States by year. All States to be initiated by 2003.

Region	1999	2000	2001	2002	2003
Northeast	ME	NY, OH	CT, MA, RI, NH, VT	NJ	DE, MD, WV, PA
North Central	MN, IA, MO, IN, WI	ND, SD, NE, KS, IL	MI		
South <sup>1</sup>	TN, TX, KY, AR	NC, MS, OK	FL, PR		
Interior West			NV, UT, AZ	ID, NM, NV, WY	MT, CO
West Coast	HI	WA, CA, Int AK	OR, Coast AK		

1 Southern states of GA, AL, VA, SC, LA were already be implemented in 1998.

Table 2. Initiation of five-year reports by state. Each State will have reports at five year intervals beginning in the year shown.

Region	2003	2004	2005	2006	2007	2008
Northeast		ME	NY, OH	CT, MA, RI	NH, VT, NJ	DE, MD, WV, PA
North Central		MN, MO	IN, WI, IA,	ND, SD	NB, KS	IL, MI
South	GA, AL	VA, SC,	LA, TN	TX, KY, PR	NC, MS, AR	OK, FL
Interior West		NV, AZ	NM, UT	CO, WY	MT	ID

West Coast		HI	WA, CA, Int AK	OR, Coast AK		
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**STAFFING RESOURCES REQUIRED**

To deliver an FIM program that measures 20 percent of all plots in all States annually will require an estimated 837 full time equivalents (FTEs) each year. This figure covers all phases of the program including preparation work, field work, information management, analysis, reporting, technique research, and management and overhead. This compares with the present program staff size of approximately 420 FTEs (including federal and State cooperators), indicating a need for 417 new FTEs. Appendix VI includes some detail on the number of staff required, by function and region. More detailed information regarding the number of staff by position and grade level is available on request.

Staffing plans for each region were developed by regional FIA managers in consultation with Station Directors and program partners and reflect the actual conditions of each region. Variation will exist across regions due to the different approaches best suited to each region.

It is not necessary that all of these new positions be Federal employees. State personnel assigned full time to FIM work, or contractors or other cooperators, may contribute the effort needed to implement the program.

**FINANCIAL RESOURCES REQUIRED**

To deliver an FIM program that measures 20 percent of all plots in all States annually will require a total budget of \$82,089,000 in 1999 dollars, with inflation increases of approximately 3% per year. Note that failure to adjust annually for inflation will inevitably lead to erosion in program delivery.

This figure covers all phases of the program, including salaries for all program staff, and the cost of equipment, travel, publications, overhead, and miscellaneous items. This compares with the present available funds of \$37,185,000 drawn from existing Forest Service and State contributions. This indicates a need for \$44,904,000 in new funds to come from federal and state sources. In addition, we estimate initial start up costs of approximately \$9,508,000 over five years for purchases of new equipment needed to increase our current capability. Appendix VI includes some detail on the funding required, by function and region. More detailed information regarding the cost by item and region is available on request.

Budgets for each region were developed by regional FIA managers based on staffing plans and reflect the actual conditions in each region. Costs vary among regions due to the nature of the resource and the different approaches best suited to each region. For example, severe topography and lower road densities in the Interior West make costs higher there than in the South because a crew may require 2 days to measure each plot. In addition, severe winter

conditions in the high-elevation west and northeast preclude crews from working in winter months when mountains become inaccessible. This requires us to either relocate work crews to warmer areas or to lay crews off and rehire/retrain crews after winter, both of which add to costs.

Although we attempted to ascertain how much States were willing to contribute to achieve this goal, most States are reluctant to commit to a figure until they see what Congress offers first. Many States feel that this level of strategic forest inventory is a federal responsibility, and so are not willing to commit cash resources to share the cost of the inventory. Other States who are willing to contribute resources are only willing to do so if they get something 'extra', above and beyond the base program offered to non-contributing states.

We believe that a federally funded base program of less than 20% of plots per State would be acceptable to our partners provided they have the opportunity to contribute resources needed to make up the difference. We would welcome a request from Congress to discuss these options further, because we believe this might reduce the total program cost by up to 30% while still addressing the concerns and interests of State Foresters and other partners and customers.

## **APPENDICES**

APPENDIX I - MAJOR CUSTOMER GROUPS AND THEIR NEEDS

APPENDIX II - CORE MEASUREMENTS

APPENDIX III - CORE TABLES AND OTHER PRODUCTS

APPENDIX IV - ADDRESSING CRITERIA AND INDICATORS

APPENDIX V - AGRICULTURAL RESEARCH, EXTENSION, AND EDUCATION REFORM

ACT OF 1998

APPENDIX VI - STAFFING AND FUNDING REQUIREMENTS

APPENDIX VII - DEVELOPMENT OF THIS STRATEGIC PLAN

APPENDIX VIII - FREQUENTLY ASKED QUESTIONS

## **APPENDIX I MAJOR CUSTOMER GROUPS AND THEIR NEEDS**

This strategic plan is designed to meet the needs of a diverse set of customers. Those customers, and a brief description of their needs, include:

**State and National Lawmakers** - Use FIA information for consideration when making and passing laws. They need nationally consistent and state-specific information, constantly updated, on a broad array of forest ecosystem attributes for making laws. They need summaries and analyses of those data, and access to historical data.

**State Foresters** - Use FIA data for developing policy proposals, communicating with their constituents, and planning economic development. They need state-specific, constantly updated information on a broad array of forest ecosystem attributes. They need access to elemental data, as well as summaries and analyses of those data.

**Private Industry and Consultants** - Use FIA information for business planning. They need the most up-to-date information possible, consistent across space without regard for political or administrative boundaries, on a broad array of forest attributes. They need access to elemental data, as well as summaries and analyses of those data.

**Government and Private Research Institutions** - Use FIA data as a basis for conducting their own research and analyses. They need reliable information on a broad array of forest ecosystem attributes, consistent across space without regard for political or administrative boundaries. They need access to elemental data (tree level data), both current data as well as historical data.

**Environmental Organizations** - Use FIA data to monitor and assess the effects of public policies regarding land use. They need information on a broad array of forest ecosystem attributes, consistent across space without regard for political or administrative boundaries. They need access to summaries and analyses of those data, and are increasingly interested in access to elemental data allowing them to conduct their own analyses.

**Media** - Use FIA data in preparing reports and articles. They need current and historical information on a broad array of forest ecosystem attributes, generally summarized and analyzed along political boundaries, e.g. national, state, or county level data. They appreciate information portrayed in a readily understood format, especially using charts and graphics.

**Internal Forest Service** - Use FIA data in preparing a variety of internal reports including the Resource Planning Act (RPA) reports, and occasionally revising/updating forest plans. Need access to data summarized according to State and FS organizational boundaries (Regions/Forest/District).



## APPENDIX II CORE MEASUREMENTS

### I. CORE FIELD VARIABLES.

The following variables will be collected according to a standard protocol on all plots across the country each year. Further documentation available in the Forest Inventory and Monitoring Field Guide.

#### PLOT LEVEL DATA:

PLOT NUMBER	SAMPLE KIND
STATE	COUNTY
YEAR	MONTH
DAY	GPS LATITUDE (CORE OPTIONAL)
GPS LONGITUDE (CORE OPTIONAL)	GPS ELEVATION (CORE OPTIONAL)
SIZE OF FORESTED AREA	TRAILS OR ROADS
DISTANCE TO IMPROVED ROAD	PUBLIC USE RESTRICTIONS
RECREATION USE	WATER PROXIMITY
WATER TYPE	LAND USE IMPACT
LAND USE IMPACT DISTANCE	

#### CONDITION CLASS DATA:

CONDITION CLASS NUMBER	CONDITION STATUS
FOREST TYPE	STAND-SIZE
STAND ORIGIN	OWNER GROUP
RESERVE STATUS	STAND DENSITY
OWNER CLASS	PRIVATE OWNER INDUSTRIAL
STAT	
STAND SPECIES ORIGIN	STAND AGE
STAND STRUCTURE	DISTURBANCE
DISTURBANCE YEAR	TREATMENT
TREATMENT YEAR	LAND COVER TYPE
SLOPE	ASPECT
PHYSIOGRAPHIC CLASS	GROUND COVER
SIZE OF CONDITION	LINEAR FEATURE
CROWN COVER	BROWSING INTENSITY
GRAZING INTENSITY	SOIL GROUP
SOIL TEXTURE	SOIL EROSION
LITTER DEPTH	HUMUS DEPTH
TREATMENT OPPORTUNITY	TOPOGRAPHIC CLASS
PAST NONFOREST LAND USE	PRESENT NONFOREST LAND USE

#### BOUNDARY REFERENCE DATA:

SUBPLOT NUMBER	PLOT TYPE
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BOUNDARY CHANGE  
 LEFT AZIMUTH  
 CORNER DISTANCE  
 SUBPLOT DATA:

CONTRASTING CONDITION  
 CORNER AZIMUTH  
 RIGHT AZIMUTH

SUBPLOT NUMBER  
 UNDERSTORY VEG COVER

SUBPLOT CENTER CONDITION  
 INVASIVE/NOXIOUS PLANTS

TREE AND SAPLING DATA:

SUBPLOT NUMBER  
 CONDITION CLASS  
 HORIZONTAL DISTANCE  
 POSTURE  
 DIAMETER AT BREAST HEIGHT  
 DIAMETER MONUMENTING  
 PERCENT ROTTEN/MISSING CULL  
 ACTUAL HEIGHT  
 CROWN CLASS  
 UNCOMPACTED CROWN RATIO  
 DAMAGE LOCATION  
 CAUSE OF DEATH  
 HEIGHT TO DIAMETER  
 MISTLETOE CLASS

TREE RECORD NUMBER  
 AZIMUTH  
 TREE STATUS  
 SPECIES  
 DIAMETER AT ROOT COLLAR  
 DIAMETER CHECK  
 TOTAL LENGTH  
 HEIGHT METHOD  
 COMPACTED CROWN RATIO  
 DAMAGE TYPE  
 DAMAGE SEVERITY  
 DECAY CLASS  
 PERCENT ROUGH CULL

REGENERATION DATA:

SUBPLOT NUMBER  
 CONDITION CLASS

SPECIES  
 SEEDLING COUNT

SITE TREE DATA:

TREE RECORD NUMBER  
 CONDITION CLASS LIST  
 DIAMETER  
 TREE AGE AT DIAMETER  
 DISTANCE

SUBPLOT NUMBER  
 SPECIES  
 TOTAL HEIGHT  
 AZIMUTH

II. EXTENDED FIELD VARIABLES.

The following variables will be collected according to a standard protocol on a subset of plots across the country each year, in addition to the base suite of variables described above. The subset will be selected to cover the entire country at a sample intensity equivalent to the present Forest Health Monitoring program, with field measurements occurring during the 10 week summer sampling window. These variables are documented in the National Forest Health Monitoring Field Guide.

CONDITION CLASS DATA:

YEAR OF PAST DISTURBANCE

PREVIOUS STAND AGE

SUBPLOT DATA:

TERRAIN POSITION

POINT HISTORY

TREE AND SAPLING DATA:

MORTALITY YEAR

NONFOREST YEAR

GROUND YEAR

CAUSE OF DEATH

CROWN EXPOSURE

CROWN POSITION

CROWN DIAMETER WIDE

CROWN DIAMETER 90 DEGREES

LIVE CROWN RATIO

CROWN DENSITY

CROWN DIEBACK

FOLIAGE TRANSPARENCY

FOLIAGE DAMAGE TYPE

FOLIAGE DAMAGE SEVERITY

FOLIAGE DAMAGE LOCATION

REGENERATION DATA:

CROWN EXPOSURE

CROWN POSITION

CROWN VIGOR

LICHEN COMMUNITY DATA:

LICHEN SPECIES

RELATIVE ABUNDANCE

FULL VEGETATIVE PROFILE DATA:

STRATA

SPECIES

PERCENT COVER

OZONE DAMAGE SYMPTOM DATA:

SPECIES

DAMAGE SEVERITY

SOIL DATA:

O HORIZON THICKNESS

A HORIZON THICKNESS

RESULTS FROM ELEMENTARY LAB ANALYSIS: pH, N, C

COARSE WOODY DEBRIS DATA:

TRANSECT SEGMENT

TYPE

DEBRIS SIZE

DECAY CLASS

### **APPENDIX III CORE TABLES AND OTHER PRODUCTS**

Following are general descriptions of core tables to be produced from the core FIM data.

1. Land area by cover class and land use
2. Area of forest land by various stratifications: forest-type, ownership, stand origin, stocking, stand size, accessibility, health status or damage class, distance to road or water, coarse woody debris class, contiguity, parcel size, etc.
3. Area of forest land treated or disturbed annually and retained in forest land by various stratifications: type, treatment, disturbance, ownership class, etc.
4. Number of trees on forest land by various stratifications: species, tree status, diameter class, forest type, ownership class, snag class, etc..
5. Volume of trees on forest land by various stratifications: species, diameter class, forest type, ownership class, etc.
6. Volume by various stratifications: species, diameter class, forest type, ownership class, etc.
7. Biomass (dry weight) by various stratifications: species, diameter class, forest type, ownership class, etc.
8. Mean cover percentage for stand-age classes and forest-type group and lower vegetation cover classes.
9. Average basal area per acre by various stratifications: ownership class, species group, d.b.h., etc.
10. Average net annual growth/removals/mortality by various stratifications: ownership class, species group, d.b.h., etc.
11. Tree species diversity
12. Crown vigor by species/species group/forest type.
13. Crown dieback by species/species group/forest type.
14. Foliage transparency by species/species group/forest type.
15. Crown density by species/species group/forest type.
16. Crown biomass by species/species group/forest type.
17. Numbers of trees with damages by damage type by species/species group/forest type/tree size.
18. Damage type/location/severity by species/species group/forest type/tree size.
19. Ozone bioindicator species and injury, amount and severity, by species and state.
20. General soil information.
21. Lichen species distribution and lichen air quality index .
22. Vegetation diversity indices.
23. Coarse woody debris by species/species group/forest type/tree size
24. Summary of quality control (remeasurement data) for all variables.

## APPENDIX IV ADDRESSING CRITERIA AND INDICATORS

One of the obligations of the Forest Service inventory programs is to respond to needs for information regarding criteria and indicators of sustainability as defined by the Santiago Accord. This list of criteria and indicators (below) is one method of assessing forest status, and is currently of great interest to several key FIM customers including State Foresters and other federal organizations.

The FIM system is not being designed specifically to respond to the criteria and indicators. It is not reasonable to expect FIM to address all of the criteria and indicators. However, many of the criteria and indicators will be addressed by the proposed inventory program, at a scale of state-level or larger. In the following table, indicators marked with 'A' are those where FIM will report as a normal course of business; those with 'B' indicate indicators which could be addressed with additional effort; and 'C' indicates indicators where FIA data might be useful, but other data (which may or may not currently be available) would also be needed.

### Criterion 1: Conservation of biodiversity

#### *ECOSYSTEM DIVERSITY*

- A 1 Area of forest by type
- B 2 Area of forest by type and age
- B 3 Area of forest by type and IUCN category
- B 4 Area of forest by type, age, and IUCN
- B 5 Fragmentation by forest type

#### *SPECIES DIVERSITY*

- C 6 Number of forest-dependent species
- C 7 Status of forest-dependent species

#### *GENETIC DIVERSITY*

- C 8 Number of forest-dependent species in restricted range
- C 9 Population levels of representative species

### Criterion 2: Maintenance of productive capacity of forest ecosystems

- A 10 Area of forest land & timberland
- A 11 All live and growingstock volume
- A 12 Area and growingstock in plantations
- B 13 Annual removals for products vs. sustainable volume
- C 14 Removals of nontimber products vs. sustainable levels

### Criterion 3: Maintenance of forest ecosystem health and vitality

- A 15 Area and percent forest damaged by insect, disease, fire, flood, etc.
- A 16 Area and percent forest affected by airborne agents [nitrate, ozone, etc.]
- C 17 Area and percent forest with diminished biological components

### Criterion 4: Conservation and maintenance of soil and water resources

- A 18 Area and percent of forest with significant soil erosion
- C 19 Area and percent of forest managed primarily for protective functions
- C 20 Percent of stream kilometers in forested catchment
- B 21 Area and percent of forest with significantly diminished soil organic matter
- B 22 Area and percent of forest with significant soil compaction
- 23 Percent of water bodies in forested areas with significant change in biodiversity
- 24 Percent of water bodies in forested areas with significant. change in hydro. character
- C 25 Area and percent of forest area experiencing significant. accum. of toxic substances

### Criterion 5: Maintenance of forest contribution to global carbon cycles

- A 26 Total forest biomass and carbon pool by type and age
- A 27 Contribution of forest to total global carbon budget
- B 28 Contribution of forest products to global carbon budget

### Criterion 6: Maintenance and enhancement of long-term multiple socio-economic benefits to meet the needs of societies

#### *PRODUCTION & CONSUMPTION*

- B 29 Value and volume of wood products (including value added)
- C 30 Value and quantity of non-wood forest products
- A 31 Supply and consumption of wood/wood products (including per capita)
- C 32 Value of wood and nonwood forest products as percent of GDP
- C 33 Degree of recycling of forest products
- 34 Supply and consumption/use of non-wood products

#### *RECREATION & TOURISM*

- C 35 Area and percent forest land managed for recreation (rel to total)
- 36 Number & type of recreation facilities (relative to forest area & population)
- 37 Number of recreation visitor days (relative to forest area & population)

#### *INVESTMENT IN FOREST SECTOR*

- C 38 Value of investment in forest growth, health, management, recreation, etc.
- 39 Expenditures on research and education
- C 40 Extension and use of new and improved technology
- C 41 Rates of return on investment

*CULTURAL, SOCIAL, AND SPIRITUAL NEEDS AND VALUES*

- 42 Area and percent forest managed to protect cultural needs
- 43 Non-consumptive forest use values.

*EMPLOYMENT AND COMMUNITY NEEDS*

- 44 Direct and indirect employment in forest sector (relative to total)
- 45 Average wage rates and injury rates in forest sector
- 46 Viability and adaptability to change of forest-dependent communities
- 47 Area and percent of forest land used for subsistence purposes

Criterion 7: Legal, institutional, and economic framework for forest conservation and sustainable management

*LEGAL FRAMEWORK*

- 48 Extent to which legal framework supports property rights
- 49 Extent to which legal framework supports forest planning
- 50 Extent to which legal framework requires public participation
- 51 Extent to which legal framework encourages best management practices
- 52 Extent to which legal framework allows for protection of special areas

*INSTITUTIONAL FRAMEWORK*

- 53 Extent to which institutional framework supports public involvement and education
- 54 Extent to which institutional framework supports forest planning
- 55 Extent to which institutional framework develops and maintains human resource skills
- 56 Extent to which institutional framework develops and maintains physical infrastructure
- 57 Extent to which institutional framework enforces laws, regulations and guidelines

*ECONOMIC FRAMEWORK*

- 58 Extent to which economic framework supports long term investments in the forestry sector
- 59 Extent to which economic framework supports nondiscriminatory trade policies

*CAPACITY TO MEASURE AND MONITOR CHANGE*

- A 60 Availability and extent of up-to-date data, statistics and other information
- A 61 Scope, frequency and statistical reliability of forest inventories and other relevant information
- C 62 Compatibility with other countries in measuring, monitoring and reporting on indicators

*CAPACITY TO CONDUCT AND APPLY RESEARCH AND DEVELOPMENT*

- 63 Development of scientific understanding of forest ecosystem characteristics and functions
- 64 Development of methods to measure and integrate environmental and social costs and benefits

- 65 Development of new technologies and the capacity to assess socioeconomic consequences
- 66 Enhancement of ability to predict impacts of human intervention on forests
- 67 Ability to predict impacts on forests of possible climate change



**APPENDIX V**

**S. 1150**

**AGRICULTURAL RESEARCH, EXTENSION, AND EDUCATION REFORM ACT OF 1998**

April 22, 1998.--Ordered to be printed

(c) Forest Inventory and Analysis.--Section 3 of the Forest and Rangeland Renewable Resources Research Act of 1978 (16 U.S.C. 1642) is amended by adding at the end the following:

(e) Forest Inventory and Analysis.--

(1) Program required.--In compliance with other applicable provisions of law, the Secretary shall establish a program to inventory and analyze, in a timely manner, public and private forests and their resources in the United States.

(2) Annual state inventory.--

(A) In general.--Not later than the end of each full fiscal year beginning after the date of enactment of this subsection, the Secretary shall prepare for each State, in cooperation with the State forester for the State, an inventory of forests and their resources in the State.

(B) Sample plots.--For purposes of preparing the inventory for a State, the Secretary shall measure annually 20 percent of all sample plots that are included in the inventory program for that State.

(C) Compilation of inventory.--On completion of the inventory for a year, the Secretary shall make available to the public a compilation of all data collected for that year from measurements of sample plots as well as any analysis made of the samples.

(3) 5 -year reports.--Not more often than every 5 full fiscal years after the date of enactment of this subsection, the Secretary shall prepare, publish, and make available to the public a report, prepared in cooperation with State foresters, that--

(A) contains a description of each State inventory of forests and their resources, incorporating all sample plot measurements conducted during the 5 years covered by the report;

(B) displays and analyzes on a nationwide basis the results of the annual reports required by paragraph (2); and

(C) contains an analysis of forest health conditions and trends over the previous 2 decades, with an emphasis on such conditions and trends during the period subsequent to the immediately preceding report under this paragraph.

(4) National standards and definitions.--To ensure uniform and consistent data collection for all forest land that is publicly or privately owned and for each State, the Secretary shall develop, in consultation with State foresters and Federal land management agencies not under the jurisdiction of the Secretary, and publish national standards and definitions to be applied in inventorying and analyzing forests and their resources under this subsection. The standards shall include a core set of variables to be

measured on all sample plots under paragraph (2) and a standard set of tables to be included in the reports under paragraph (3).

(5) Protection for private property rights.--The Secretary shall obtain authorization from property owners prior to collecting data from sample plots located on private property pursuant to paragraphs (2) and (3).

(6) Strategic plan.--Not later than 180 days after the date of enactment of this subsection, the Secretary shall prepare and submit to Congress a strategic plan to implement and carry out this subsection, including the annual updates required by paragraph (2) and the reports required by paragraph (3), that shall describe in detail--

(A) the financial resources required to implement and carry out this subsection, including the identification of any resources required in excess of the amounts provided for forest inventoring and analysis in recent appropriations Acts;

(B) the personnel necessary to implement and carry out this subsection, including any personnel in addition to personnel currently performing inventoring and analysis functions;

(C) the organization and procedures necessary to implement and carry out this subsection, including proposed coordination with Federal land management agencies and State foresters;

(D) the schedules for annual sample plot measurements in each State inventory required by paragraph (2) within the first 5-year interval after the date of enactment of this subsection;

(E) the core set of variables to be measured in each sample plot under paragraph (2) and the standard set of tables to be used in each State and national report under paragraph (3); and

(F) the process for employing, in coordination with the Secretary of Energy and the Administrator of the National Aeronautics and Space Administration, remote sensing, global positioning systems, and other advanced technologies to carry out this subsection, and the subsequent use of the technologies.

=====  
Following are Conference notes from the House and Senate Committee members who agreed upon the final language of the law. While not included in the body of the law, the notes give some additional guidance regarding the intent of Congress.  
=====

(Section 251)

The Senate has no comparable provision.

**Under the House amendment, the Secretary shall inventory and analyze public and private forests and their resources at least every five years as compared with the current eight to ten years. The Secretary shall also prepare a State forest inventory for each State. At least every five years, the Secretary shall prepare a report that contains a description of the State forest inventories, analyzes the results of the annual nationwide reports, and analyzes forest health trends.**

The conference substitute adopts the House provision with an amendment regarding authorization from private property owners for the inventory and an amendment authorizing forestry research for Northeastern states.

**The Managers recognize that the Forest Service already obtains verbal permission from private landowners before visiting plots located on private land, abides by provisions of the Privacy Act of 1974 to safeguard the confidentiality of data collected on private lands, and assumes the liability for any injury suffered by field crew members while on private land. Where a landowner wishes a written authorization, a written notice shall be provided outlining the purpose and legal authority for conducting the forest inventory, the voluntary nature of private landowner participation, and a means for the landowner to communicate in writing a denial of access. Landowners participating in the inventory program by allowing data collection on their property shall be provided a written communication of the date and time when data were collected and a copy of the annual compilation required by paragraph (2) that is based, in part, on their data.**

**The Managers intend that the core set of variables collected on federal lands, such as the National Forest System should be consistent across all land ownerships.**

Committee on Resources,  
Washington, DC, March 20, 1998.  
Robert Smith, Chairman, Committee on Agriculture,

Richard G. Lugar,	
Larry Combest,	Thad Cochran,
Bill Barrett,	Paul D. Coverdell,
Charles W. Stenholm,	Tom Harkin,
Calvin Dooley,	Patrick Leahy,
Managers on the Part of the House.	Managers on the Part of the Senate.

## **APPENDIX VI STAFFING AND FUNDING REQUIREMENTS**

The following tables show the expected staffing and financial resources required to deliver the annual forest inventory with 20% of all plots measured in each state each year. These requirements cover the complete program including planning, management, data collection, equipment, travel, analysis, information management, reporting, and overhead.

Because of the dramatic change between the existing program and the desired program, numerous assumptions were made in order to produce estimates of the resources required. Those assumptions are documented below. As we gain more information during the implementation of the program, these assumptions will be modified accordingly.

### **ASSUMPTIONS**

1. All dollar figures are 1998 dollars. Expect inflation to increase financial figures at approximately 3% per year.
2. All staffing figures are in Full Time Equivalentents (FTEs). An FTE is 12 person-months of work, either by a single full time employee or by a group of different part time employees. This is generally broken into two-week pay periods.
3. The staffing and financial estimates are for the program as a whole, without regard to who will contribute. It is possible that the final program will be partly funded by a variety of sources including federal, state, and other partners.
4. Salary estimates are Cost to Government which include all direct and indirect salary costs. For purposes of planning for presently unoccupied positions, we generally used the step 5 pay level of each federal employee grade, plus 35% for indirect costs.
5. In general we assume fieldwork is done by two person crews except (1) the subsample of plots with extended measurements will require up to four people, and (2) plots on remote wilderness lands in the western US are often visited by three person crews for safety reasons. Crew size is determined such that the majority of plots are completed in 1 day plus access time. Some plots in remote areas require one or more days simply to hike in to the plot. All scheduled forested plots are visited, as are a portion of non-forested plots which are borderline to forest.
6. Staffing and financial requirements were determined by each Station FIA leader, in consultation with their staff, their partners, and their Station Director. Assumptions regarding grade (pay) level for employees, number of staff needed, field and office productivity rates, length of productive working season, Station overhead rates, and most economical means of travel were based on locally prevailing custom and economic conditions. There will be variation in approaches and procedures across the country due to differences in costs of living, accessibility of the forest land, availability of potential employees, etc.

Some of these local assumptions are documented below:

Southern Region (TN, TX, KY, AR, NC, MS, OK, FL, GA, AL, VA, SC, LA, PR, VI)

Crews average 22 productive pay periods per year  
Crews average 8 forested plots per pay period

Northeast Region (ME, NY, OH, CT, MA, RI, NH, VT, NJ, DE, MD, WV, PA)

Crews average 17 productive pay periods per year  
Crews average 8 forested plots per pay period across the region

North Central Region (MN, IA, MO, IN, WI, ND, SD, NE, KS, IL, MI)

Crews average 20 productive pay periods per year.  
Crews average 8 forested plots per pay period

Rocky Mountain Region (NV, UT, AZ, ID, NM, WY, MT, CO)

Crews average 13 productive pay periods per year across the region;  
6 pay periods in high elevation northern areas  
nearly year round in low elevation southern regions  
Crews average 6 forested plots per pay period  
4-5 plots/pay period on national forest lands (access difficulties)  
7-8 plots/pay period on other lands

Pacific Northwest - South Region (OR, WA, CA, HI, Pacific Islands)

Crews average 13 productive pay periods per year  
Crews average 6 forested plots per pay period

Alaska Coastal lands

Plots are accessed via helicopter launching off of a ship  
Need 2 helicopter ships/season to cover entire region  
Crews average 7 productive pay periods per year  
Crews average 9 forested plots per pay period

Alaska Interior lands

Base grid is 50% intensity of rest of US (1 plot per 14,000 acres)  
Plots are accessed via boat, float plane, helicopter, and on foot.  
Crews average 7 productive pay periods per year  
Crews average 8 forested plots per pay period

## List of tables

In all tables, the following column headings are used: PNW-S for Pacific Northwest Research Station/Southern Zone (OR, WA, CA, HI), AK for Alaska (administered by PNW), RM for Rocky Mountain Research Station, NC for North Central Research Station, NE for Northeastern Research Station, S for Southern Research Station, WO for Washington Office. Refer to Note 6 above for a complete listing of states in each region.

1. Area, forest area, and number of plots by state and region.

Notes: Area estimates are best current estimates, may differ slightly from published data. Number of plots is the base grid (all plots).

2. Staffing Resources Required, 20% Annual Inventory.
3. Financial Resources Required, 20% Annual Inventory
4. Per Unit Costs and Expected Productivity, 20% Annual Inventory

Notes: Per unit costs are expressed in dollars per 1000 acres of forest per year assuming 20 percent of all plots are measured annually. Productivity is expressed in number of plots per crew person FTE per year. Differences between units reflect the different costs of operations in different settings.

## **APPENDIX VII DEVELOPMENT OF THIS STRATEGIC PLAN**

Forest Service inventory staff began planning a response to PL 105-185 in January 1998, when we first became aware of some of the specifics in the proposed legislation. We began developing budget and staffing alternatives under a variety of annual and periodic inventory scenarios, in order to have some frame of reference for discussions with program partners. FIA program managers agreed to work within their respective regions to consult with partners in the development of plans and alternatives to be considered in drafting the strategic plan. The National office staff continued to interact with national level customers and organizations such as the National Association of State Foresters (NASF) and the members of the Second Blue Ribbon panel on forest inventory.

By early August 1998, a complete draft plan based on significant internal and external discussion was made available for review. Copies were sent to all State foresters, members of the Blue Ribbon Panel, other partners and cooperators, and several Congressional staff members. A version was also posted on our internet web site. Comments were requested by September 25 1998, but comments received after that date (as late as October 31) were still considered.

We received a total of 75 written comments including comments from 31 States, 24 Forest Service individuals or groups, six other government organizations, five private citizens, five partner groups, two academic institutions, one private consulting firm, and one anonymous comment. The comments were reviewed by the FIA program managers, who made a series of recommendations for modifications to the draft plan. These recommendations were considered by a meeting of the Transition team consisting of senior executives of the Forest Service plus three State Foresters, who made the final decision regarding the composition of the draft strategic plan.

This draft was then reviewed by the Chief of the Forest Service, then by the USDA Undersecretary for Natural Resources. Their changes were incorporated into the final draft which has been sent to Congress.

## APPENDIX VIII FREQUENTLY ASKED QUESTIONS

Question: Your proposal asks for nearly three times as many people and over twice as much money to do approximately twice as much work. Why?

Answer: The increase in effort necessary to conform to PL 105-185 is not distributed uniformly across the country. Presently, our program consists of cycles of approximately eight years in the south, 13+ years in the north, and 15+ years in the west. The proposal calls for the equivalent of five years everywhere. Inventory work is 2-3 times more expensive in the west (in both dollars and people), where difficult access requires more crew time per plot and where short field seasons cause us to spend more money and time moving crews into and out of operating areas. As our budget breakdown shows, a disproportionate share of the new program dollars required is to be spent in the west to bring their higher current cycle down in line with the required 20% per year.

Question: Not every part of the country needs or wants 20% annual inventory per year. Why do you not consider this in your plan?

Answer: We asked every State Forester directly whether they would be willing to accept less than 20% of plots per year. Some States volunteered that other States might not need the full 20% per year sample, but few States were themselves willing to accept less than 20%, probably out of fear that historic inequities in resource allocation and inventory cycles would be perpetuated. Discussions of this sort, pitting States against each other, are simply not fruitful. All States need and are deserving of an equitable level of service.

We have discussed alternative schemes with State Foresters and other partners and customers. One alternative popular with our partners would provide for a base Federal program of 15% of plots per year per State in the eastern US, 10% per State in the west, with reports still produced at five year intervals and with all States given the opportunity to contribute resources to move their sampling up to 20% per year. This alternative would cost approximately \$56,614,000 per year and would require new federal funds of approximately \$23,259 above the FY 99 appropriation, plus annual inflation increases in the future.

Question: Inventory cycles should be shortest where the trees are growing or being harvested the fastest. Why do you not recognize this in your plan by prioritizing efforts in such areas?

Answer: We disagree that inventory cycles should be dependent solely or primarily upon rates at which trees grow or are harvested. The FIM program does much more



than measure timber growth and harvest. We also measure land use and land cover change, forest ecosystem health, changes in species distribution, biomass productivity, and a host of other attributes. Many of these items are presently changing faster than tree growth or harvest rates. Because of this wide array of interests, and because we cannot anticipate all of the policy-driven needs for information in the future, it is important to have a reliable base system which covers all forested ecosystems.

Question: Does this strategic plan address the concerns expressed by the Second Blue Ribbon Panel on Forest Inventory and Analysis?

Answer: We have tried to address as many of the Second Blue Ribbon Panel concerns as possible. For example, we are moving to an annual inventory system; we are elevating the priority of the inventory program within the Forest Service; we are addressing all forest lands; and we are indicating our intent to create a consistent, coherent program which addresses core ecological and timber data. However, first and foremost this plan is in response to PL 105-185 as passed by Congress, and as such does not include significant details on items which are of interest to the Second Blue Ribbon Panel but are not directly relevant to the legislation. Future action towards implementing this plan will directly involve State Foresters and other members of the Second Blue Ribbon Panel, and will complete our response to the report.

Question: Historically, the FIA program has not been responsible or funded for strategic forest inventory on National Forests, and so has not met all of the National Forest manager needs for inventory information. How will FIM simultaneously meet the broader needs of FIM customers for consistent data while still addressing the specific information needs of National Forest managers?

Answer: The reassignment of responsibility for strategic forest inventory on National Forests from the National Forests themselves to the FIM is a significant change for the Forest Service. Change is never easy, and much discussion of transition arrangements remains. Yet, the Forest Service is committed to fulfilling the strategic needs outlined in PL 105-185 on National Forests. To the extent possible, we will also address other strategic inventory needs of individual National Forest System Regions and Forests. The core FIM program is neither designed nor able to address 100% of the National Forest manager information needs from the base grid, just as the core program does not address 100% of the information needs of other partners and customers.

The positive aspect of the change is that participation in the base FIM program will provide each National Forest with a consistent, objective, scientifically credible, long-term database that covers lands inside and outside of the forest boundaries. This will be a tremendous asset for the next round of forest planning. We can add to that information in a variety of ways- by increased sampling intensity, by additional measurements, and by linkages to spatial databases,

models, and smaller-scale, project-level inventory activities- to provide the solid and stable information base needed to manage forests in a responsible and sustainable fashion. An additional part of the change is increased involvement of NFS managers in all levels of the FIM program, so they will have a voice on shaping program decisions and priorities. At present, seven of nine National Forest Regions have voluntarily consented to participate at this level, and we are confident that we can address the concerns of the remaining two western Regions.

**Table 1. Area, forest area, and number of plots by state and region**

		Land	Forest	Percent	Base #	Forested	For Acres/
	State	Area	Area	Forest	Plots	Plots	For plot
Northeast	MD	6,255,776	2,689,983	43%	1043	466	5,772
	WV	15,415,392	12,178,160	79%	2569	2111	5,769
	PA	28,684,551	16,923,885	59%	4781	2933	5,770
	OH	26,209,658	7,862,897	30%	4388	1363	5,769
	NY	30,223,264	18,738,424	62%	5037	3248	5,769
	ME	19,753,303	17,580,439	89%	3292	3047	5,770
	VT	5,919,571	4,558,069	77%	987	790	5,770
	NH	5,740,390	4,994,139	87%	957	866	5,767
	MA	5,016,307	3,210,436	64%	836	556	5,774
	CT	3,101,050	1,829,619	59%	517	317	5,772
	RI	668,787	401,272	60%	111	70	5,732
	NJ	4,748,058	1,994,184	42%	791	346	5,764
	DE	1,250,957	387,797	31%	208	67	5,788
Northeast subtotal		152,987,064	93,349,304	61%	25,517	16,180	5,769
North Central	IA	35,817,000	2,050,000	6%	5970	390	5,256
	IL	35,630,000	4,266,000	12%	5938	811	5,260
	IN	23,002,000	4,439,000	19%	3834	844	5,259
	KS	52,367,000	1,546,000	3%	8728	318	4,862
	MI	36,358,000	19,281,000	53%	6060	3665	5,261
	MN	50,911,000	16,681,000	33%	8485	3171	5,260
	MO	44,125,000	13,998,000	32%	7354	2661	5,260
	NE	49,507,000	948,000	2%	8251	190	4,989
	ND	44,156,000	673,000	2%	7359	130	5,177
	SD	48,609,000	1,704,000	4%	8102	330	5,164
	WI	34,761,000	15,965,000	46%	5794	2976	5,365
NC subtotal		455,243,000	81,551,000	18%	75,875	15,486	5,266
North subtotal		608,230,064	174,900,304	29%	101,392	31,666	5,523
South	AL	32,500,000	22,000,000	68%	5825	3944	5,578
	AR	33,300,000	17,900,000	54%	5972	3209	5,578
	FL	34,600,000	16,200,000	47%	6923	3240	5,000
	GA	37,100,000	24,100,000	65%	7421	4820	5,000

**Table 1. Area, forest area, and number of plots by state and region(continued)**

		Land	Forest	Percent	Base #	Forested	For Acres/
	State	Area	Area	Forest	Plots	Plots	For plot
South	KY	25,400,000	12,700,000	50%	4920	2460	5,163
	LA	26,300,000	13,800,000	52%	4471	2415	5,714
	MS	30,000,000	18,600,000	62%	5476	3190	5,831
	NC	31,200,000	19,300,000	62%	6205	3860	5,000
	OK	44,000,000	7,500,000	17%	2437	1500	5,000
	PR	2,200,000	710,000	32%	382	125	5,680
	SC	19,300,000	12,600,000	65%	3860	2520	5,000
	TN	26,300,000	13,600,000	52%	4565	2361	5,760
	TX	167,600,000	19,200,000	11%	5770	3840	5,000
	VA	25,400,000	16,000,000	63%	5080	3200	5,000
South subtotal		535,200,000	214,210,000	40%	69,307	40,684	5,265
Rocky Mountain	MT	93,600,000	21,400,000	23%	15167	3472	6,164
	ID	53,600,000	21,300,000	40%	8678	3447	6,179
	NV	71,000,000	11,700,000	16%	11491	1902	6,151
	UT	52,400,000	16,200,000	31%	8493	2620	6,183
	WY	60,900,000	11,000,000	18%	9857	1788	6,152
	CO	61,600,000	23,200,000	38%	9984	3756	6,177
	AZ	73,500,000	20,400,000	28%	11902	3303	6,176
	NM	76,800,000	14,400,000	19%	12434	2336	6,164
RM subtotal		543,400,000	139,600,000	26%	88,006	22,624	6,170
PNW	OR	61,440,000	28,000,000	46%	10240	4667	6,000
South	WA	42,570,000	20,890,000	49%	7095	3481	6,001
	CA	99,720,000	39,880,000	40%	16620	6646	6,001
	HI	4,110,000	1,980,000	48%	685	330	6,000
PNW-S subtotal		207,840,000	90,750,000	44%	34,640	15,124	6,000
Alaska	Coastal	36,000,000	14,000,000	39%	7000	2280	6,140
	Interior	326,000,000	115,000,000	35%	54333	9615	11,960
Alaska subtotal		365,000,000	129,000,000	35%	61,333	11,895	10,845
<b>GRAND TOTAL</b>		<b>2,259,670,064</b>	<b>748,460,304</b>	<b>33%</b>	<b>354,678</b>	<b>121993</b>	<b>6,135</b>

**Table 2. Staffing Resources Required, 20% Annual Inventory**

	PNW-S	AK-Coast	AK-Interior	RM	NC	NE	S	National	ALL
STAFFING NEEDS (Full Time Equivalents*)									
Management	6	1	1	14.7	5	5	7	3	42.7
Image analysis	11	0	5.5	3	5	4	4	0	32.5
Field work	77	7	33	112.5	42	50	104	0	425.5
QA	9	2	6	26.1	6	10	27	0	86.1
Field supervision	16	3	6	29	3	14	7	0	78
Information mgmt	5.5	2	2	6	7	10	9	0	41.5
Compilation	5	2	1	9	0	3	8	0	28
Analysis	9	4	2	7	9	6	20	0	57
Techniques Research	1	0	0	0	4	8	15	0	28
Others	7	3	2	0	0	0	0	0	12
National initiatives	0	0	0	0	0	0	0	6	6
<b>TOTAL STAFFING</b>	<b>146.5</b>	<b>24</b>	<b>58.5</b>	<b>207.3</b>	<b>81</b>	<b>110</b>	<b>201</b>	<b>9</b>	<b>837.3</b>
Less: Current Staffing									
FIA**	-20.0	-17.0	0.0	-47.0	-43.0	-34.4	-102.0	-2.0	-265.4
FHM	-14	0	0	-13	-11	-12	-15	-4	-69.0
State	0	0	0	0	0	0	-86	0	-86.0
<b>Total Current Staffing</b>	<b>-34</b>	<b>-17</b>	<b>0</b>	<b>-60</b>	<b>-54</b>	<b>-46.4</b>	<b>-203</b>	<b>-6</b>	<b>-420.4</b>
<b>NEW STAFF NEEDED</b>	<b>112.5</b>	<b>7.0</b>	<b>58.5</b>	<b>147.3</b>	<b>27.0</b>	<b>63.6</b>	<b>-2.0</b>	<b>3.0</b>	<b>416.9</b>
	=====	=====	=====	=====	=====	=====	=====	=====	=====

\* A Full Time Equivalent (FTE) is 12 person-months of work.

\*\* Includes NFS lands where FIA does fieldwork (all lands except OR, WA, CA)

**Table 3. Financial Resources Required, 20% Annual Inventory, FY 99**

	PNW-S	AK-Coast	AK-Interior*	RM	NC	NE	S	National	ALL
ANNUAL COST									
Salary	\$7,353	\$1,676	\$3,047	\$9,423	\$4,053	\$5,338	\$9,799	\$900	\$41,588
Equipment	\$1,139	\$1,154	\$1,207	\$997	\$654	\$1,236	\$1,345	\$0	\$7,732
Travel	\$1,810	\$1,275	\$5,204	\$3,232	\$709	\$1,017	\$3,414	\$200	\$16,861
Publications	\$126	\$40	\$40	\$50	\$50	\$50	\$150	\$0	\$506
Miscellaneous	\$100	\$100	\$121	\$100	\$111	\$150	\$300	\$200	\$1,182
Station Overhead	\$2,106	\$849	\$1,924	\$1,822	\$1,174	\$1,558	\$1,951	\$900	\$12,284
National initiatives	\$0	\$0	\$0	\$586	\$0	\$100	\$0	\$1,250	\$1,936
TOTAL ANNUAL COST	\$12,634	\$5,094	\$11,542	\$16,210	\$6,751	\$9,449	\$16,959	\$3,450	\$82,089
Less: Available Funds									
FY99 Appropriated, FIA	(\$2,650)	(\$1,255)	\$0	(\$3,063)	(\$3,227)	(\$3,840)	(\$7,824)	(\$1,275)	(\$23,134)
FY99 Appropriated, FHM	(\$871)	\$0	\$0	(\$1,249)	\$0	(\$1,100)	(\$944)	(\$2,036)	(\$6,200)
FY99 Appropriated, NFS	(\$1,200)	(\$540)	\$0	(\$1,800)	(\$180)	(\$44)	(\$257)	\$0	(\$4,021)
FY99 Committed, States	\$0	\$0	\$0	\$0	\$0	\$0	(\$3,830)	\$0	(\$3,830)
TOTAL AVAILABLE	(\$4,721)	(\$1,795)	\$0	(\$6,112)	(\$3,407)	(\$4,984)	(\$12,855)	(\$3,311)	(\$37,185)
NEW FUNDS NEEDED	\$7,913	\$3,299	\$11,542	\$10,098	\$3,344	\$4,465	\$4,104	\$139	\$44,904
	=====	=====	=====	=====	=====	=====	=====	=====	=====
STARTUP COSTS	\$1,698	\$450	\$775	\$4,146	\$639	\$975	\$825	\$0	\$9,508

\* Interior Alaska has a base grid of half intensity compared to the rest of the US, with 20% of the base grid measured annually.

NOTE: Costs will increase at approximately 3% per year based on historical experience.

NOTE: NFS has not committed to allocating all of their funds to FIA; additional appropriated funds may be needed to make up any shortfalls.

NOTE: "New Funds Needed" represents the total funding increase required to deliver the 20% program. This might be a combination of federal and State funds.

NOTE: "Startup Costs" are the total needed over the five year transition for one time equipment charges needed to increase capability to the 20% level.

**Table 4. Per Unit Costs and Expected Productivity, 20% Annual Inventory**

	PNW-S	AK-Coast	AK-Interior	RM	NC	NE	S	National	ALL
ANNUAL BUDGET	\$12,634	\$5,094	\$11,542	\$16,210	\$6,751	\$9,449	\$16,959	\$3,450	\$82,089
STAFFING	146.5	24	58.5	207.3	81	110	201	9	837.3
Crew FTEs	68	7	33	112.5	42	50	104	0	416.5
QA FTEs	8	2	6	26.1	6	10	27	0	85.1
Field Supervision FTEs	15	3	6	29	3	14	7	0	77
BACKGROUND									
Total Land acres	207,840,000	36,000,000	326,000,000	543,400,000	455,243,000	152,987,064	535,200,000		2,256,670,064
Total Forest Acres	90,750,000	14,000,000	115,000,000	139,600,000	81,551,000	93,349,304	214,210,000		748,460,304
Total Plots	34,640	7,000	54,333	88,006	75,875	25,517	69,307		354,678
Total Forest plots	15,124	2,280	9,615	22,624	15,486	16,180	40,684		121,993
Forest acres/plot	6,000	6,140	11,960	6,170	5,266	5,769	5,265		6,135
ANNUAL WORKLOAD									
Total plots/year	6,928	1,400	10,867	17,601	15,175	5,103	13,861		70,936
Forest plots/year	3,025	456	1,923	4,525	3,097	3,236	8,137		24,399
TOTAL PROGRAM PER UNIT COSTS									
\$/1000 ac forest/yr	\$139	\$364	\$100	\$116	\$83	\$101	\$79		\$110
\$/forest plot/yr	\$4,177	\$11,171	\$6,002	\$3,582	\$2,180	\$2,920	\$2,084		\$3,364

PRODUCTIVITY									
plots/crew FTE/yr	101.9	200.0	329.3	156.5	361.3	102.1	133.3		170.3
forest plots/crew FTE/yr	44.5	65.1	58.3	40.2	73.7	64.7	78.2		58.6

*FTE = Full Time Equivalent, 12 person-months of work*