United States
Department of
Agriculture

Forest Service

# Forest Service Research and Development R&D

## Fiscal Year 2008 Performance and Accountability Report

The Research and Development (R&D)

mission of the Forest Service,

U.S. Department of Agriculture (USDA),

is to develop and deliver knowledge and

innovative technology to improve the

health and use of the Nation's forests and

grasslands—both public and private.

# Performance & Accountability Report

## Fiscal Year 2008

## About This Report

The Government Performance and Results Act of 1993 requires all Federal agencies to engage in a strategic planning process that aligns resources with results and improves the accountability of all Government activities to the American people.

This process focuses on results and includes the development and implementation of a 5-year strategic plan. Annual reporting identifies specific, measurable targets for performance at the beginning of each fiscal year and a year-end assessment of the success of these endeavors.

This *Fiscal Year 2008 Performance and Accountability Report (PAR)* is the year-end progress report of the U.S. Department of Agriculture (USDA), Forest Service, Research and Development (R&D) Deputy Area. It reviews the Forest Service's strategic goals and objectives and compares initial R&D targets to actual performance. The data that Forest Service R&D used to measure actual performance are collected using standardized methodology that conforms to generally recognized principles for reporting.

This report outlines the Forest Service R&D organization, describes how it has applied the public's investments, and provides an accounting of budgets and accomplishments. It helps policymakers make informed decisions and presents an overview for all Americans interested in the workings of their Government and R&D's ability to "manage for results" in delivering its information, technology, and applications.

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## Message From the Deputy Chief

I am pleased to present the Forest Service Research and Development (R&D) Deputy Area *Fiscal Year 2008 Performance and Accountability Report (PAR)*. This report presents key budget and financial information and programmatic performance in achieving the R&D mission. The PAR provides transparency and accountability to the American people, highlights areas of demonstrated excellence, and identifies areas that need improvement.

Fiscal year 2008 was a challenging one for R&D funding, partly because of fire suppression costs, which reduced the Forest Service base budget to R&D and other programs. The Forest Service budget expended on fire suppression has doubled since 2001, in part because of climate change and urban expansion.

Sound scientific information is needed for land management decisions that address problems facing our forests, grasslands, and urban environments from invasive pests, pollution, fire, water shortages, and population pressures. Forest Service R&D provides high-quality scientific information and applications that help land managers restore and maintain healthy forests and grasslands for community protection; multiple environmental and social benefits, such as clean air and clean and abundant water; a great array of recreational opportunities; and a wide range of ecosystem services.

R&D supports the Forest Service mission of *sustaining the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generations* through dedicated scientists and technical staff. Their work is recognized worldwide for contributions to basic scientific knowledge and cutting-edge applications. Forest Service R&D also offers long-term, established research projects; committed land base, (experimental forests and ranges, watersheds, grasslands, demonstration areas, and research natural areas); ties to land managers; regional, national, and global perspectives; and a "public service" focus on questions of public significance.

ANN BARTUSKA
Deputy Chief for Research and Development

## The R&D Mission

The Research and Development (R&D) mission of the Forest Service, U.S. Department of Agriculture (USDA), is to develop and deliver knowledge and innovative technology to improve the health and use of the Nation's forests and grasslands—both public and private. R&D provides knowledge and technology to landowners, managers, policymakers, and the American people to help inform their decisions and actions.

Forest Service R&D scientists conduct research in all U.S. territories and the 50 States on both Federal and non-Federal lands. We integrate efforts on national, regional, and local research needs and scientific issues to address critical problems such as climate change, invasive species, and the need for alternative sources of energy in a coordinated and strategic manner. Forest Service R&D uses and contributes research to the international scientific community to inform policies and natural resource practices worldwide and works with scientists from around the globe to solve problems of common interest.

The ability to manage public lands for sustainable benefits and to promote sustainable management of natural resources on private land requires a continuum of both qualitative and quantitative information about the health, condition, productivity, and use of forests and grasslands. Forest Service R&D provides land and resource managers with the scientific, social, and economic tools they need to achieve the desired outcome to care for the land and serve people, now and in the future.

Forest Service researchers work independently and with a range of partners to provide land managers with information and technology to make management and land use decisions on issues such as invasive species, healthy watersheds, wildfire, climate change, and traditional and alternative forest products. The Forest Service R&D workforce includes scientists and technicians in the biological, physical, and social science fields, working in partnership with researchers from other agencies, academia, nonprofit groups, and industry.

## Organizational Structure

The R&D mission area has been a vital part of the Forest Service since the agency's inception in 1905. The organization consists of 5 research stations—which cover geographical regions within the 50 States, territories, and possessions—plus the International Institute of Tropical Forestry, the Forest Products Laboratory, and 81 experimental forests and ranges. R&D interacts internally with national forests in nine regions and with the State and Private Forestry Deputy Area throughout the United States.

Forest Service R&D is also allied with agencies in the USDA Research, Education and Economics mission area, including the Agricultural Research Service (ARS); National Institute of Food and Agriculture; National Agricultural Statistics Service; and the ARS' National Agricultural Library. Forest Service R&D also partners with other Federal agencies, nongovernmental organizations, universities, and the private sector.

## Headquarters Staff

Forest Service R&D is organized into six staff groups that ensure scientific and programmatic synergy among the research stations and national headquarters, provide science-based leadership in agency policy decisionmaking, and provide strategic leadership across broad program areas. This structure helps to ensure timely and effective coordination and cooperation with other deputy areas within the Forest Service and with key clients and stakeholders outside the agency. By producing and disseminating relevant research information and new technologies, this structure also helps these managers make science-based policy and management decisions. The staffs also build support at the strategic level for continued investments in research programs, facilities, and employees.

The **Forest Management Sciences** Staff provides research oversight and leadership in connection with wise natural resource policies and new options for protecting and managing forest and rangeland resources. A major focus is developing approaches to protect the health, diversity, and productivity of the Nation's forest and rangeland resources from natural and human-caused disturbances, such as climate change, fire, and invasive species.

The **Resource Use Sciences** Staff provides research oversight and leadership in connection with improving the sustainable production and utilization of goods and services from natural resources and evaluating the potential of new and emerging goods and services. Three major foci are new wood products and the performance of those products for a wide variety of uses, including the harvesting and processing of wood for emerging markets, such as bioenergy, along with improved performance of traditional products; services, including outdoor recreation and ecosystem services; and the human dimensions of resource use, including social sciences and cultural heritage influences on resource uses.

The **Environmental Sciences** Staff provides research oversight and leadership in connection with wise natural resource policies and new options for protecting and managing the ecological components of forests and rangelands other than trees. A major focus is developing approaches to protect and manage watersheds for both water and aquatic habitats for fish and other creatures; soils to prevent erosion and maintain productivity; air quality; and terrestrial habitats for wildlife.

The **Quantitative Sciences** Staff provides research oversight and leadership in connection with monitoring the conditions of forests and rangelands and detecting changes in their health and productivity in time to adapt management activities to avoid detrimental outcomes. The major foci include designing and conducting inventory, monitoring, and analysis activities of the Nation's forests and grasslands and related natural resources; establishing and monitoring indicators of environmental sustainability; assessing the status and condition of renewable resources, such as forests and rangelands, timber, water, fish and wildlife, and outdoor recreation; and providing liaison and collaboration in the international research community on forest science and related policy issues.

The **Science Quality Services** Staff provides leadership, development, and oversight of strategic planning and performance accountability; technology development and applications; agency patent and licensing activities; science education; and information management and technology liaison for Forest Service R&D activities.

The **Policy Analysis** Staff provides the Chief and staff with timely, objective, and high-quality analyses of issues and events important to the productivity, health, and sustainability of the Nation's natural resources and agency policies, programs, and practices.

## Strategic Program Areas

Forest Service R&D organizes research under seven Strategic Program Areas (SPAs), which support an integrated approach to the study of broad, complex environmental and social issues. Within this structure, researchers address the Forest Service strategic goals and objectives at the watershed, landscape, regional, and national levels to focus research on the large-scale problems of national concern identified in the *USDA Forest Service Strategic Plan: FY 2007–2012*. SPAs provide consistent and stable nationally strategic subdivisions of the national Forest Service research program for purposes of program development; management of review and oversight; communication to national audiences, including national interest organizations, the Administration, Congress, and the general public; budget formulation and presentation; and fostering integration and collaboration among research stations and between stations and external partners.

The **Wildland Fire and Fuels SPA** provides the knowledge and tools that managers use to reduce negative effects and enhance beneficial effects of fire and of fire and fuels management on society and the environment. The SPA has five major focus areas: understanding and modeling fundamental fire processes, interactions of fire with ecosystems and the environment, social and economic aspects of fire, evaluation of integrated management strategies and disturbance interactions at multiple scales, and application of fire research to address management problems.

The **Invasive Species SPA** provides scientific information, methods, and technology to reduce, minimize, or eliminate the introduction, establishment, spread, and effect of invasive species and to restore ecosystems affected by invasive species or restore their functions. The SPA focuses on plants, animals, fish, insects, diseases, invertebrates, and other species that are not native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm.

The **Outdoor Recreation SPA** provides human and ecological sustainability through research directed at understanding and managing outdoor environments, activities, and experiences that connect people with the natural world. Research in this SPA is interdisciplinary and focuses on nature-based recreation and changing trends in American society; connections among recreation visitors, communities, and the environment; human benefits and consequences of recreation and nature contact; the effectiveness of recreation management and decisionmaking; and sustaining ecosystems affected by recreation.

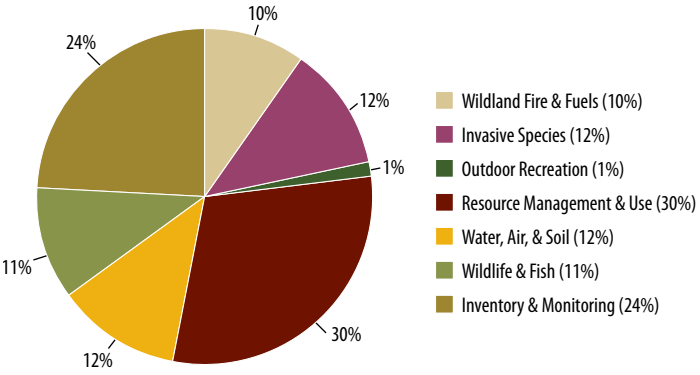
The **Water, Air, and Soil SPA** enables the sustainable management of these essential resources by providing clear air and safe drinking water, protecting lives and property from wildlife fire and smoke, and adapting to climate variability and change. The SPA features ecosystem services with a high level of integration among water, air, and soil research. It stresses the effects of climate variability and change on water budgets, and it focuses on carbon sequestration from an ecosystem perspective.

The **Inventory and Monitoring SPA** provides the resource data, analysis, and tools needed to effectively identify current status and trends of forests; management options and effects; and threats and effects of fire, insects, disease, and other natural processes, enhancing use and value of the Nation's forests and grasslands. Assessing current and potential effects of climate change is dependent on monitoring forest ecosystems at greatest risk to rapid change. Focus areas include the development and use of integrated interdisciplinary science, technologies, and remote sensing to increase the timeliness and spatial resolution of forest fragmentation caused by land use change and to reduce incidence of insect, disease, fire, and extreme weather events.

The **Wildlife and Fish SPA** relies on interdisciplinary research to inform policy initiatives affecting wildlife and fish habitat on private and public lands and the recovery of threatened or endangered species. Scientists in this SPA investigate the complex interactions among species; ecosystem dynamics and processes; land use and management; and emerging broad-scale threats, including global climate change, loss of open space, invasive species, and disease.

The **Resource Management and Use SPA** provides the scientific and technological base to sustainably manage and use forest and range resources and forest fiber-based products. Focus areas include plant sciences, soil sciences, social sciences, silviculture, productivity, forest and range ecology management, harvesting and operations, forest and biomass products and utilization, economics, urban forestry, and climate change.

**Percent of Budget to SPAs**




## Research Locations

Forest Service R&D strives to be recognized as a world leader in innovative science for sustaining global forest resources for future generations. We provide the information and solutions to sustain forests and grasslands and the values they provide for people. Our research benefits the owners and managers of working forests and farms, helps restore healthy forests, and protects communities. Forest Service R&D operates seven research stations, including the Forest Products Laboratory and the International Institute of Tropical Forestry in Puerto Rico. Forest Service R&D employs approximately 500 scientists and hundreds of technical and support personnel, who are located at 67 field sites throughout the United States, Puerto Rico, and the U.S.-affiliated territories and nations of the Pacific.

The **Northern Research Station (NRS)**, headquartered in Newtown Square, PA, has research and development programs across 20 States in the Midwest and Northeast (CT, DE, IA, IL, IN, MA, MD, ME, MI, MN, MO, NH, NJ, NY, OH, PA, RI, VT, WI, and WV). This NRS was formed in 2006 through the consolidation of the former North Central and Northeastern Research Stations. The station's research products and technologies provide the knowledge and tools to protect people and forest landscapes from the threat of undesirable disturbances, improve the quality of life in urban areas through natural resources stewardship, maintain and enhance forest productivity and benefits, and increase production of clean water and air for a growing population.

The **Southern Research Station (SRS)**, headquartered in Asheville, NC, conducts research programs across 13 States (AL, AR, FL, GA, KY, LA, MS, NC, OK, SC, TN, TX, and VA). The SRS mission is to create the science and technology needed to sustain and enhance southern forest ecosystems and the benefits they provide. The SRS realigned its organizational model from 28 research work units into 15 units grouped under 5 science areas that clearly define core strengths. These areas include threats to forest health; forest ecosystem restoration and management; forest values, uses, and policies; forest watershed science; and forest inventory and monitoring.

The **Rocky Mountain Research Station (RMRS)**, headquartered in Fort Collins, CO, conducts research programs across 12 States in the Interior West (AZ, CO, ID, KS, MT, ND, NE, NM, NV, SD, UT, and WY). The RMRS is evolving from a system of 30 research work units (including ecosystem management units and national programs) into a comprehensive programmatic structure consisting of 8 science program areas and several research, development, and applications programs. The station's 92 scientists work collaboratively with National Forest System (NFS) managers, universities, State agencies, and other Federal agencies to provide high-quality scientific information for solving land management and policy development issues related to sustaining natural resources. These issues include watershed and fire research to address fuels management and restoration of forests and grasslands, control and mitigation of bark beetle invasions, social and economic issues relative to fire effects and ecosystem uses, wildlife habitat and population sustainability, and controlling the spread of invasive weeds.

The **Pacific Northwest Research Station (PNW)**, headquartered in Portland, OR, maintains research and development programs in three States (AK, OR, and WA). PNW, which provides scientific information to land managers, policymakers, and citizens, employs about 500 people. Like the other stations, its mission is to generate and communicate scientific knowledge that helps people understand and make informed choices about people's behaviors and attitudes, natural resources, and the environment.

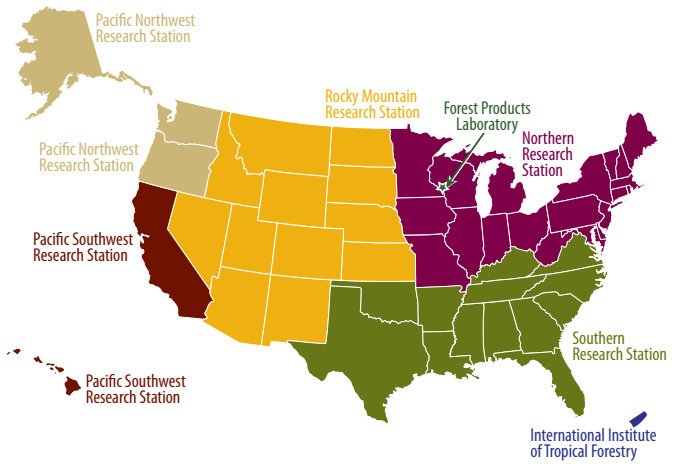
The **Pacific Southwest Research Station (PSW)**, headquartered in Albany, CA, conducts research, development, and applications programs in CA, HI, and the U.S.-affiliated territories and nations of the Pacific. PSW's primary work occurs in California (the most populous State with the fifth largest economy in the world) and Hawaii (a strategic location in the Pacific Rim economies and tourism). The station develops and delivers science-based information, technologies, understanding, and applications to help people make well-informed decisions about natural resource management, conservation, and environmental protection.

The **Forest Products Laboratory (FPL)**, located in Madison, WI, is con-

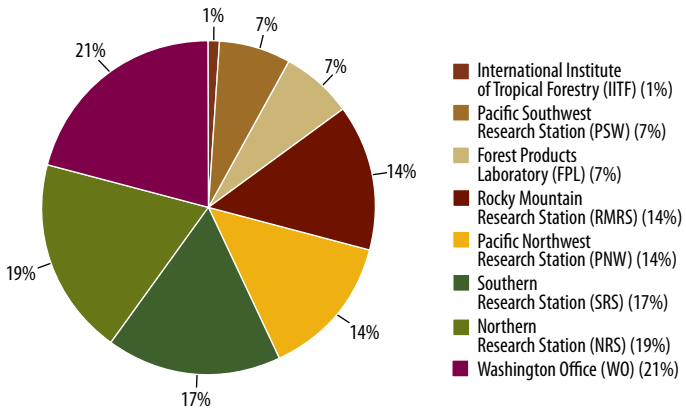
cerned with the long-term health of the Nation's forests and how the Nation depends on sound conservation practices, including utilization. FPL uses science and technology to conserve and extend the Nation's forest resources and to develop innovative wood-related products. FPL's mission is to promote healthy forests and forest-based economies through the efficient, sustainable use of wood resources.

The **International Institute of Tropical Forestry (IITF)**, located in Rio Piedras, PR, has one work unit. The mission of this unit is to generate and disseminate scientific information in support of the sustainable use of tropical forests. The IITF accomplishes its mission by developing and disseminating knowledge of scientifically sound practices that contribute to the sustainable use of forest resources, conservation of primary forests, rehabilitation of degraded lands, and management of wildlife and watersheds. This work is conducted through an extensive network of collaborators at home and abroad.

## Research Stations



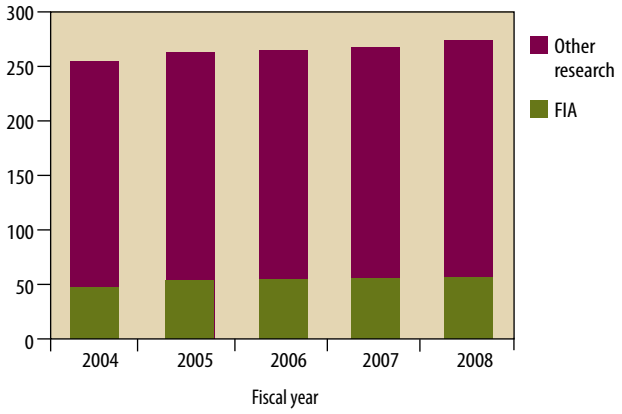

## Percent of Forest Service R&D Budget to Research Stations and Washington Office




Forest Service R&D receives support from two foundation programs that provide the infrastructure to sustain and expand R&D's research temporally and spatially.

The **Forest Inventory and Analysis (FIA)** program, a congressionally mandated census of the resources of U.S. forests, is conducted in partnership with the State foresters and State and Private Forestry. The program, which operates out of NRS, PNW, RMRS, and SRS, is coordinated nationally from the Washington Office. The FIA program assesses and reports on the status and trends in tree species, size, and health; forest area and location; tree growth, mortality, and removal by harvest; wood production and utilization; and forest land ownership. The FIA assessments extend to the trust territories and Puerto Rico and include reports on changes in carbon budgets and forest health. R&D manages the program in cooperation with State and Private Forestry and NFS and implements the program in cooperation with a variety of partners, including State forestry agencies and private landowners, who grant access to their lands for data collection.

## FIA Portion of Research Appropriation




| | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|
| Other research[a] | $215 | $220 | $218 | $221 | $226 |
| FIA[b] | 52 | 56 | 59 | 59 | 60 |

FIA = Forest Inventory and Analysis.
R&D = Research and Development.
SPIA = Forest Resource Information and Analysis.
[a] Includes research and facilities maintenance.
[b] R&D FIA only; does not include SPIA.

The **Experimental Forests and Rangelands (EFR)** program provides the venue for long-term research in which Forest Service R&D scientists can address continental-scale environmental change issues in rural and urban areas. The 81 experimental forests and ranges comprise lands that have been authorized by Congress and designated by the Chiefs of the Forest Service for the past 100 years. The EFR network, which has developed progressively since the first designation in 1908, provides study sites for long-term vegetation and watershed science and management. Many of these sites are more than 50 years old and support research in all the major vegetation types and topographies areas of the continental United States.

### Research Scientists, FYs 1995–2008

| Fiscal Year | 1995 | 1997 | 2001 | 2002 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|
| R&D FTEs | 2,379 | 2,379 | 2,632 | 2,494 | 2,730 | 2,699 | 2,286 | 2,283 | 2,283 |
| Research scientists | 607 | 548 | 524 | 507 | 503 | 486 | N/A | 547 | 498 |

N/A = Data not available.

The EFRs are considered "living laboratories," where Forest Service R&D can demonstrate research projects and results to cooperators and stakeholders. They represent some of the few places where ecological research can be maintained over the long term and perpetuate experimental studies far beyond the term of any individual scientist's career.

## Our People

In fiscal year (FY) 2008, Forest Service R&D had 2,283 full-time employees (FTEs), including research scientists, support personnel, biological and forestry technicians, statisticians, and administrative and technical support staff.

Over the past decade, the number of research scientists in Forest Service R&D has declined by nearly 18 percent, at a time when demand for scientific knowledge and technology has been increasing. In FY 2008, Forest Service R&D had approximately 500 full-time scientists, a decline of 9 percent in just the past year. This decrease reflects fixed or marginally increasing funding levels more than offset by inflation and rising technology costs. In response, R&D has adopted a broader, more integrated approach to how we study the environment. Our researchers now have wider skill sets than the historically more specialized single-discipline scientists. Today's scientists can solve problems of national and regional scope across many landscapes. Forest Service R&D facilitates multidiscipline, integrated programs and work units to focus on larger scale research rather than the more narrowly defined work units of the past.

The public's heightened concerns about climate change, alternative energy, clean and abundant water, and loss of open space from urban expansion have given the Forest Service R&D community a greater role in providing science for policy decisionmaking. Hiring programs, such as the Scientist Recruitment Initiative, have been successful in attracting entry-level scientists to Forest Service R&D who will be positioned to research the current environmental and social issues facing the Nation's forests and grasslands. Upon completion of their doctoral degrees, the students in the program will fill permanent scientist positions identified by program, research, workforce, and diversity needs.

## Collaboration

Forest Service R&D's enterprise consists of high-quality scientific research, applying findings to NFS lands and making these findings available to others for application to their lands. Forest Service R&D distributes information and technology to land managers and land use planners through a variety of mechanisms, including publications, videos, training, and demonstrations. R&D's ability to interact with users of its research and transfer technology is substantially enhanced through partnerships, particularly those with other research organizations, land management practitioners, State agencies, urban planners, private forest owners, private organizations, and horticultural and agricultural interests.

These partners of Forest Service R&D include Federal and State agencies, universities, industry, nongovernmental organizations, tribal governments, and foreign government research cooperators.

Forest Service R&D has a long history of supporting extramural research through grants and agreements to colleges and universities; State, local, and tribal governments; nonprofit organizations; industry; and individuals. FY 2008 saw a decline in both number of grants and the percent of appropriated dollars spent on grants, a reflection of the funding pressures brought about by a severe fire season that constrained our ability to execute extramural grants and the need to continue to fund core R&D research.

### Number of Grants and Agreements and Percent of Forest Service R&D Budget

| Fiscal Year | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|
| Number of G&As | 756 | 697 | 734 | 729 | 541 |
| Percent of R&D budget | 13% | 12% | 12% | 14% | 12% |

G&As = Grants and agreements. R&D = Research and Development.

## Summary of Budget Changes by Source and Use of Funds, FY 2004–08 ($ in millions)

| Funding Sources | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|
| Forest Service appropriation | 4,941 | 4,820 | 4,378 | 4,698 | 5,039 |
| Research appropriation (FRRE) | 266.4 | 276.4 | 277.7 | 280.5 | 285.9 |
| National Fire Plan (FRFR/FRF2) | 22.0 | 21.7 | 22.8 | 22.8 | 23.5 |
| Joint Fire Science Program (WFSU)[a] | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 |
| **Total Research (FRFR)[b]** | **296.3** | **306.0** | **308.4** | **311.2** | **317.3** |
| Forest Resource Information & Analysis (SPIA) | 4.9 | 5.0 | 4.6 | 4.6 | 4.5 |
| Facilities, Construction & Deferred Maintenance (CMFC/CMII) | 19.0 | 18.5 | 13.2 | 22.0 | 21.2 |
| Grand Total Sources | 320.2 | 329.5 | 326.2 | 337.8 | 343.0 |
| **Funding Uses** | | | | | |
| **Other than FIA[c] research** | **244.6** | **250.1** | **245.8** | **248.6** | **253.5** |
| FIA | 51.7 | 55.9 | 59.4 | 59.4 | 60.4 |
| Forest Resource Information and Analysis (State and Private Forestry) | 4.9 | 5.0 | 4.6 | 4.6 | 4.5 |
| **Total inventory and analysis** | **56.6** | **60.9** | **64.0** | **64.0** | **64.9** |
| **Facilities construction and maintenance[d]** | **19.0** | **18.5** | **16.4** | **25.2** | **24.6** |
| **Grand Total Uses** | **320.2** | **329.5** | **326.2** | **337.8** | **343.0** |

[a] Annually reprogrammed to FRRE.
[b] FY 2004–08 includes FIA; FY 2006–08 includes facilities maintenance.
[c] FIA = Forest Inventory and Analysis
[d] FY 2006–08 includes Facilities Maintenance Fund (CP09).

Budget line item codes:
FRRE = Forest and Rangeland Research
FRFR/FRF2 = National Fire Plan
WFSU = Wildland Fire Suppression
SPIA = Forest Resource Information & Analysis
CMFC/CMII = Facilities, Construction & Deferred Maintenance

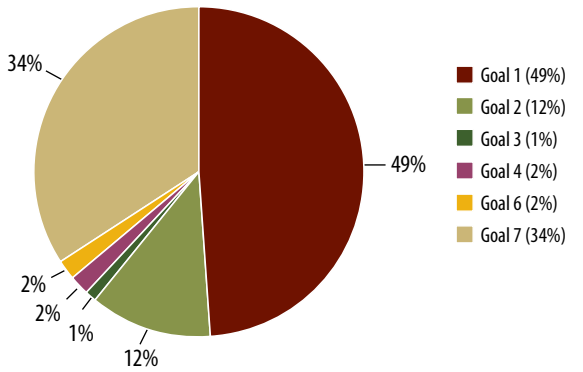
# Strategic Plan Overview

The *USDA Forest Service Strategic Plan: FY 2007–2012* provides the strategic direction that guides the agency in delivering its mission and identifies major current issues important to natural resource management. The direction and issues are addressed in seven strategic goals:

**Strategic Goal 1:** Restore, Sustain, and Enhance the Nation's Forests and Grasslands.
**Strategic Goal 2:** Provide and Sustain Benefits to the American People.
**Strategic Goal 3:** Conserve Open Space.
**Strategic Goal 4:** Sustain and Enhance Outdoor Recreation Opportunities.
**Strategic Goal 5:** Maintain Basic Management Capabilities of the Forest Service.
**Strategic Goal 6:** Engage Urban America With Forest Service Programs.
**Strategic Goal 7:** Provide Science-Based Applications and Tools for Sustainable Natural Resources Management.

Based on the Forest Service strategic plan, Forest Service R&D targets its research and development activities and develops the means and strategies that contribute to achieving the plan's outcomes.

### Percent of Forest Service R&D's FY 2008 Budget to Strategic Goals




Although R&D supports Goal 5 through cost pool assessments on the R&D appropriation, we do not track the extent of this support as an R&D activity. The facilities maintenance, information systems, and landownership management support is displayed elsewhere in the agency where the pooled funds are aggregated and managed centrally.

# Budget and Finance

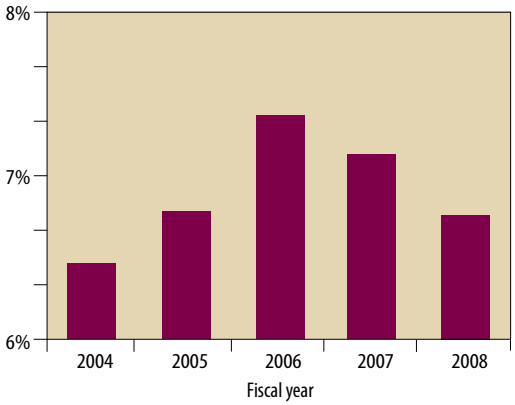
Forest Service R&D focuses its resources on the agency's mission, the priorities identified in the *USDA Forest Service Strategic Plan: FY 2007–2012*, direction from Congress, and Executive Branch priorities. The base Forest Service R&D program is formulated using input from the research stations, including FPL and IITF, which prioritize efforts needed to address the nature and magnitude of current and anticipated future resource problems and information requirements of resource managers.

Station directors communicate frequently with users of research products and technologies to ensure they consider local, State, and regional resource issues. The directors then request budget levels that best serve the science and technology needs of their clients, including other Forest Service deputy areas. These field requests are reviewed, coordinated with strategic priorities, and merged into a national research program. Funds are allocated to support the priorities and needs aggregated into the seven SPAs.

Forest Service R&D places a high priority on accountability and is committed to making the best use of taxpayers' dollars. Financial accounting is consolidated at the agency-level Agency Financial Report.

In FY 2008, Forest Service R&D was appropriated $285.9 million, an increase of less than 2 percent from FY 2007. This amount includes $60.4 million for FIA and $3.4 million for a facility maintenance fund. In addition, Forest Service R&D received $23.5 million for the National Fire Plan and $7.9 million for the Joint Fire Science Program. The R&D appropriation represents 6.8 percent of the FY 2008 Forest Service appropriation.

**R&D Appropriation as Percent of Forest Service Appropriation**




# Summary of Annual Performance for Strategic Goals

## Strategic Goal 1

### Restore, Sustain, and Enhance the Nation's Forests and Grasslands

The national forests and grasslands were established to protect the land, secure favorable water flows, and provide a sustainable supply of goods and services to the American people. The Forest Service provides land management assistance to the States and private forest landowners as well as to the national forests. In recent years, the increasing extent and frequency of uncharacteristically severe wildland fires and insect and disease outbreaks, along with the effects of climate change, have been of particular concern to the public, the Administration, Congress, and land management agencies.

In FY 2008, Forest Service R&D contributed to achieving Goal 1 by conducting research in fire, soil, water and air, fish and wildlife, invasive species, landscape ecology, global change, wilderness, and range. Performance for this goal is summarized by three major themes: fire, invasive species, and healthy watersheds. A key component of this research is long-range research conducted at experimental forests and rangelands and research natural areas.

### Goal 1. Resource Investments (dollars in thousands)

| Strategic Program Area | FY 2008* ($) |
|---|---|
| Wildland Fire and Fuels | 20,162 |
| Invasive Species | 23,988 |
| Outdoor Recreation | 857 |
| Resource Management and Use | 44.288 |
| Water, Air, and Soil | 26.802 |
| Wildlife and Fish | 19.120 |
| Inventory and Monitoring | 981 |
| Forest Inventory and Analysis (FIA) | 6,115 |
| **Total Goal 1** | **142,313** |

* Funding levels to SPAs are approximate and represent investments planned.

### Selected Accomplishments: Wildland Fire

The FireMapper® thermal-image radiometer, under development by PSW scientists and their long-time partners, provided rapid response fire intelligence in support of suppression operations of several large fires in the West during Santa Ana wind events in FY 2008. California wildfire activity increased dramatically in the summer of 2008. Incident management teams used the thermal-infrared imaging transmitted to and displayed by satellite to aircraft in their suppression efforts on several major fires.

To predict the effects of climate variability and change on future fire severity and extent, it is important to understand the climate conditions under which regional fire years occurred. Forest Service scientists, working with researchers from the University of Idaho, identified the climate conditions under which regional fire years have occurred over the past three and one-half centuries in the northern Rockies; they found that climate is a major driver of fires in this region despite suppression, logging, and grazing activities.

Forest Service researchers collaborated with a national forest in northern Wisconsin to evaluate the relative effectiveness of four fire mitigation strategies (banning debris-burning, redistributing flammable forest types, establishing fire breaks, reducing roadside ignitions) in an area of the forest where fire-dependent pine and oak overlap with a rapidly developing wildland-urban interface (WUI). Using simulation modeling, the study showed significant differences in the effectiveness of the various methods in reducing fire risk, with banning debris-burning having the strongest influence. Simulations also showed that long-term maintenance of fire-dependent communities (oak and pine) requires active management. Results of the study provide a means for resolving conflict between maintaining fire-dependent communities and expanding WUI.

In 2008, 5 people were killed and 38 injured in a 70-car pileup in Florida. This incident was caused by decreased visibility from dense "superfog" that was linked to smoke from a nearby wildfire. Forest Service research determined that smoke moisture is the key factor in the formation of superfog, and the model the researchers developed will be a valuable tool for informing State highway officials of the dangers of superfog. The model can also inform land managers of when to burn and how to burn to prevent the formation of superfog. With the Google®-based user interface, county managers can access interactive maps daily and issue traffic advisories in advance of dangerous conditions.

## Selected Accomplishments: Invasive Species

FY 2008 was notable for several significant results in invasive species research. Mountain pine beetle and Douglas-fir beetle are two of the most damaging pests to conifers in North America. Researchers from PSW, collaborating with the pheromone industry, developed the first pheromone release products to treat these pests that can be applied by aircraft or broadcast spreaders, allowing area-wide protection. Test treatments significantly reduced attack levels when applied according to guidelines, and the U.S. Environmental Protection Agency registered both products for use in forest stands.

Forest Service R&D scientists planted more than 750 blight-resistant American chestnut seedlings in an abandoned coal mine in Ohio. The seedlings had been inoculated with mycorrhizal fungi, known to improve survival and growth of plants in hostile environments. These efforts will not only serve to reforest the area but will help to restore the valuable American chestnut tree.

Forest Service R&D scientists developed models to create maps that locate the highest risk area for new invasions of emerald ash borer (EAB) and identified that the most common vector for new infestations is transportation in firewood or on vehicles. These results will make it possible to better prevent the spread of EAB from forests near roads, campgrounds, and rest stops.

A Forest Service scientist, working with international partners, provided the science used to revise the international phytosanitary trade standard regulating wood packaging material (WPM). Results revealed that treating WPM under the current guideline did not prevent wood borers from infesting the material. This work led to a revision of the international standards, which were released as a draft in 2008 and will have a major impact on reducing the spread of invasive species by WPM.

## Selected Accomplishments: Healthy Watersheds

The Water Supply Stress Index (WaSSI) was developed to evaluate water stress conditions over time and across the 666 8-digit Hydrologic Unit Code watersheds in the 13 Southeastern States. Scientists from SRS incorporated predictions from two Global Circulation Models, one land use change model and one human population change model, to project future water supply stress. The results of this work will help water resource managers develop long-term water supply and help policymakers considering appropriate actions to manage multiple stresses from climate change, population growth, and economic development across the Southeastern United States.

Forest Service scientists, in a book titled *The Economics of Disturbance,* compiled research focused on forest decisionmaking on a number of natural disturbance events. Public land managers are concerned with managing forests to alter fuel loads and reduce damage in the face of evolving fire regimes. Private forest managers must account for multiple risks as they make investment decisions. Most decisions regarding forest management or protection must account for disturbances, and this book defines the state of science in natural resource economics on this issue.

Large amounts of nitrogen-containing pollutants, emitted to the atmosphere in California from transportation fuels and agricultural activities, are settling in natural areas and causing excessive nitrogen "fertilization." This causes undesirable ecological and environmental impacts when the "critical load" for nitrogen input levels has been exceeded. Researchers from PSW have determined the thresholds at which sensitive organisms and ecological processes are affected within mixed conifer forests in California. These data are a valuable tool for air quality regulators to protect resources from excessive nitrogen deposits.

## Strategic Goal 2

### Provide and Sustain Benefits to the American People

This goal focuses on sustaining the productivity of the Nation's forests and grasslands to meet the needs of present and future generations. Forests and grasslands contain abundant natural resources and opportunities that help meet the demands and needs of the American people. Sustainable management of these resources ensures that the availability of goods and services continues into the future and that land productivity is maintained.

The Multiple-Use Sustained-Yield Act of 1960 directed that the national forests be administered for outdoor recreation, rangeland, timber, watershed, and wildlife and fish. National forest management provides a variety of use opportunities while maintaining wildlife diversity, supplies of wood products, energy sources and transmission infrastructure, wildlife and domestic livestock forage, water supplies, and other goods and services.
Forest Service research provides a solid scientific foundation for the sustainable management of forests and grasslands and improvements in the use and marketing of forest products and services. The FIA and Forest Health Monitoring programs continually gathered baseline information to assess the effectiveness of land management practices and to help guide the development of new research. A major emphasis of the research under Goal 2 was on developing new technologies for forest products and energy and on understanding global economic influences on the forest sector.

### Goal 2. Resource Investments (dollars in thousands)

| Strategic Program Area | FY 2008 ($) |
|---|---|
| Wildland Fire and Fuels | 789 |
| Invasive Species | 2,069 |
| Outdoor Recreation | 579 |
| Resource Management and Use | 21,968 |
| Water, Air, and Soil | 2,391 |
| Wildlife and Fish | 1,134 |
| Inventory and Monitoring | 502 |
| Forest Inventory and Analysis (FIA) | 4,326 |
| **Total Goal 2** | **33,758** |

### Selected Accomplishments

NRS scientists conducted a study in an industrial region of the Midwest to gauge the extent of fishing for consumption and to learn about the perceptions of the risks of eating contaminated fish. Findings suggest that outreach to the public, by using new channels, providing information to reduce risks through preparation techniques, and making the information more easily accessible, is important to providing safe fishing opportunities to a diverse population.

Scientists examined the changes in three western amenity-transition communities, those experiencing a shift from commodity-oriented industries to recreation, tourism, second-home growth, and retirement in-migration. Scientists documented changes in these communities since the 1950s and depicted these changes using stages of the adaptive cycle: exploitation, conservation, release, and reorganization. This resiliency theory can help identify community-based indicators of adaptive capacity, sources of vulnerability and resiliency, and opportunities to build adaptive capacity.

Researchers at SRS are using an integrated gasification-combustion-electricity generation unit to reclaim energy from woody biomass. This system can gasify wood chips, pellets, nutshells, and other carbonaceous material; combust the gas; and generate up to 25kW of electricity. The scientists are also working on converting the gas to liquid transportation fuels, using catalytic and microbial methods. The unit has been installed on the Kisatchie National Forest and will be used to offset electricity costs on the ranger district. The woody biomass used in this system will provide a carbon-neutral alternative to fossil-based energy and enhance forest health by removing unused fuel material.

## Strategic Goal 3

### Conserve Open Space

Open space provides many environmental, social, and economic benefits to rural and urban communities. Undeveloped forests and grasslands help protect water quality; conserve native wildlife; and provide renewable timber and nontimber products, recreational opportunities, and quality-of-life benefits. These "green spaces" enhance home values and generate jobs and economic vitality. Current population growth trends show a steady loss of these vital open spaces to developed uses.

The Forest Service helps communities develop sustainable urban and community forestry programs. In FY 2008, research activities provided the economic, social, and ecological information that communities use for urban forest management. Urban managers used this research information to develop strategies to help mitigate the effects of existing and new developments on open space, to understand the impacts of fragmentation on animal and plant populations, and to generate revenue from ecosystem services.

### Goal 3. Resource Investments (dollars in thousands)

| Strategic Program Area | FY 2008 ($) |
|---|---|
| Wildland Fire and Fuels | 228 |
| Invasive Species | 517 |
| Outdoor Recreation | 61 |
| Resource Management and Use | 646 |
| Water, Air, and Soil | 265 |
| Wildlife and Fish | 226 |
| Inventory and Monitoring | 0 |
| Forest Inventory and Analysis (FIA) | 0 |
| **Total Goal 3** | **1,943** |

### Selected Accomplishments

Results from FIA's National Woodland Owner's Survey indicate that more than 10 million families and individuals collectively own 264 million acres, or 35 percent, of the forest land in the United States. *Family Forest Owners of the United States* is the first report in more than a decade that documents information on the number of family-owned forests, including size of holdings, ownership histories, ownership objectives, forest uses, and management practices.

Pacific Northwest scientists developed a model that will enable managers to identify and prioritize landslide sites with the greatest likelihood of reaching fish-bearing streams. The Oregon Bureau of Land Management used this model extensively to develop and evaluate options for its latest land management plan, as did the Aquatic and Riparian Effectiveness Monitoring Plan of the Northwest Forest Plan.

Population growth and residential development put pressure on the resources from public lands. Tens of millions of acres of rural land in the Pacific Northwest are expected to experience residential development in the coming decade. Researchers working with the NFS have developed monitoring approaches to estimate recreation activity that managers are using for the WUI.

## Strategic Goal 4

### Sustain and Enhance Outdoor Recreation Opportunities

The public demand for high-quality outdoor recreational experiences places pressure on the ecological integrity of national forests and grasslands. The combination of increasing U.S. populations and declining public access to privately owned forest land creates demand for public lands to provide more recreational opportunities.

If public lands are to provide additional recreational benefits without unacceptable resource effects, we must emphasize effective management solutions that have a solid scientific foundation. Forest Service R&D studied the effects of changing demographics and peoples' perceptions of the value, importance, and opportunities created by healthy forests and rangelands. Our research helped communities understand the relationship between the quality of the recreation experience and the importance of ecological integrity to maintain recreational opportunities into the future.

### Goal 4. Resource Investments (dollars in thousands)

| Strategic Program Area | FY 2008 ($) |
|---|---|
| Wildland Fire and Fuels | 522 |
| Invasive Species | 775 |
| Outdoor Recreation | 2,015 |
| Resource Management and Use | 1,292 |
| Water, Air, and Soil | 1,329 |
| Wildlife and Fish | 1,134 |
| Inventory and Monitoring | 0 |
| Forest Inventory and Analysis (FIA) | 0 |
| **Total Goal 4** | **7,067** |

### Selected Accomplishments

Findings from three surveys in the Pacific Northwest to assess public reactions to recreation fees revealed that residents agree that fees are acceptable and useful and that they are preferable to closing sites or allowing them to deteriorate. Residents expect some balance between fees and taxes and support implementation options designed to enhance fairness of the fee program. Results of this study suggest that the Forest Service recreation fee program has been successful at communicating the reasons for the program and the benefits to recreation users.

Recreation management in wilderness is a controversial issue. Wilderness should be managed to provide a primitive type of recreation, but population growth has made such management increasingly difficult. Forest Service scientists, in collaboration with the University of Idaho, studied the effects of use level on the experience that visitors have in wilderness. Results indicate that most visitors perceive that adverse changes have occurred since their earliest wilderness trips, but that these changes have a minimal negative effect on wilderness experiences. These results suggest that people are able to cope with change and may explain the lack of support for management actions that restrict access.

## Strategic Goal 5

### Maintain Basic Management Capabilities of the Forest Service

Reliable information, good-quality facilities, and land protection are necessary to effectively manage natural resources in a perpetual state of change. Forest Service R&D must maintain investments in research laboratories, experimental forests and ranges, information systems, and a skilled workforce to support the research necessary to inform natural resource management decisions and activities.

Forest Service R&D contributed to Goal 5 by making strategic and careful investments in buildings and facilities and by taking the actions necessary to protect and prolong the life of valuable and sensitive laboratory equipment. We continued to manage our workforce needs through recruitment and retention programs and to develop a diverse workforce with the skills needed to address complex research problems and emerging issues.

## Facilities

### Assessment and Allocation

Forest Service R&D maintains a fund for facility maintenance as directed by Congress (Title III, Administrative Provisions, P.L. 109-54). Funding is obtained from an annual assessment of program funds, providing an incentive to dispose of unneeded buildings and to restrain new construction.

In FY 2008 the facilities assessment was $1.52/sq. ft., distributed across approximately 2.2 million total gross square feet based on the previous year's direct labor hourly charges for each program.

### Goal 5. Resources Invested (dollars in thousands)

### FY 2008 Facilities Maintenance Assessment and Allocation for the Forest Service R&D Facilities

| Unit Name | Total (gross sq. ft.) | Total Assessment/ Allocation ($) |
|---|---|---|
| Forest Products Laboratory | 402,850 | 596,000 |
| International Institute of Tropical Forestry | 27,045 | 40,000 |
| Rocky Mountain Research Station | 414,247 | 613,000 |
| Northern Research Station | 427,412 | 729,000 |
| Pacific Northwest Station | 280,326 | 415,000 |
| Pacific Southwest Station | 190,404 | 282,000 |
| Southern Research Station | 477,818 | 707,000 |
| **Research Total** | **2,220,102** | **3,382,000** |

## Strategic Goal 6

### Engage Urban America With Forest Service Programs

The Forest Service maintains an integrated program of natural resources stewardship designed to inform and educate urban residents on the value of well-managed public and private forested lands and to improve their quality of life. A vital part of the work with communities is in conservation education, urban "greening" efforts, and natural resources programs for youth. The Forest Service coordinates with Federal, State, and local partners to provide urban residents with the benefits they seek from local parks, nearby woodlands, and national forests.

Forest Service R&D scientists studied the effects of urbanization on public lands and provided the science needed to make decisions on how best to manage private lands and maintain working forests within urbanizing landscapes. This work included studying the effects of transportation expansion and fragmentation on streams, wildlife, and invasive species. Decision support tools provided include remote sensing, analysis, computer models, and expert systems to address issues such as wildland fire in the WUI.

### Goal 6. Resource Investments (dollars in thousands)

| Strategic Program Area | FY 2008 ($) |
|---|---|
| Wildland Fire and Fuels | 1,973 |
| Invasive Species | 2,069 |
| Outdoor Recreation | 244 |
| Resource Management and Use | 646 |
| Water, Air, and Soil | 265 |
| Wildlife and Fish | 0 |
| Inventory and Monitoring | 0 |
| Forest Inventory and Analysis (FIA) | 0 |
| **Total Goal 6** | **5,197** |

### Selected Accomplishments

The Forest Service Center for Urban Forest Research (CUFR) led a stakeholder process to develop the first urban forest greenhouse gas (GHG) reporting protocol. It establishes eligibility requirements, methods to calculate GHG reductions, and performance-monitoring instructions. It applies to tree-planting projects on urban municipal landscapes, educational campuses, and utility service areas anywhere in the United States. It is the first protocol to offer local governments with offset credits for their sustainable activities. New science quantifying the effects of urban forests on GHG is the foundation of the protocol and the CUFR Tree Carbon Calculator (CTCC) translates this information into a tool to provide information on carbon storage, energy savings, and biomass volume.

The Centers for Urban and Interface Forestry encompasses two technology transfer efforts: InterfaceSouth and Urban Forestry South. In FY 2008, InterfaceSouth, a collaborative effort with State and Federal partners, developed a quarterly publication, Leaves of Change, that focuses on science delivery for WUI issues. Urban Forestry South continued with the next phase of disaster response for urban forests, which grew out of the aftermath of the 2005 hurricanes. In 2008, Urban Forestry South conducted a second training workshop for the Southern Region Urban Forest Strike Teams and for arborists and Federal Emergency Management Agency representatives from the Northeastern United States. The strike teams are trained to develop in-State and regional capacity for responding to disasters affecting urban trees.

## Strategic Goal 7

### Provide Science-Based Applications and Tools for Sustainable Natural Resources Management

The Forest Service provides science and technology solutions for clients' and partners' priority issues in ways they find effective and useful for sustainably managing forests and grasslands.

In FY 2008, Forest Service R&D conducted research to evaluate the effectiveness of organizations, both public and private, in managing natural resources. This research includes developing applications of organizational behavior, public administration, and social science to respond to changes in climate, improve inventory and monitoring activities, adapt to landscape changes, and better manage fire incidents and watershed conditions.

### Goal 7. Resource Investments (dollars in thousands)

| Strategic Program Area | FY 2008 ($) |
|---|---|
| Wildland Fire and Fuels | 3,319 |
| Invasive Species | 4,979 |
| Outdoor Recreation | 357 |
| Resource Management and Use | 16,917 |
| Water, Air, and Soil | 4,327 |
| Wildlife and Fish | 8,927 |
| Inventory and Monitoring | 6,891 |
| Forest Inventory and Analysis (FIA) | 49,931 |
| **Total Goal 7** | **95,648** |

### Selected Accomplishments

Scientists from RMRS led an interagency team that developed new and practical methods for monitoring trends in wilderness character. This monitoring strategy defines a core set of 4 qualities and 13 indicators of wilderness character on which each agency would report trends, resulting in improved accountability, decisionmaking, and public trust, as well as the generation of legacy information to benefit management of wilderness areas.

Although recent papers and press have intimated that nature-based recreation in the United States is declining, analysis of results of the National Survey on Recreation and the Environment showed that nature recreation is increasing. Between 2000 and 2007, the number of people who participated in nature-based activities increased by 3.1 percent and the number of days of participation grew by about 32 percent.

In 2008, the FIA program completed its 10th year of a transition from a periodic to an annual inventory system. With the addition of Oklahoma, FIA is implemented in 47 States. FIA has current (less than 2 years old) data accessible online for 45 States. In FY 2008, Forest Service R&D identified high-quality outcome measures to accurately monitor the performance and progress of the FIA program. These performance measures were integrated with FIA program costs to improve program efficiency and to allocate funding to the field research stations.

Airborne laser scanning (LIDAR) data from Alaska showed this technology to be a useful sampling tool for forest stand conditions in an operational forest inventory program.

Estimates of forest carbon stocks and fluxes for California circa 1990 were modeled from forest inventory data in support of California's legislatively mandated GHG inventory, providing reliable estimates of live-tree carbon stocks and fluxes on timber land outside national forests for the first time.

FIA researchers developed 22 maps showing composition, structure, ownership, utilization, and spatial patterns of forest resources across the United States. This effort is the first comprehensive compilation of national-scale, forest-related maps that present attributes of plot-level data at a broader scale.

# Measuring Forest Service R&D Performance

**Investment Criteria:** The President's Management Agenda (PMA) was designed to improve management of the Federal Government by addressing areas of weakness where the most improvements can be made. It included five governmentwide initiatives and nine program initiatives. One program initiative was "Better R&D Investment Criteria," which recognized that science and technology are critically important for keeping the Nation's economy competitive and for addressing challenges in the environment. The White House Office of Science and Technology Policy identified three key indicators of research and development success: *relevance, quality, and performance* (M-03-15, June 5, 2003).

## Relevance

### Customer Satisfaction Survey

In FY 2006, Forest Service R&D contracted with the Federal Consulting Group, now a part of the U.S. Department of the Interior, to design and conduct a survey of the various people and groups who use our research information and products. The survey uses econometric models, developed collaboratively with Forest Service R&D staff and customized for our products and services. The results are presented as a score based on the American Customer Satisfaction Index methodology, which enables users to make comparisons with the scores of other Federal R&D agencies.

The model included three main components: relevant activities in each area that drive customer satisfaction, satisfaction itself, and desirable customer behaviors/outcomes. The FY 2006 survey scored 72, slightly better than the average for Federal agencies. It also identified ways to improve satisfaction by making products easier to use and by making information more accessible.

Results from this survey were incorporated into Forest Service R&D program planning to ensure that the work we do is relevant to customers' needs. The survey will be repeated in FY 2009.

## Quality

### Forest Service R&D Quality Assurance Reviews

Forest Service R&D places a high value on conducting sound science that customers and the scientific community view as being of the highest quality. To ensure that this work meets stringent standards for ensuring scientific integrity, Forest Service R&D routinely invites panels of internal and external reviewers to evaluate its performance. Such reviews include the following:

- Refereed reviews of publications.
- Statistical reviews and quality assurance/quality control procedures.
- Research grade evaluation process.
- Research performance accountability reviews.
- Strategic Program Area reviews.

### Peer Review of Strategic Program Areas

Peer review is a recognized and effective tool for evaluating research programs and designing future research. It provides managers with a basis on which they can (1) select, continue, modify, or redirect research program areas; (2) assess alignment of ongoing research activities with strategic planning documents; (3) assess research program area performance and productivity; (4) identify new opportunities or termination points for ongoing projects; and (5) provide important information to a research program area that is under particularly close external scrutiny. Peer reviews are used as part of the evidence accepted by the Office of Management and Budget (OMB) in the Program Assessment Rating Tool.

Every National Strategic Program Area peer review in the past 5 years, including two programs in FY 2008, has recommended a rating of satisfactory or excellent.

## Performance

### Program Assessment Rating Tool (PART) and Scorecard

The OMB evaluates the progress of Government agencies in integrating budget and performance, achieving program goals, and using best management practices. The assessments provide feedback on how OMB views the efficiency of a program's design, strategic planning, management, and performance evaluations.

## USDA Scorecard Performance Measures and Annual Ratings for Forest Service R&D

| USDA Scorecard Metrics | FY 2005 | FY 2006 | FY 2007 | FY 2008 |
|---|---|---|---|---|
| Agency has practices and procedures that promote quality, relevance, and performance of R&D activities. | Yellow | Green | Green | Green |
| Managers meet at least monthly to plan, coordinate, assess, and redirect agency activities informed by results of program and project assessments using criteria. | Green | Green | Green | Green |
| Percent of Program Assessment Rating Tools (PARTs) moderately effective or better. | N/A | N/A | N/A | N/A |
| Budget proposals to Office of Management and Budget use the R&D criteria. | Yellow | Green | Green | Green |
| Budget proposals to Office of Management and Budget and Congress document how criteria have influenced budgets decisions and management changes. | Yellow | Green | Green | Green |
| **Annual score** | **Yellow** | **Green** | **Green** | **Green** |

## Trends in Forest Service R&D Performance Outcomes

| Performance Measure | FY 2006 | FY 2007 | FY 2008 Planned | FY 2008 Actual |
|---|---|---|---|---|
| Customer satisfaction index score | 72 | 72 | 72 | 72 |
| Number of patent applications filed (3-year average) | 11 | 11 | 6 | 6 |
| Percent of R&D programs that have been externally peer reviewed within the past 5 years | 25% | 50% | 75% | 75% |
| Percent of R&D programs that achieved a rating of satisfactory or excellent during the past 5 years | 100% | 100% | 100% | 100% |
| Percent of Nation with accessible Forest Inventory and Analysis data | 84% | 88% | 90% | 90% |
| Quality fire science index— Wildland Fire PART performance measure calculated as the number of peer-reviewed fire science publications per scientist year on a 3-year rolling average | 3.5 | 3.5 | 3.5 | 3.5 |
| Fire output efficiency index— Wildland Fire PART performance measure calculated as the total number of fire science products per scientist on a 3- year rolling average | 5.1 | 5.1 | 5.0 | 5.1 |
| Number of invasive species tools developed, delivered, and used is an invasive species PART performance measure calculated as the number of invasive species tools on a 5-year rolling average | 171 | 170 | 142 | 180 |
| Cost per invasive species tool— invasive species PART metric calculated as the cost of producing tools on a 5-year running average adjusted for budgets | $242 | $238 | $426 | $207 |

Under the PMA, every Federal R&D program is expected to invest every dollar as effectively as possible and justify the investments in their R&D programs. Implementation of the PMA was evaluated for effectiveness using a PMA scorecard. For the third consecutive year, Forest Service R&D was fully successful in meeting all of its performance targets for the scorecard measures in FY 2008.

Forest Service R&D underwent PART evaluation under the USDA Research, Education, and Economics mission area and contributed to the PART evaluations in the Forest Service's Fire, Invasive Species, Watershed, Energy, and Recreation programs.

### Annual Outcome Measures

Forest Service R&D reports targets for the number of annual outcome measures in the Forest Service Budget Justification. In FY 2008, Forest Service R&D met or exceeded all of its targets.

Forest Service R&D is also responsible to the USDA for a number of accomplishments reported in the USDA Performance and Accountability Report.

## Additional Accomplishments Reported to USDA

| Accomplishment | FY 2006 | FY 2007 | FY 2008 |
|---|---|---|---|
| New interagency agreements and contracts | 54 | 41 | 40 |
| Interagency agreements and contracts continued | 15 | 17 | 12 |
| Articles published in journals | 1,691 | 1,336 | 1,903 |
| Articles published in all other publications | 1,817 | 1,846 | 1,487 |
| Patents granted | 7 | 3 | 6 |
| Patent licenses executed | 1 | 0 | 1 |

## Challenges and Opportunities

FY 2008 was a productive year for Forest Service R&D, yet a number of challenges continue to loom. Concern about climate change and its effects on forests and rangelands have prompted legislators to ask for scientific solutions that can help them adapt to these effects, as well as to find ways forests and rangelands can help mitigate the effects. Solving climate effects problems will require sound science directed at social, economic, and natural resources issues.

Social, economic, and ecological disturbance continue to present great challenges to Forest Service R&D, especially as populations are growing and becoming more urbanized. Demands from conflicting interest groups continue to test the agency's ability to ensure the long-term sustainability of U.S. forests and rangelands through development and application of truly science-based management practices. Forest Service R&D will need to track the evolution of forest and rangeland resource management practices as they are applied over time to ensure preservation of the continuity of their scientific basis.

One of our most unique and valuable assets to address these issues is the network of 81 EFRs located throughout the United States and Puerto Rico. In 2008, we celebrated the Centennial Anniversary of the EFRs. The challenge, however, of maintaining the infrastructure, both physical and electronic, that is needed to support their growth and expansion into the 21st century is daunting. There is no equivalent to this bastion of continuous long-term forest and rangeland research in North America. We must and will find ways to protect and expand this vital natural treasure.

A challenge is having sufficient resources to meet the growing complex of natural resource issues. Budgets, as a percent of the total Forest Service appropriation, fell significantly in 2008, as funding for research continued to lag funding to the Forest Service at large. The number of research scientists also declined, putting a greater strain on the existing workforce to develop partnerships and tackle complex, multiresource issues.

Even in the face of resource constraints, Forest Service R&D scientists have the skills, public support, and commitment to research the multitude of problems and to provide land managers throughout the United States and internationally with the information and tools they need to ensure success in providing the resources and experiences that people desire. Forest Service R&D plans to continue to recruit and train a diverse workforce capable of meeting current and future challenges, while building on partnership opportunities and judiciously employing graduate students, postdoctoral students, temporary scientists, and term-limited scientists.

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