



United States Department of Agriculture

Forest Inventory and Analysis

Fiscal Year 2019 Business Report



Cover photo: Salvage logging after Hurricane Michael (October 2018), Florida. Photo by Jason A. Cooper, Forester, USDA Forest Service, Southern Research Station, Forest Inventory and Analysis.

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Fiscal Year 2019 Business Report

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Executive Summary

For 90 years, the Forest Inventory and Analysis (FIA) program has played an integral role in providing the information vital to the management and conservation of the Nation's forest resources. In recent years, an increased number of major decisions regarding the Nation's forests have been made with reference to and reliance on FIA findings and forest resource evaluations. Contemporary topics include carbon sequestration, water, recreation, biodiversity, forest products and services, biomass availability, economic development, land cover and land use change, invasive species, pollutant effects, pests and diseases, and fire risk.

In 1999 (Farm Bill, Public Law 105-185) and again in 2014 (Farm Bill, Public Law 113-79), Congress directed the Forest Service, an agency of the U.S. Department of Agriculture (USDA), to reevaluate its statewide inventory mission and to transition to survey each State annually rather than periodically, with the exception of Interior Alaska and U.S. islands of the Caribbean and Pacific Ocean. In collaboration with partners, FIA developed these plans. [FIA's Strategic Plan](#) includes a requirement for an annual business report that outlines the status and progress of the national annual inventory program.

This annual business report, the program's 22nd, tells the taxpayers, partners, and clients the program results accomplished with the provided financial resources and the results forecasted for the coming year with budgeted financial resources. This relationship with taxpayers, partners, and clients is integral to FIA's continued success because accountability demonstrates our commitment to transparently delivering the best value, quality, and array of products expected by the communities we serve. In FY 2019, some key findings included in this report are—

Progress on annualized inventory. FIA conducted inventory activity in all 50 States, including Interior Alaska, and measured 12 percent of the forest sample locations. Except Interior Alaska and Hawaii, all States, including Coastal Alaska, use an annualized survey. The Tanana Valley and the Susitna-Copper unit in Interior Alaska, and the Caribbean and Pacific island inventories are surveyed using a periodic inventory implementation. The total area currently sampled represents about 90 percent of all U.S. forest lands, with Interior Alaska outside the Tanana Valley representing the remaining 10 percent of the Nation's forest area. Inventory efforts started in the Susitna-Copper unit with the complete acquisition of NASA Goddard's LiDAR, Hyperspectral and Thermal Imager (G-LiHT) imagery. The FIA survey of the Susitna-Copper unit will increase the total forest area sampled by almost 13 million acres.

Funding and partners' support. Annual FIA funding appropriated by Congress remained steady at \$77 million. This amount was \$20.2 million less than the amount, adjusted for inflation, needed for full program implementation of 2014 Farm Bill options A through C. In addition to annual appropriations, Congress funded a supplemental appropriation of \$1 million for hurricane relief in the South at the end of FY 2019.

Partners' fund contributions reached \$11.7 million, a one-half-million-dollar increase over the previous year. Almost \$4.4 million of the partners' fund was directed at intensifying the plot network or buying down plot measurement and reporting cycles to 5 years. The remaining \$7.3 million were contributions that added value to the FIA program. Thirty-seven State agencies represented the largest group of supporters, contributing \$3 million to base program and an additional \$1.9 million to add value. Most of these agencies, 34, are from Eastern States. The rest of the partners included universities, other USDA Forest Service programs, other Federal agencies, and nongovernmental organizations.

Grants and agreements. FIA contracts out critical work to external cooperators when equal quality can be achieved for less cost. Almost \$19.4 million was invested in this way in FY 2019, with more than a third—\$7 million—managed by the FIA unit at the Southern Research Station (SRS). Eighteen State governments received FIA funds.

Data availability. Data for all States and Coastal Alaska were accessible online, and it is expected that data for the Tanana Valley unit in Interior Alaska will be available online in FY 2020. Data for most States were less than 2 years old, except for Kentucky, Oklahoma, Tennessee, Louisiana, Florida, and Texas, which were 3 years old. [Data from Hawaii](#) were released. Inventories in the Tanana Valley in Interior Alaska were completed, and data will be released in FY 2020. Published inventories of the Caribbean and Pacific islands data were 5 years old or more because, in part, they are sampled under a periodic inventory. FIA data supplied information for 242 spatial data requests and almost 4.5 million online data requests, a big jump from previous years due to the high number of hits to the EVALIDator API as new data dashboard applications were developed and released over the past year.

Reporting and publications. By FY 2019, FIA had completed and published at least one 5-year report or periodic report for all States and islands except for Hawaii, where the State report is currently under review and about to be published. In FY 2019, FIA published 204 publications, 122 of which were peer-reviewed journal articles.

Quality assurance. FIA field-checked 12 percent of all measured field plots to ensure that FIA databases comprise only the highest quality data. All plots were further checked for consistency when loaded into the FIA database.

Users groups. FIA held 6 national and 13 regional users group meetings to ensure that the program is providing the highest quality service and meeting its planned objectives according to the goals stated in the strategic plan and the previous year's annual report.

Personnel. FIA, directly and through cooperators, employed 618 full-time employees, 59 more employees than the previous year. Cooperators are integral to the efficient delivery of the FIA program, comprising 237 full-time employees, or 38 percent of the total workforce. The number of Federal FIA full-time employees increased slightly, from 339 in FY 2018 to 382 in FY 2019. Of the total workforce, 30 percent, or 183 employees, were employed in information management, techniques research, or resource analyses; they provided 950 consultations (7,764 hours) to help users and clients effectively use FIA data.

Program features. Although plot-based field surveys provide most FIA data, additional questionnaires and surveys are conducted to report on timber product output (TPO), logging utilization, and the characteristics and management objectives of the Nation's private woodland owners through the National Woodland Owner Survey (NWOS). Since FY 2000, FIA has collected such data from about 121,000 surveys and questionnaires. This information, in concert with FIA plot data, is critical to monitoring the sustainability of the Nation's forest resources.

FIA Strategic Plan. The 2014 Farm Bill requirements addressed in the FIA Strategic Plan include: (1) complete the transition to a fully annualized forest inventory program; (2) implement an annualized inventory of trees in urban settings; (3) report on renewable biomass supplies and carbon stocks; (4) engage State foresters and other users in evaluating core FIA data; (5) improve the timeliness of the TPO program and database; (6) foster greater cooperation among FIA, research station leaders, and State foresters; (7) promote availability of and access to non-Federal resources to improve information management; (8) collaborate with other agencies to integrate remote sensing, spatial analysis techniques, and new technologies into FIA; (9) understand and report on changes in land cover and use; (10) expand existing programs to promote sustainable forest stewardship through increased understanding of the more than 10 million family forest owners; and (11) implement procedures to improve the statistical precision of estimates at the sub-State level.

FIA Direction in 2018 Farm Bill. On December 11, 2018, Congress passed the [2018 Farm Bill](#). Section 8632 requested the Chief to continue to find efficiencies in the FIA program through the improved use and integration of advanced remote sensing technologies to provide estimates for State- and national-level

inventories, where appropriate; and to partner with States and interested stakeholders.

Looking to 2020. FIA had a productive year in FY 2019 and looks forward to further progress in FY 2020. Important goals for FY 2020 include—

- Continue annualized inventory of 50 States, with focused attention on the completion of the periodic field inventory in Susitna-Copper unit and the initiation of the periodic inventory in the Southwest unit, the second unit of 6 in Interior Alaska. Make available online the inventory data for the Tanana Valley, the first sampled unit in Interior Alaska. Publish the first State report of Hawaii, and the latest inventory report of the U.S. Virgin Islands.
- Complete loading all historical Timber Products Output studies from the Northern Research Station into the national compilation system. Conduct research on modeling approaches to estimate mill receipts under non-response.
- Publish results of the base NWOS, initial results of the urban NWOS, and results of the corporate NWOS pilot test. Develop and plan for further implementation of the corporate NWOS.
- Report U.S. forest carbon estimates to the USDA National Greenhouse Gas Inventory.
- Produce national-scale maps relevant for carbon assessments and related inventory reporting.
- Finish editing the printed version of the *Forest Atlas of the United States*.
- Continue with current urban inventories and start data collection in six new urban locations: Boston (MA), Manchester (NH), Sioux Falls (SD), Columbus and Toledo (OH), and U.S. Virgin Islands.
- Further develop DATIM and release four new versions: 11.1, 12.0, 12.1, and 13.0.
- Beta-test FIESTA's newly developed modules for small area and model-assisted estimations.
- Publish national-level results and maps related to forest disturbance and recovery. Work on the development of a national Land Use and Land Cover reporting tool in Tableau.
- Complete the first FIA State report for Hawaii based on the most recent 2010–2015 inventory data. And complete at least fifteen 5-year State reports.
- Produce ready-to-use templates and training for entering into legally binding agreements using the newly adopted instruments (Material Transfer Agreement and Memorandum of Understanding) that will further protect FIA confidential data and will ensure FIA acknowledgment in those products developed with FIA data and information.
- Fill vacant positions with quality recruits at levels required for successful program delivery.

For additional detail, see updates for the portfolio leads business plans.



Fall foliage at peak in the Huron-Manistee National Forests, Michigan.
Photo by Jon Breithaupt, USDA Forest Service.

Introduction

The Forest Inventory and Analysis (FIA) program of the Forest Service, an agency of the U.S. Department of Agriculture (USDA), provides the information needed to assess the status, trends, and sustainability of America's forests. This business report, which summarizes program activities in fiscal year (FY) 2019 (October 1, 2018, through September 30, 2019), gives our customers and partners a snapshot of past activities, current business practices, and future program direction. It is designed to increase our accountability and foster performance-based management of the FIA program.¹

The FIA program has been the Nation's continual forest census since 1930. We collect, analyze, and report information on the status and trends of America's forests: how much forest exists, where it exists, who owns it, how it is changing, and how the trees and other forest vegetation are growing, how much has died or been removed, and how the harvested trees have been used in recent years. This information can be used in

many ways, such as in evaluating wildlife habitat conditions, assessing sustainability of current ecosystem management practices, monitoring forest health, supporting planning and decision-making activities undertaken by public and private enterprises, predicting the effects of climate change, and providing authoritative data to the forest products industry and other forest-related investments. The FIA program combines this information with related data on insects, diseases, and other types of forest damage to assess the current health and potential risks to forests. These data are also used by the Forest Service Research and Development (R&D) Resource Planning Act Assessment Program to project how forests are likely to appear in 10 to 50 years; various scenarios evaluate whether current forest management practices are sustainable in the long run and assess whether current policies will enable our grandchildren and their grandchildren to enjoy the benefits provided by America's forests as we do today.

¹ This business report does not include statistical information about the forests of the United States. For this information, contact the appropriate regional or national FIA office listed in appendix A of this report or go to www.fia.fs.fed.us.

Changes From Previous Years' Business Reports

The FIA program continues to seek performance measures that accurately reflect the program's progress toward meeting the goal of annualized inventory for all 50 States.

As FIA has been successfully moving toward greater consistency as a national program delivered by the four regional FIA units housed at the Northern Research Station (NRS), the Southern Research Station (SRS), the Rocky Mountain Research Station (RMRS), and the Pacific Northwest Research Station (PNW), this year's report includes the FIA program accomplishments as achievements led by joint efforts from all units. While most of the FIA accomplishments in FY 2019 had a national scope, others remained regional.

Since FY 2017, the FIA Program has had its own budget line within the Forest Service R&D mission area. As a result, the indirect costs charged to the FIA program were estimated differently through the so-called cost pools and other pooled costs that include Office of Worker's Compensation Programs and Unemployment Compensation Insurance. While cost pools are estimated proportionally to the number of full-time employees (including those holding permanent, temporary, intermittent, and other types of positions, within programs in a budget line), other pooled costs are assessed only on permanent employees' direct labor hours. In FY 2019, the FIA program was charged \$9,825,750 in national cost pools and \$709,842 in other pooled costs. The total, \$10,535,592, is accounted as the total effective indirect under National Office in table B-2. As in FY 2018, R&D funds were used to pay for the Information Resources Decision Board (IRDB) charges to FIA, an amount of \$2,510,800 in FY 2019 (table B-2). The IRDB fund manages agency-sponsored information technology projects.

As a [supplement](#) to the FY 2019 Business Report, information related FIA data available online, production and publication years of 5-year State reports, and links to the reports, as of end of FY 2019, can be explored interactively for each State.

Fiscal Year 2019 Program Overview

In FY 2019, the FIA program completed the 18th year of implementing inventories annually, as outlined in the *Strategic Plan for Forest Inventory and Monitoring*, written in response to the Agricultural Research, Extension, and Education Reform Act of 1998 (Public Law 105-185). The FIA program includes two basic sampling levels: Phase 1 (P1) consists of remote sensing for stratification to enhance precision; Phase 2 (P2) is based on the original set of FIA forest measurement plots (approximately one plot per 6,000 acres). A subsample of P2 plots may also be measured for a broader set of forest ecosystem indicators. The number of plots with various ecosystem indicators is noted in table B-9. The primary goal is to implement an annual FIA program that measures at least 10 percent of all P2 sample locations per year in the Western United States, and 15 percent of P2 sample locations per year in the Eastern United States. Table 1 shows the overall distribution P2 plots of the FIA sample for the United States, including Puerto Rico, the U.S. Virgin Islands, and U.S. territories and affiliated islands in the Pacific. These data are for illustrative purposes only and do not include possible additional plots that may be required because of partially forested sample locations, which can add 15 to 20 percent more plots that have to be visited to collect data.

The base program includes annual compilations of the most recent year's information, with full State-level reporting at 5-year intervals. All States have the option to contribute the resources necessary to bring the program up to the full sample intensity of 20 percent per year or to make other value-added contributions, such as funding new measurements or additional sample locations. In FY 2019, the total appropriated funding of \$77 million was \$20 million below the target level, adjusted for inflation, outlined in the [FIA Strategic Plan](#)² to complete the transition of the base program to full implementation of Plan options A through C. The following sections highlight current outputs and products, program resources, and partners' contributions.

Outputs and Products

With appropriated funding remaining steady at \$77 million and an increase from FIA partners' support of \$585,671, the FIA program continued to deliver inventory information about the extent and conditions of the forests in the United States and provided good customer service to its clients in FY 2019.

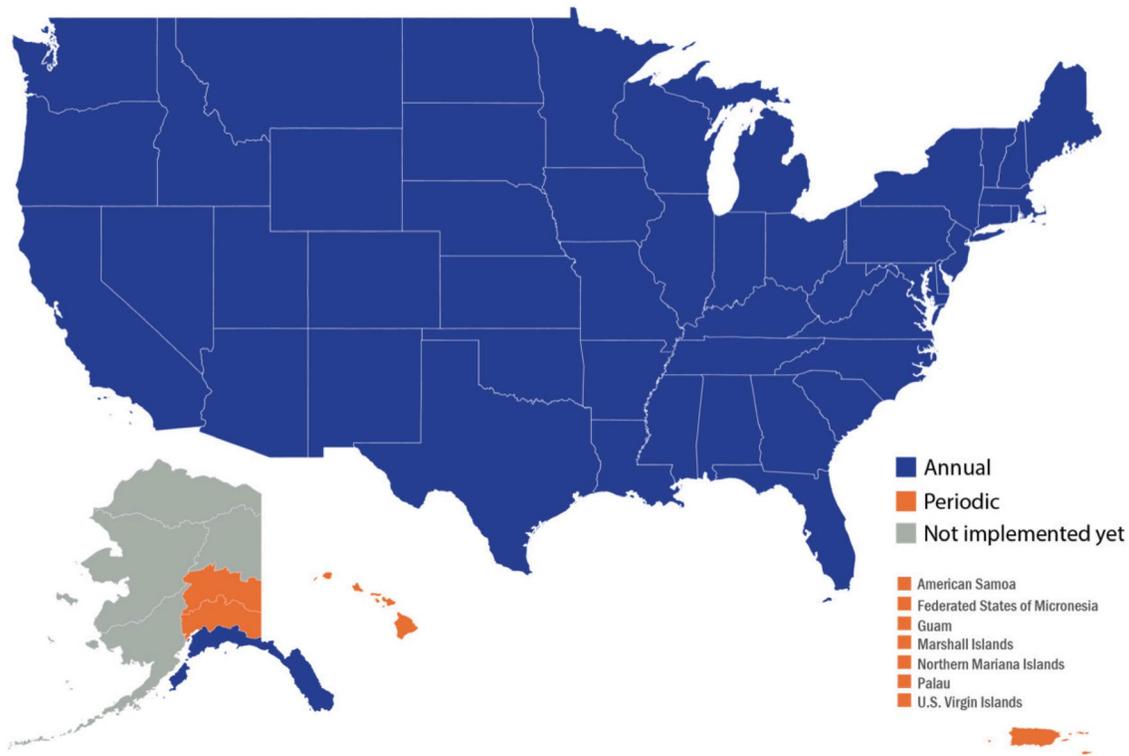
Table 1. Overview of land area, FIADB forest area, RPA assessment program forest area, and P2 plots by region in FY 2019.

Region	Land area	Forest area (FIADB)	Forest area (RPA)	Forest	All P2
	Mil. acres	Mil. acres	Mil. Acres	Percent	Plots
North	607	182	176	30	101,140
South	533	267	246	50	88,839
Interior West	548	152	131	27	91,282
Pacific Coast (California, Oregon, Washington)	204	88	83	42	33,944
Coastal Alaska	39	14	14	35	6,507
Interior Alaska	327	114	114	35	3,373
Islands (including Hawaii)	7	4	3	53	1,163
Total	2,264	822	767	33	326,247

FIADB = Forest Inventory and Analysis Database; FY = fiscal year; Mil = million; P2 = Phase 2; RPA = Resources Planning Act.

Note: RPA total forest area is 1.7 million higher than the data published in the [2017 Forest Resources of the United States report](#) because table 1 includes Puerto Rico, the U.S. Virgin Islands, and U.S. territories and affiliated islands in the Pacific.

² U.S. Department of Agriculture, Forest Service. 2016. Forest Inventory and Analysis Strategic Plan. FS-1079. Washington, DC: U.S. Department of Agriculture, Forest Service. 46 p.



FIA = Forest Inventory and Analysis; FY = fiscal year.

Figure 1. FIA implementation status, FY 2019.

Table B-1 shows comparisons across FIA regional units of the funds and the performance estimates of implementing the FIA program. In FY 2019, FIA inventoried a sample of 14,848 base grid forest plots, representing 12 percent of the total, throughout all 50 States, including Coastal Alaska and the Tanana Valley of Alaska. Spatial and temporal inventory intensification efforts resulted in an additional 4,811 plots sampled, a 32-percent increase of the sampled base grid. At the end of FY 2019, all States were covered by some level of annual surveying activity, and 48 States were fully implemented. Coastal Alaska uses an annualized³ survey and Interior Alaska and Hawaii are surveyed using a periodic⁴ survey unit basis (fig. 1).

FIA’s Congressional mandate, under the Renewable Resources Research Act of 1978 (PL 95-307), states that the Nation’s Trust Territories and Freely Associated States are to be treated as States for research purposes. Since 2000, in compliance with this mandate, periodic inventories have been completed in the Commonwealth of Puerto Rico, U.S. Virgin Islands, Federated States of Micronesia, American Samoa, Guam, the Republic of Palau, the Republic of the Marshall Islands, and the Commonwealth of the Northern Mariana Islands, all of which are exempt from the annualized system and have periodic

inventories. Reinventory of the islands continued with work in Puerto Rico and the U.S. Virgin Islands in FY 2019 (table B-10).

The total number of FIA publications reached 204, including journal articles, proceedings, and reports. Of these publications, 28 were core publications consisting of reports specific to a complete survey unit, complete State, national forest, or national reports. Core reports include 5-year State reports as required by legislation. FIA also published 122 articles in peer-reviewed journals and 11 articles in proceedings from scientific meetings and conferences.

In FY 2019, some 950 consultations were requested by FIA customers, including government, academia, industry, nongovernmental organizations (NGOs), private landowners, and media. These consultations required 7,764 hours of FIA staff time—equivalent to 3.5 full-time staff positions. FIA processed almost 4.46 million online data retrievals in which FIA customers obtained user-defined tables, data downloads, and maps of interest. The overall online numbers continue to increase with improved interactive tools and additional refinements to online user access.

³ Annual inventory measures 10 percent to 20 percent of all plots in each State each year.

⁴ Periodic inventory measures plots once every few years. State-level inventory is based on a full measurement of existing plots.

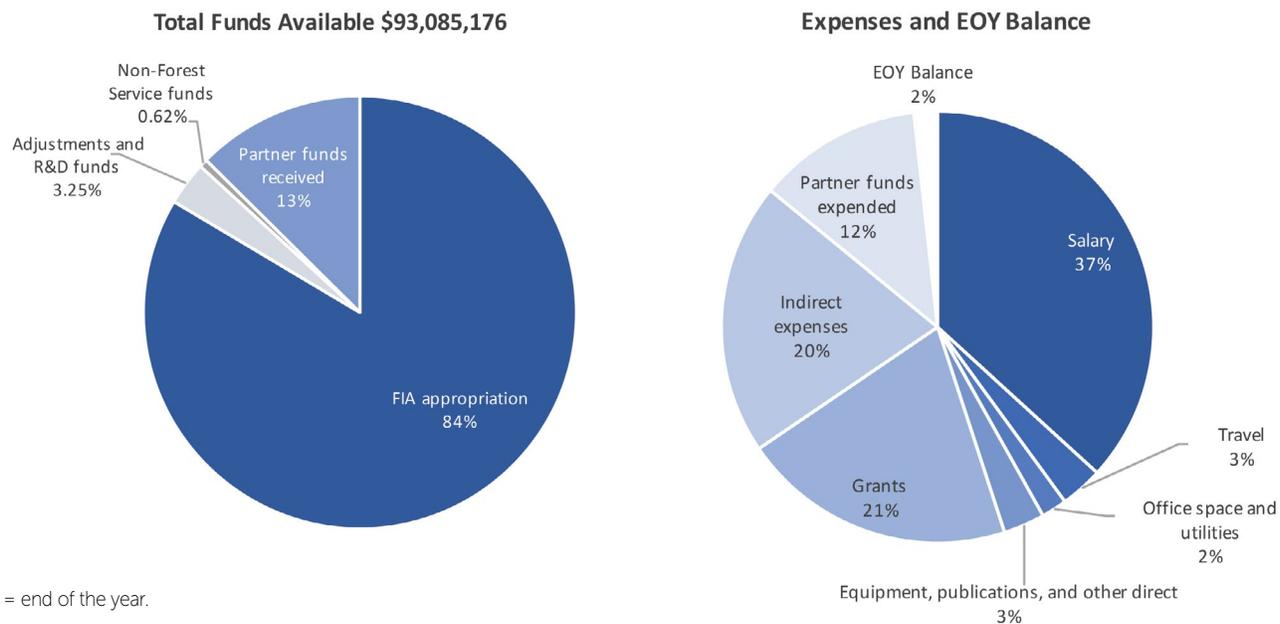


Figure 2. FIA program available funds and expenses by category, FY 2019.

Program Resources

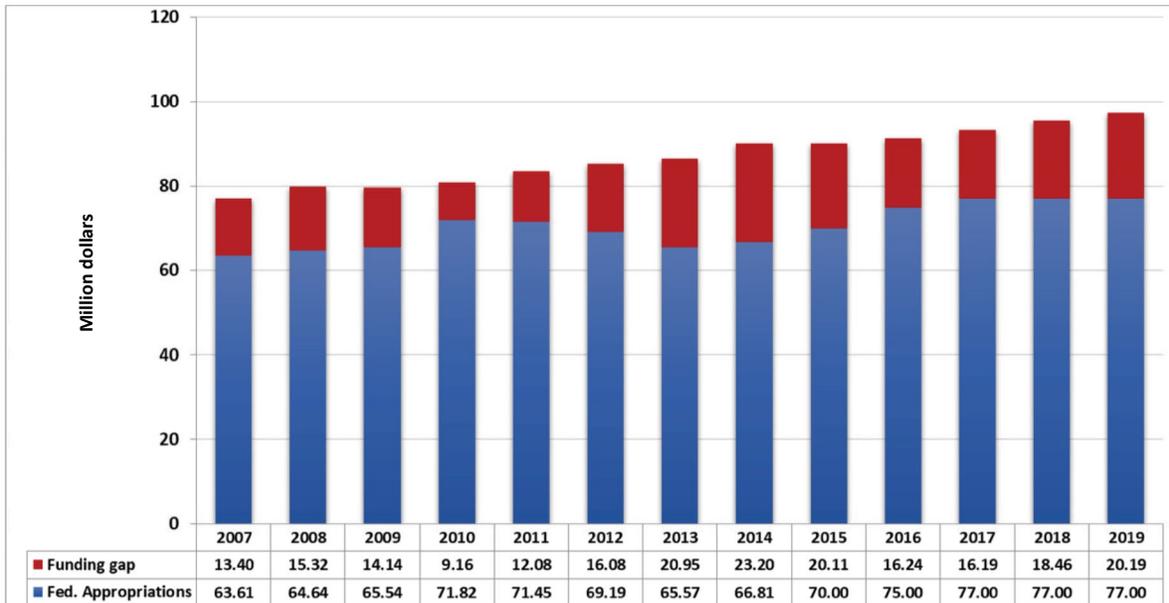
Congress appropriated funds for the FIA program in one Forest Service deputy area: Research and Development (R&D). In FY 2019, appropriated funds remained steady at \$77 million. An additional \$1 million supplemental was appropriated for hurricane relief activities in the South. Because these additional appropriated funds were received at the end of FY 2019, the supplemental was scheduled to be spent in FY 2020. State agencies, universities, other Forest Service programs, other Federal agencies and NGOs provided an additional \$11.7 million, 13 percent of total available funds, for plot intensification (almost \$4.4 million) and other value adds (\$7.3 million) to the program (fig. 2 and table B-4). Of the \$11.7 million, State agencies contributed \$4.9 million.

In its annual appropriation, Congress intends for FIA to make funds available for cost-sharing with States to help implement the FIA program. Annual FIA grants to the 19 States that contributed with data acquisition reached \$10.6 million (table 2). In turn, State agencies take advantage of FIA’s on-the-ground resources, contracted or dedicated, to contribute funds for additional data collection to meet their local needs. Thirty-seven State agencies contributed \$5.2 million to leverage data collection: \$3 million to base program, and an additional \$2.2 million to add value (table 2). Most of the State agency contributions, \$4.2 million, are from the Eastern States (table B-4).

Table 2. Annual FIA appropriations and allocation of FIA-appropriated and State-contributed funds for fieldwork, FYs 2009–2019.

Category	Fiscal year										
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
<i>Thousand Dollars</i>											
Total FIA appropriation	65,536	71,817	71,452	69,186	65,567	66,805	70,000	75,000	77,000	77,000	77,000
FIA data collection grants to States	6,971	7,278	8,002	7,475	5,338	7,098	5,173	8,428	8,945	9,652	10,633
Number of States receiving grants	19	20	17	18	16	17	16	18	17	20	18
Average grants to participating States	367	364	471	415	334	418	323	323	526	482	536
Percent of appropriated funding granted to States for data collection	11%	10%	11%	11%	8%	11%	7%	11%	12%	13%	13%
State contributions for leveraged data	4,594	5,039	6,192	5,567	3,962	3,919	4,324	5,506	5,205	6,568	5,239
Number of States contributing funds	44	45	40	41	38	36	37	34	36	41	37
Average contribution from States	104	112	155	136	104	109	117	162	145	151	132

FIA = Forest Inventory and Analysis; FY = fiscal year.



Fed. = Federal; FIA = Forest Inventory and Analysis; FY = fiscal year.

Note: Estimated total annual funding to fully achieve the 2007 Strategic Plan was \$77 million. The 2014 Farm Bill required a new Strategic Plan with added items requiring \$90 million annually to fully achieve Plan options A through C. Required annual funding levels for full implementation have been adjusted for inflation each year. Funding gap is noted in the red segment on bars.

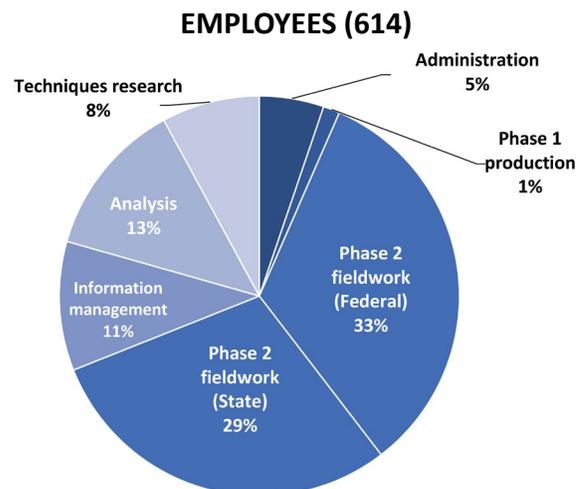
Figure 3. FIA-appropriated funding level, FYs 2007–2019.

Nearly one-third of the entire FIA workforce were State fieldwork employees, provided through these partnerships (fig. 4).

Across FIA regions, cost and productivity figures differ because of the cyclical nature of the inventory system and because of differences among field units in operational methods, topography, distance to roads, and access to property. Rates of effective indirect expenses in FIA field units in FY 2019 ranged from 9 to 16 percent (table B-2), reflecting differences in sources of funding and research station indirect expense assessments. Since 2018, the Forest Service increased FIA indirect costs using a new mechanism, called cost pools, based on the number of FIA employees (table B-3). In 2019, the FIA program cost pool share was \$9,825,750, with other additional cost pools of \$709,842 taken off the top to pay for common business infrastructure and services, telecommunications, utilities, overhead workers compensation program, and unemployment. Of the \$77 million appropriated to the FIA program, \$66,048,408 was made available for distribution to FIA units.

Figure 3 shows the total appropriated funding for FIA from FY 2007 through FY 2019. Throughout this period, the FIA budget has been less than the funding level necessary for full implementation—in FY 2019, around \$97.19 million (adjusted for inflation). For more trends on performance measures, check table B-12.

Of all Federal and cooperator FIA employees, approximately 59 percent were involved in data collection and field support, 22 percent in analysis and information management, 7 percent in techniques research, 5 percent in program management and administration, and 1 percent in phase 1 production work (fig. 4). FIA funds were also used to cover the partial administrative costs of the R&D staff among research stations who provide support to FIA personnel.



FIA = Forest Inventory and Analysis; FY = fiscal year.

Figure 4. Federal and States FIA program employees by job group, FY 2019.

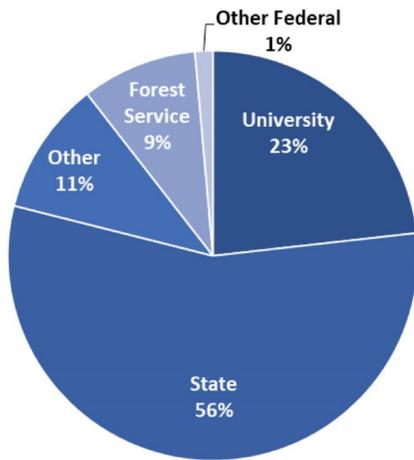


Figure 5. Grants and agreements by recipient group, FY 2019.

FIA Grants and Partners' Contributions

The FIA program is envisioned by Congress to be a Federal-State partnership, in which both Federal and State partners contribute resources to accomplish the work. The base Federal commitment is an inventory program that collects data from 10 percent of the sample locations in the Western States (10-year cycle) and 15 percent of the sample locations in the Eastern States (7-year cycle) annually, with comprehensive, analytical reports for all States produced at 5-year intervals. The following discussion summarizes program grants and partners' contributions.

Grants and Agreements. Each year, FIA units enter into various grants and cooperative agreements with partners to accomplish specialized work in support of the FIA mission. In some cases, partners provide expertise that complements or is not available within FIA; in other cases, they share the workload

in data collection, information management, and research in techniques development. Table B-5 lists the 113 grants and agreements that FIA entered in FY 2019, granting almost \$19.4 million to partners. This number fluctuates from year to year, but it demonstrates the reliance of the FIA program on collaborations with external partners to efficiently complete the work. Most of these grants and agreements were with 19 different State agencies (56 percent) and universities (23 percent) (fig. 5).

Additional cooperators included other Federal and Forest Service offices (9 percent) and other non-Federal partners (11 percent). We expect to continue to make significant use of grants and agreements to augment FIA staff capacity in the analysis and reporting of annual FIA data for individual States.

Partners' Contributions. At their discretion, partners may contribute the resources that are needed to bring the FIA program up to the full 20-percent measurement per year (5-year cycle) that is described in the authorizing legislation. In addition to that choice, or as an alternative, partners may choose to contribute resources for other purposes that add value to the FIA program from their perspective, such as intensifying the base FIA sample location grid to support analysis at finer spatial resolution, funding additional types of measurements on FIA sample locations, or providing analyses or reporting beyond that provided by FIA. The willingness of partners to contribute resources demonstrates the inherent value of the FIA program as a flexible framework on which to address other issues of interest.

Table B-4 lists 114 partners that have contributed resources to the FIA program in FY 2019, either to achieve the 20-percent level of cost-sharing envisioned by Congress or to add value to FIA in other ways. These resources include staff time, vehicle use, office space, equipment, travel costs, and other noncash items that support or add value to the FIA program. Contributions are valued for reporting purposes in terms of what it would have cost

Table 3. FIA partner agreements and partners' contributions, FY 2010 through FY 2019 (10-year summary).

Group	Total FIA grants	Average annual grants	Percent of grants	Total partner contributions	Average annual contributions	Percent of contributions
	Dollars			Dollars		
States/islands	79,686,504	7,968,650	49%	54,356,548	5,435,655	57%
Universities	43,150,660	4,315,066	27%	8,163,243	816,324	9%
Forest Service	13,023,055	1,302,306	8%	23,081,559	2,308,156	24%
Other Federal	2,322,492	232,249	1.4%	8,219,140	821,914	9%
Other partners	23,454,976	2,345,498	15%	1,497,593	149,759	2%
Total	161,637,687	16,163,769	100%	95,318,083	9,531,808	100%

FIA = Forest Inventory and Analysis; FY = fiscal year.
Note: Percentages may not add to totals because of rounding.

the Federal FIA staff to provide the same service, which may not necessarily be the same as the actual cost to the partner making the contribution.

Overall, partners contributed almost \$4.4 million toward the full 20percent of target plots measured annually and another \$7.3 million in contributions that add value to the FIA program, for a total of \$11.7 million (over a half-million dollars more than partner contributions in FY 2018). The source of these contributions varies based on the region of the country and the ability of States and partners to contribute. In the West, where forest land ownership is primarily Federal, the major cost-sharing partners tend to be Federal land managers.

Over the last 10 years, FIA has provided partner support of almost \$162 million to efficiently carry out annualized inventory. Partners have contributed more than \$95 million to leverage Federal dollars that have reduced inventory cycles and provided for other annual inventory enhancements. Table 3 summarizes FIA grants and partners' contributions by organization.

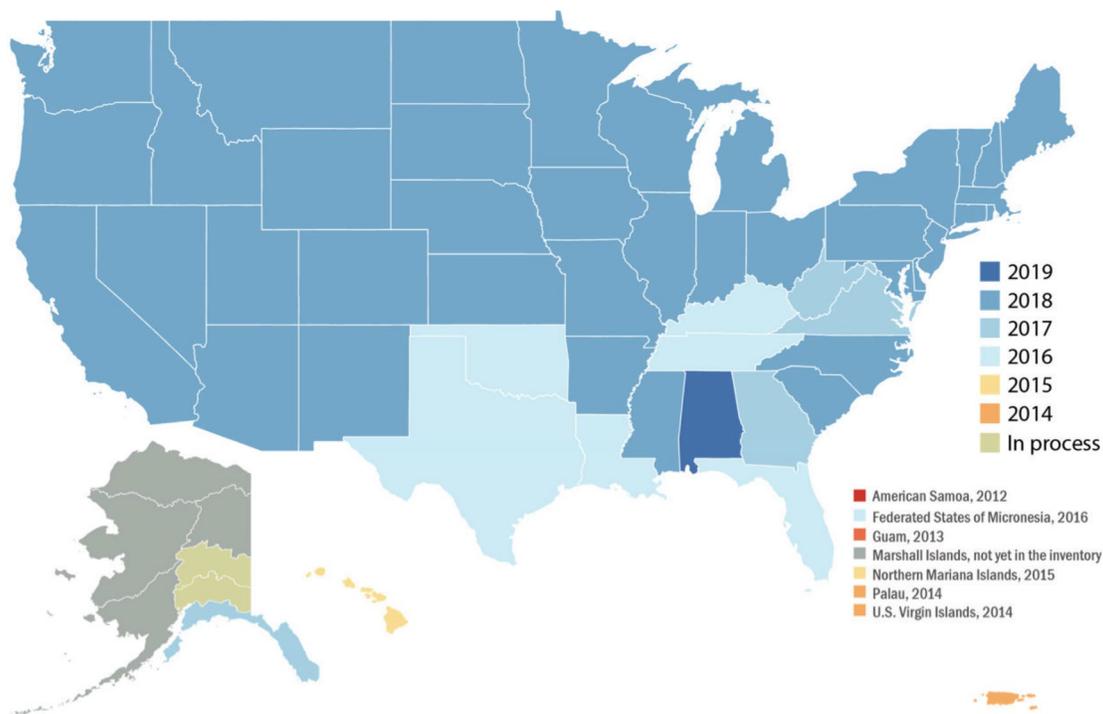
FIA Data Availability

The FIA program is designed to provide continually updated, accurate, and reliable information on status and trends in the Nation's forested resources. Obtaining current information is

of primary interest to FIA customers. Our program objectives include: (1) providing annual access to current and past data for all forested lands sampled as part of the annual inventory system, and (2) producing analytical reports for all States on a 5-year cycle.

In an effort to measure how the FIA program satisfies these program objectives, we created an interactive [app](#) to explore FIA data available online, production and publication years of 5-year State reports and links to them, and status of future 5-year State reports, as of the end of FY 2019.

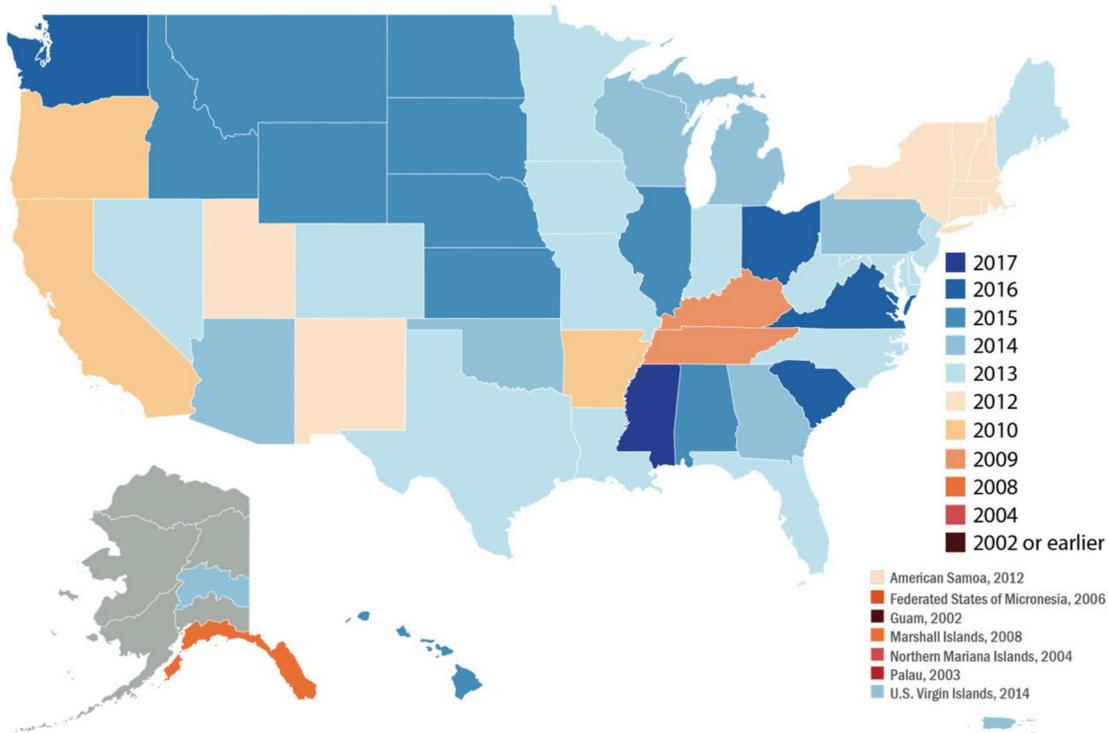
Figure 6 shows, for each State, the most recent year for FIA data accessible in our public database as of September 30, 2019—the end of FY 2019. Most of the conterminous States and Coastal Alaska had data less than 2 years old available online. Data from Kentucky, Oklahoma, Tennessee, Louisiana, Florida, and Texas were 3 years old. Except for Guam, America Samoa, and the Marshall Islands, all data from U.S. islands and territories are dated less than 5 years. A user-friendly [online inventory database](#) with the latest forest inventory data of the Hawaiian Islands was released to the public. In Interior Alaska, field inventory for the Tanana Valley unit was completed and for the Susitna-Copper unit started. Inventory data for the Tanana Valley is expected to be released in FY 2020. Continued improvements in data processing and in the National Information Management System



FIA = Forest Inventory and Analysis; FY = fiscal year.

Note: In east Texas, the most recent online available data is from FY 2018, in Central and West Texas, from FY 2016.

Figure 6. Availability of online FIA data, FY 2019.



FY = fiscal year.
 Note: Dates are dates of publication, not dates of data shown in the publication.

Figure 7. Inventory year of FIA State reports, FY 2019.

(NIMS) are paying dividends by enabling FIA to establish a more routine loading schedule.

Figure 7 shows the last inventory year included in the 5-year FIA State report, which differs from the year of publication (fig. 8). Shaded in blue tones are the 36 States, Coastal Alaska, and Puerto Rico with report data less than 6 years old (darker tones correspond with the most recent data). State reports of 13 States and Coastal Alaska and island reports included data that were 7 years old or older, showing in orange shades in fig. 7. The oldest data included in any report of the continental States was from 2009 in the States of Kentucky and Tennessee. Hawaii’s first State report, which includes 2015 inventory data, was close to completion at the end of the fiscal year.

Except for Hawaii, Coastal Alaska, Tennessee, and Maryland, 5-year State reports were published less than 6 years ago, meeting the program objective (fig. 8). Maryland’s 2013 State report was produced as a series of story maps, yet to be published. The Virgin Islands report including 2014 inventories was about to be published by the end of FY 2019. Although the goal is not to exceed 10 years outside the continental United States, because of longer inventory cycles, some islands have not been able to report earlier.

Quality Assurance

The FIA program collects, analyzes, and publishes tremendous amounts of data annually. A large part of our work consists of designing, implementing, and carrying out procedures to ensure the data are unbiased and represent the larger forest. Toward this end, FIA’s Quality Assurance (QA) program employs a framework to promote consistency during all stages of the national core FIA inventory process. The *FIA National Core Prefield Guide* and *National Core Field Guide* document the protocols, ensuring consistent prefield and field data collection for core data items. FIA’s national field data entry program, the Mobile Integrated Data Acquisition System (MIDAS), is integrated into the overall FIA information management structure and provides consistent logic and error-checking in the field. The NIMS database and NIMS Compilation System (NIMS-CS) provide additional error checks, and consistently calculate and provide access to a variety of derived variables using estimation equations that are described in general technical reports. Each field unit uses a system of post-collection quality assurance checks to inspect data for anomalies. Feedback from users provides an important step in ensuring the quality of the data. We continue to evolve and automate QA throughout our processes.

The National QA Coordinator position remained vacant in FY 2019 due to hiring limitations, but we plan to hire and train this position in 2020. This position works with the National FIA Program Office and the regional and national band leads (data collection, information management, and analysis) to provide direction and coordination for the FIA QA program.

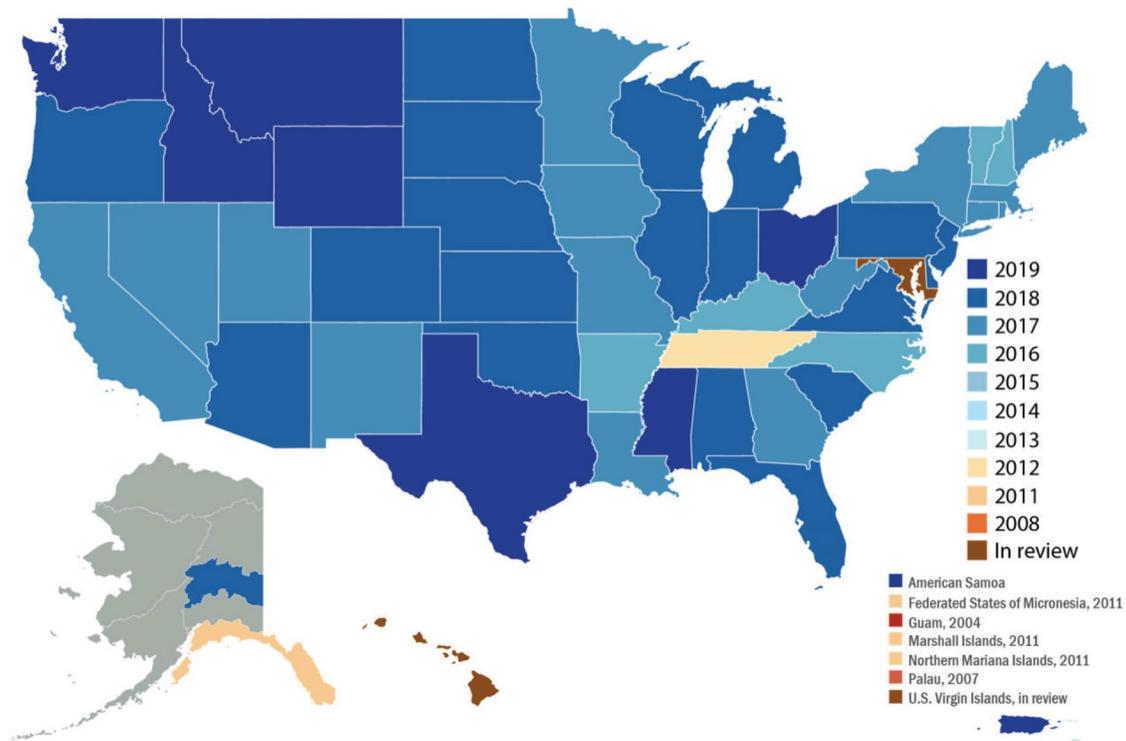
The FIA program promotes process transparency and consistency by extensively documenting methods and procedures, including—

- [The FIA National Prefield Guide 6.0](#) and rigorous QA protocols define a nationally consistent process to collect information about FIA plots before field visits.
- Up-to-date FIA *National Core Field Guides*, such as [Field Guide version 9.0](#), ensure consistent core program data collection (see <https://www.fia.fs.fed.us/library/field-guides-methods-proc/index.php> for more details; for urban field procedures see <https://www.fia.fs.fed.us/program-features/urban/>).

- The field [QA Check Procedures Guide](#) promotes field QA consistency from region to region.
- The [Forest Inventory and Analysis Database \(FIADB\)](#) displays standardized output tables and is accompanied by detailed documentation in a recently updated [Database Description and User Guide, version 8.0](#).
- A [National R&D QA Plan](#) provides direction to ensure consistency of research standards and procedures and explain review processes. The QA Plan establishes standards and procedures for all organizational units and personnel within Forest Service Research and Development.

Ongoing QA tasks in FY 2019 were aimed at identifying errors and increasing efficiency and consistency in the national inventory, including—

- Expanding FIA analysts’ toolbox by distributing regionally developed analytical QA error-checking applications to FIA State analysts nationally.



FY = fiscal year.

Note: Report publication year does not match the dates of data shown in the publication.

Maryland’s 5-year State report, produced as a collection of story maps, was created in 2013 but has not yet been published. The last published report for Maryland is 2008.

Figure 8. Publication year of FIA 5-year State reports, FY 2019.

- Adopting annual national urban field data collection certification.
- Developing urban field, compiled, and i-Tree data summary reports to share internally and externally for review data prior to public data release.
- Developing systematic edit checks of data before public release, including MIDAS logic checks and NIMS load error checks.
- Defining rigorous national cold-check field and scoring procedures to allow for equivalent field crew assessments across regions and crew types.
- Documenting and implementing national data collection staff training standards.
- Developing well-defined prefield canopy cover measurement training procedures and training material.
- Developing and documenting NIMS tables and NIMS-CS, a consolidated FIA data processing system.
- Working toward improved database systems, the Universal NIMS database (UNIMS), that connect different components of the inventory (e.g., urban, rural, special studies).

FIA Program Accomplishments for FY 2019

This section provides information on selected FIA results, accomplishments, and outcomes throughout the country. Some of these achievements have a nationwide impact, while others are regional, but equally important. More detailed information is available from the respective FIA unit leading the effort, as shown below. (Contact information for each FIA unit also appears in appendix A.)

Publishing the Nation's forests statistics that support the official national and international assessments for the United States.

Accomplishment: The publication of Forest Resources of the United States, 2017

Impact: These authoritative data support national and international assessments to inform future decisions and further research. *Forest Resources of the United States, 2017* is part of a series of General Technical Reports that support the Resources Planning Act (RPA) Assessment, mandated by Congress every 10 years, as well as providing official statistics for the Global Forest Resources Assessment produced by the United Nations Food and Agriculture Organization. These assessments are some of the most comprehensive official analyses on the status, conditions, and trends of forests in the United States and worldwide.

Outcome: The report summarizes Forest Inventory and Analysis data collected from all 50 States, as well as associated islands and territories. One of the most relevant findings is that the Nation's forest land area remains stable, but the composition and distribution of those forests is changing. The Forest Resources report also found that U.S. forest area—including lands covered by forest as well as the small woody species that grow in arid regions—has plateaued at 822.5 million acres. Together, forests and woodlands comprise over one-third of the national landscape. More than half of this acreage is privately owned.

Partners: W. Brad Smith (Forest Service retired); Kevin Megown (Forest Service Remote Sensing Applications Center), Kurt Riitters (SRS - Forest Environmental Threat Assessment Center), Anita Rose (Forest Service National Forest System), Beth Schulz (Forest Service retired), Francisco X. Aguilar (University of Missouri), Michael Benedict (Bureau of Indian Affairs), Alan Ek (Emeritus, University of Minnesota), Kristen Manies (U.S. Geological Survey), Robert Smith (Oregon State University).

Contact: Sonja N. Oswald, sonja.n.oswald@usda.gov (SRS)

Making FIA data summaries more accessible to users through the creation of automated annual factsheets for every State

Accomplishment: The publication of a series of one-click factsheets⁵ summarizing State-level estimates of forest land, number and volume of trees, and acres of forests disturbed by fire and other weather events for each State. The factsheets are automated, so FIA will be able to swiftly update nationally consistent information for every State. For more than 70 years, FIA has provided continuously improved and increasingly comprehensive inventories to State foresters, forest industry, forestry consultants, conservation groups, national forests, universities, and the entire U.S. citizenry. You can access to the information for each State through an online [map app](#) accessible through [FIA website](#).

Impact: This new visual tool enables quick, easy access to the most up-to-date forest statistics for each State. The wealth of FIA's repeated measurement data holds answers to many questions about the latest information around forest resources. Increasingly, FIA scientists and scientists from universities or other organizations are working collaboratively to apply FIA data to answer broad-scale research questions.

Outcome: The one-click factsheets are automated, so they are updated frequently, pulling information from a database that has already gone through a very robust vetting process. The information comes from a variety of FIA data sources, including Timber Products Output and the National Woodland Owners Survey. The factsheets link to an interactive map where users can browse summaries for other States, along with regional and national statistics.

These factsheets require significantly less effort to develop than previous resource updates, which, in turn, allows FIA scientists to focus on regional and national products while collaborating with other USDA scientists and external researchers, to the benefit of every American who relies on forests.

Partners: All FIA units.

Contacts: Christopher M. Oswald, christopher.oswald@usda.gov and Ted R. Ridley, ted.ridley@usda.gov (SRS)

⁵ FIA is still working on the estimates shown in the app for some Western States. Alaska data only include inventories from the Coastal Unit.

Increasing awareness and use of FIA data by managers of national forests in Regions 2, 3, and 4

Accomplishment: Through peer reviewed publications and formal presentations,⁶ as well as informal presentations,⁷ meetings, and consultations, the FIA program has enhanced the capabilities of partners to leverage inventory data for planning, decision-making, and monitoring. This has been accomplished in national forests in Regions 2, 3, and 4.

Impact: Improvement of FIA data use impacts the management, project development, vegetation mapping, and broad-scale monitoring of national forests.

Outcome: These efforts have contributed to enhancing the national forests managers' understanding of FIA data, to better identifying their data needs, and to integrating FIA data into their day-to-day operations. This contributes to agency efficiency by helping forests to use data collected by an existing monitoring program, rather than initiating their own, and resulting in consistent data across nearby owners' lands.

Partners: Colorado State University, the Washington Office Ecosystem Management and Coordination – Analyst and Resource Inventory and Monitoring Coordinators group, Forest Service Region 3, Region 2, and Region 4 staff.

Contact: Kristen Pelz, kristen.pelz@usda.gov (RMRS)

Estimating the carbon loss due to tree mortality caused by the most damaging non-native insects and diseases in U.S. forests

Accomplishment: The quantification of increases in tree mortality, and associated biomass loss, caused by the 15 most damaging nonnative forest pests in the United States. In collaboration with Purdue University, FIA scientists utilized 92,978 forest plots distributed across the conterminous U.S. forests.

Impact: This work demonstrates the value of FIA data to assess broad-scale changes in forests and indicates that forest pest invasions, driven primarily by globalization, are creating a large risk to U.S. forests and have significant impacts on carbon dynamics. Non-native forest pests threaten an estimated 76 percent of carbon sequestration in North America that comes from forests. Increased tree mortality from the impacts of alien insect and diseases results in the transfer of carbon stored in live trees

into dead material, much of which will eventually return to the atmosphere.

Outcome: Worldwide, forests are increasingly affected by non-native insects and diseases, some of which cause substantial tree mortality. Forests in the United States have been invaded by more than 450 tree-feeding pest species, including insects such as the emerald ash borer, gypsy moth, and hemlock woolly adelgid and diseases including Dutch elm disease, beech bark disease, and laurel wilt disease. The 15 most-damaging species alone caused an annual loss of 5.53 teragrams of carbon through increased tree mortality, an amount comparable to carbon emissions from 4.4 million cars or one-fifth of all wildfires annually. In addition, 41 percent of the total live forest biomass in the conterminous United States is at risk to future loss from these 15 pests.

Partners: Songlin Fei, Purdue University.

Contact: Randall S. Morin, randall.s.morin@usda.gov; and Andrew Liebhold, andrew.liebhold@usda.gov (NRS)

A management/research collaboration to answer critical carbon questions across the National Forest System

Accomplishment: For the first time, baseline assessments of carbon stocks in every national forest incorporate detail on the causes of carbon stock change, including timber harvesting, insect outbreaks and diseases, aging, climate variability, increasing atmospheric carbon dioxide concentrations, and nitrogen deposition. Previous baseline assessments of carbon stocks evaluated observed trends based on forest inventory data but were limited in ability to reveal detailed causes of these trends. The published study (Birdsey et al., 2019) also allowed the alignment and calibration of results with FIA data, which already underpins the monitoring of national forests in many disciplines.

Impact: Results of these expanded assessments will support national forest units in assessing carbon stocks, quantifying carbon outcomes of broad forest management strategies and planning, and meeting carbon assessment requirements of the 2012 Planning Rule and directives. The Forest Service, Office of Sustainability and Climate developed a Tableau-based delivery app and conducted a series of trainings and workshops in FY 2019 to support application of the baseline information produced

⁶ Wurtzebach, Z.; DeRose, R.J.; Bush, R.R. [et al.]. 2019. Supporting National Forest System Planning with Forest Inventory and Analysis Data. *Journal of Forestry*. 118: 289–306. doi:10.1093/jofore/fvz061.

⁷ Pelz, Kristen. October 5, 2018. Using Forest Inventory and Analysis Data to Facilitate an Adaptive Management Approach to Forest Plan Revision. Society of American Foresters Annual Convention; Portland, Oregon; October 3-6, 2018. Pelz, Kristen. May 23, 2019. FIA-based State and Transition Modeling to Inform Forest Management in Region 3: Focus on Regeneration. National Silviculture Workshop; Bemidji, MN; May 21-23, 2019.

through this project in the context of the forest plan revision process. More than 20 national forests are already using the data and findings of this research.

Outcome: Carbon storage is one of many ecosystem services provided by our national forests. NFS managers have not been directed to maximize carbon storage, but they do need to assess carbon implications of their proposed management plans. This work identifies which processes (fire, harvest, outbreaks, etc.) are the biggest threats to carbon storage. Results also help managers describe to stakeholders the global change benefits that national forests provide.

The landscape-level processes evaluated in these assessments provide a context for local change processes. Events such as harvest and fire strongly influence carbon at the site level, but if they are rare enough, their overall impact may be minimal. Conversely, disturbances may be more subtle at the site level but extremely important if they are ubiquitous, forest-wide. The recent RMRS publication helps managers focus their efforts on the carbon-related factors that are most important.

Partners: Richard Birdsey (Woods Hole Research Center), Duncan McKinley (Forest Service, Office of Sustainability and Climate), Alex Hernandez (Utah State University).

Contact: Sean Healey, sean.healey@usda.gov (RMRS)

Birdsey, R.A.; Dugan, A.J.; Healey, S.P.; Dante-Wood, K.; Zhang, F.; Mo, G.; Chen, J.M.; Hernandez, A.J.; Raymond, C.L.; McCarter, J. 2019. [Assessment of the influence of disturbance, management activities, and environmental factors on carbon stocks of U.S. national forests](#). Gen. Tech. Rep. RMRS-GTR-402. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 131 p.

Developing the theoretical basis for the National Aeronautics and Space Administration Global Ecosystems Dynamics Investigation (NASA GEDI) mission's estimates of global forest biomass

Accomplishment: A FIA team has developed a theoretical framework for the quantification of 1-km estimates of mean forest biomass to be made across the world by the NASA GEDI (Global Ecosystems Dynamics Investigation) mission. Drawing upon sampling theory and conventions developed with airborne LiDAR systems, FIA published both a research paper and a NASA Algorithm Theoretical Basis Document (ATBD) describing a means to use spaceborne LiDAR to create statistical inferences of forest biomass.

Impact: This research brings new level of accuracy and rigor to our scientific understanding of the role of forests in the global carbon cycle. Most uses of spaceborne LiDAR for biomass estimation have ignored formal modes of uncertainty estimation. GEDI is the first mission designed around forest sampling considerations. FIA scientists used specially collected field and airborne LiDAR data to test a hybrid model-based statistical estimator that GEDI will use globally.

Outcome: GEDI will sample all forests in temperate and tropical biomes. With the theoretical framework articulated by the FIA team, biomass estimates and their uncertainties will be consistently interpretable across the globe.

Partners: The Swedish Agricultural University, NASA Goddard Space Flight Center, The University of Maryland.

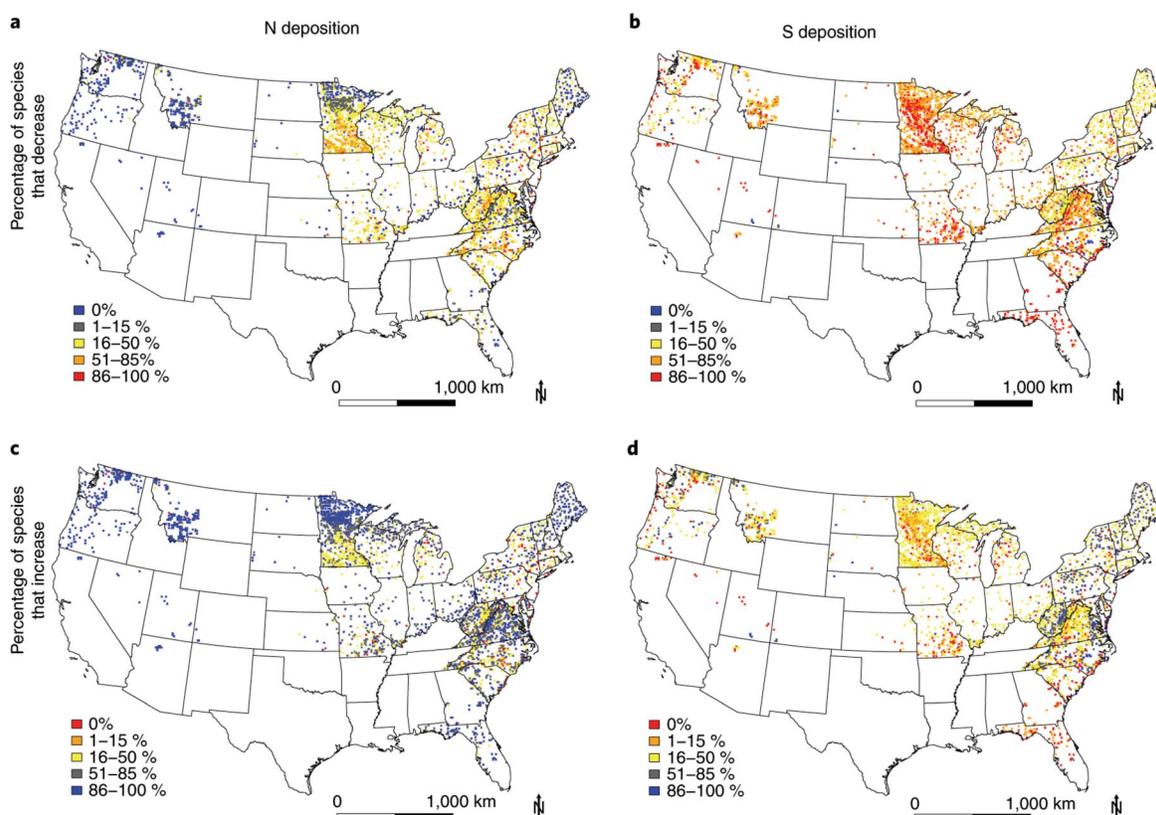
Contact: Sean Healey, sean.healey@usda.gov; Paul Patterson, paul.l.patterson@usda.gov; Zhiqiang Yang, zhiqiang.yang@usda.gov

Herbaceous species show widespread vulnerability to atmospheric deposition of nitrogen and sulfur in the United States

Accomplishment: Analysis by an FIA scientist and partners found that the probability of occurrence for 70 percent of species is negatively associated with nitrogen or sulfur deposition in the conterminous United States. The association between nitrogen and sulfur deposition and the probability of occurrence was estimated for 348 herbaceous species using species composition data from more than 14,000 FIA survey sites across the conterminous United States. Results are unprecedented at this scale and in numbers of species assessed.

Impact: The analysis demonstrates that many herbaceous species are at risk from atmospheric deposition, a finding that can inform improvements to air quality policies in the United States and globally. This work can help inform the review of the U.S. Environmental Protection Agency (EPA) secondary standards for oxides of nitrogen, oxides of sulfur, and particulate matter to identify species and regions of concern from these stressors.

Outcome: Results strongly indicate widespread vulnerability to nitrogen and/or sulfur deposition and that species respond differently on the basis of local environmental context. The wide range of thresholds within species suggests that vulnerability is linked to local edaphic factors and atmospheric co-pollutants. Atmospheric nitrogen and sulfur pollution increased over much of the country during the 20th century from fossil fuel combustion and industrial agriculture. Despite recent declines,



Note: Plots were aggregated in a 12 x 12 km² grid cell and unique species were only counted once if they were potentially vulnerable anywhere in the cell. The color ramps are flipped between decrease and increase, with warmer colors denoting negative effects (more decreases and fewer increases, most species assessed were native).

Figure 9. Percentage of species that decrease (a) or increase (c) in probability of occurrence with increasing nitrogen deposition and decrease (b) or increase (d) with increasing sulfur deposition.

nitrogen and sulfur deposition continue to affect many plant communities in the United States, although which species are at risk remains uncertain.

Partners: U.S. Environmental Protection Agency; University of Colorado, Boulder; University of California, Riverside; U.S. Geological Survey, Southwest Biological Science Center; U.S. Geological Survey, Western Ecological Research Center; University of New Mexico, Albuquerque; USDA Forest Service, Watershed, Fish, Wildlife, Air & Rare Plants (WFW); University of West Florida; USDA Forest Service, Northern Research Station; Lancaster University; University of Colorado, Boulder; Arizona State University; University of Wisconsin, Madison.

Contact: Sarah Jovan, sarah.jovan@usda.gov (PNW)

Clark, C.M.; Simkin, S.M.; Allen, E.B.; Bowman, W.D.; Belnap, J.; Brooks, M.L.; Collins, S.L.; Geiser, L.H.; Gilliam, F.S.; Jovan, S.E.; Pardo, L.H.; Schulz, B.K.; Stevens, C.J.; Suding, K.N.; Throop, H.L.; Waller, D.M.

2019. Potential vulnerability of 348 herbaceous species to atmospheric deposition of nitrogen and sulfur in the United States. Nature Plants 5: 697–705. <https://doi.org/10.1038/s41477-019-0442-8>

Using Drones with Lasers and Aerial Photos To Complement Field Surveys in Forest Monitoring

Accomplishment: An efficient and responsive unmanned aerial system method enhances field measurement and aerial laser scanning in strategic forest inventories. FIA tested the performance of an unmanned aerial system and photogrammetry to assess tree density and height in Central Oregon. The project compared and contrasted results gained from the photogrammetric workflow to those obtained via direct field measurements and airborne laser scanning. All three methods yielded similar results, corroborating the use of the developed unmanned aerial system method.

Impact: This alternative method aids forest inventories using affordable, commercial unmanned aerial system hardware and photogrammetry software, and sufficiently establishes a comprehensive representation of forest field plots.

Outcome: Forest inventories are constrained by resource-intensive fieldwork, while unmanned aerial systems offer rapid, reliable, and replicable data collection and processing. This research leverages advancements in photogrammetry and market sensors and platforms to incorporate an unmanned aerial systems-based approach into existing forest monitoring schemes. The research also demonstrated incorporating a new data source into an existing forest monitoring program. As this method was meant to broaden ongoing forest monitoring, it is not concerned with reliance on historical data. In fact, it has shown that a meaningful representation of stand characteristics can be achieved even when field data cannot be collected contemporaneously due to resource constraints, program timelines, and retrospective research. This further increases its relevance to private, nonindustrial forestland owners who will have some flexibility to obtain reasonable results despite their work not being exactly aligned with external data.

Partners: Oregon Health and Science University and Washington State University

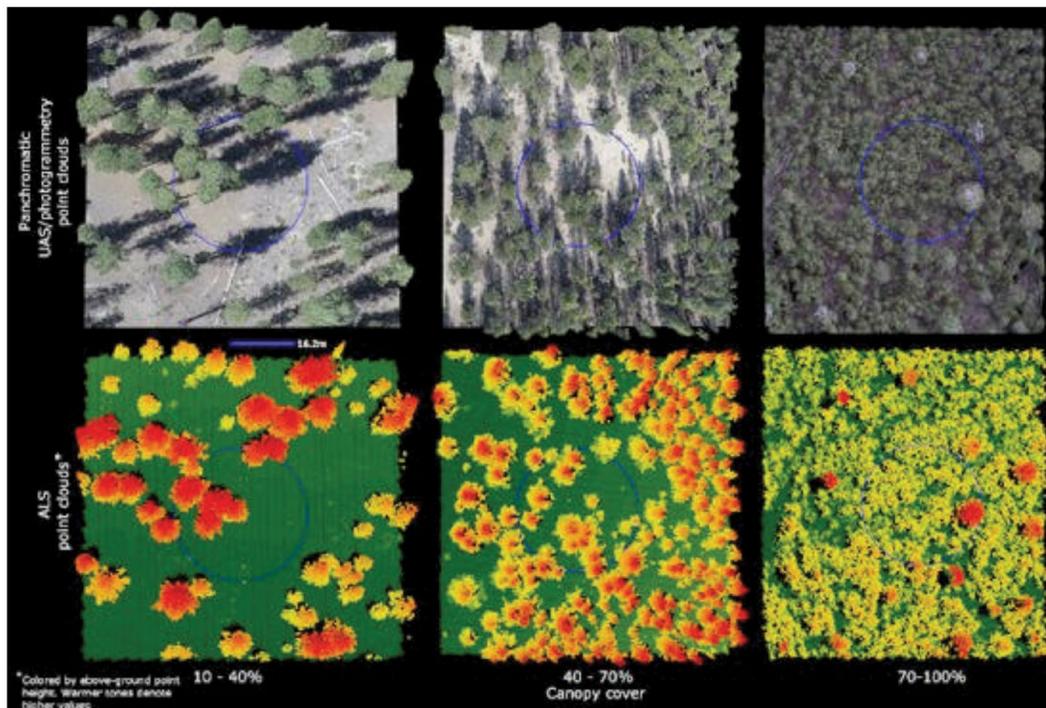
Contact: Demetrios Gatzolis, demetrios.gatzolis@usda.gov (PNW)

Fankhauser, E.K.; Strigul, S.N.; Gatzolis, D. 2018. Augmentation of traditional forest inventory and airborne laser scanning with unmanned aerial systems and photogrammetry for forest monitoring. Remote Sensing. 10(10): 1562. <https://doi.org/10.3390/rs10101562>

Development and distribution of FIA 101: A training module for FIA staff and aspiring data users

Accomplishment: An easy-to-understand, self-guided training course introduces customers and new FIA staff to the program’s history, data uses, and features.

Impact: This self-guided introduction to FIA provides sufficient background for users to be familiar with the types of questions FIA data can address. The FIA program



Note: The point clouds from imagery collected with the UAS are displayed in red, green, blue (RGB) while the point clouds obtained from ALS are colored according to aboveground height. The blue circle represents the boundary of the 16.2-m radius plot.

Figure 10. Nadir views of 3D representations produced by unmanned aerial system (UAS)- and airborne laser scanning (ALS)-derived methods, respectively, from one plot in each canopy cover between (a, d) 10–40 percent; (b, e) 40–70 percent; and (c, f) 70–100 percent.

serves multiple stakeholders, including private interests, the National Forest System, other Federal agencies, State resource agencies, universities, and nongovernmental organizations. These diverse users often consult with FIA staff to learn more about the program and its data, and the FIA 101 training course can cut time spent describing basic program features and makes more time available to provide ready-to-use data to FIA's stakeholders. FIA 101 also serves as an onboarding tool for new employees and gives them a broad perspective on why their work with FIA is important.

Outcome: The FIA 101 training course has been distributed to dozens of recipients, both within and outside the Forest Service. Its distribution has also resulted in greater information sharing about training resources among the four FIA units across the country. Feedback from NFS stakeholders has contributed to a plan for future enhancements to better serve NFS by adding an appendix describing how FIA differs across units.

Contact: Sara Goeking, sara.goeking@usda.gov (RMRS)

Estimating the number of trees needed to compensate the loss of a healthy one

Accomplishment: FIA developed a new method of tree compensation to determine the number of trees required to compensate for the loss of one healthy tree. This method bases compensation on the loss of future tree values and enhances our ability to adequately compensate for tree loss.

Impact: An accurate estimation of how much a tree owner should be compensated for the loss of a healthy tree removed from the landscape recognizes the true value that forests provide both to the landowner and the society. Various formulas exist that estimate the value of a tree, but these formulas are often based on tree size and thus compensate for services already received. The key to determining adequate compensation is to estimate the amount of future services lost due to tree removals.

Outcome: This new procedure considers the future benefits provided by both the removed tree and newly planted trees to determine compensation. Compensation can be in number of trees to be planted or equivalent dollars to plant the trees. The compensation rates vary with tree size and estimated remaining lifespan.

Contact: David Nowak, david.nowak@usda.gov (NRS)

Partnering to provide reliable estimates on the status and trends of carbon in Oregon's forest ecosystems

Accomplishment: A new analysis of annual field measurements revealed that Oregon's forests have been functioning as a net sink of carbon, with stores increasing at an average rate of 30.9 ± 7.4 million metric tons of carbon dioxide equivalent per year from 2001 to 2016.

Impact: Land stewards need a reliable forest carbon accounting framework to support planning, policy development, and monitoring. This report supplies the quantitative information needed to track the status and trends for carbon in Oregon's forests, based on an extensive field-plot monitoring system (Forest Inventory and Analysis sample of 9,483 forested plots).

Outcome: This partnership with the Oregon Department of Forestry provides a strong, quantitative basis for planning and policy development based on the measurements of carbon status and trends. As a national program, FIA can partner with other States to provide similar accounting and reporting throughout the Nation.

Partners: Oregon Department of Forestry.

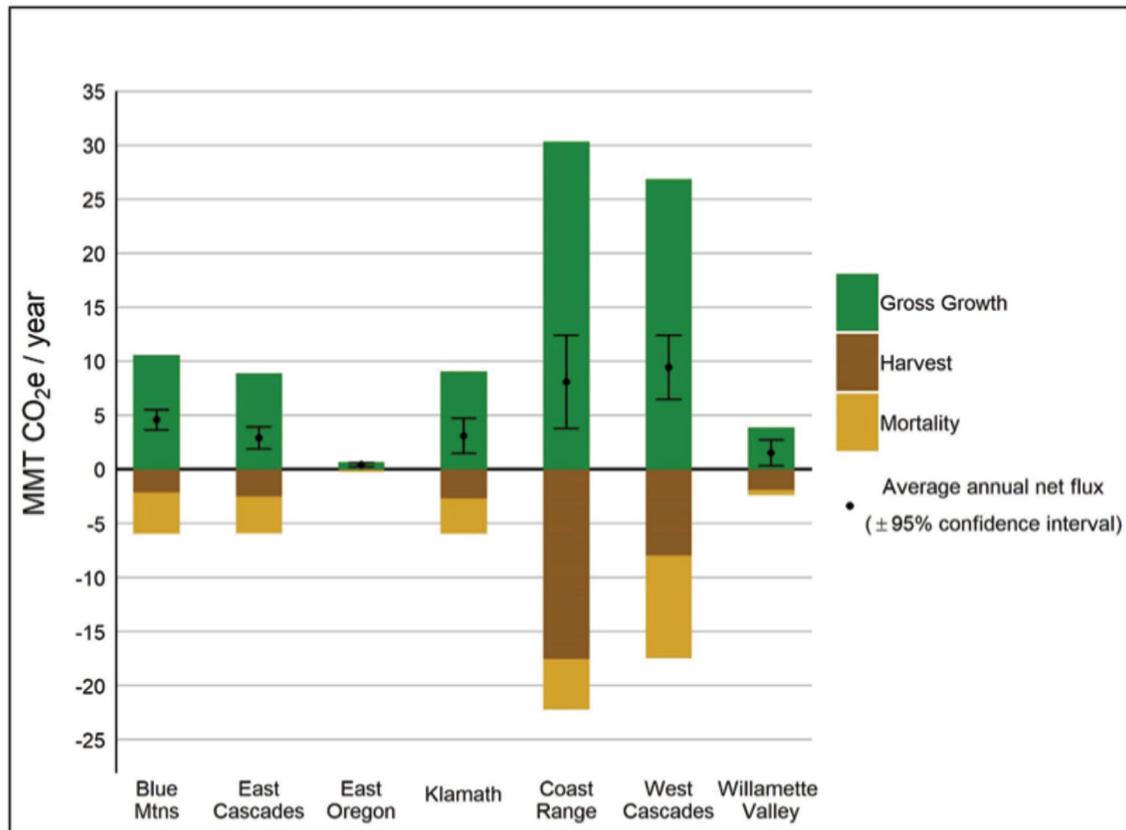
Contact: Glenn Christensen, glenn.christensen@usda.gov (PNW)

Christensen, G.A.; Gray, A.N.; Kuegler, O.; Yost, A.C. 2019. Oregon forest ecosystem carbon inventory: 2001–2016. Salem, OR: Oregon Department of Forestry. 11 p.

Estimating greenhouse gas emissions and removals from managed forest land in Alaska

Accomplishment: For the first time, annual estimates of greenhouse gas (GHG) emissions and removals from all managed forest land in Alaska were compiled from 1990 to 2017.

Impact: Including all managed forest land in Alaska in the 2019 U.S. GHG inventory establishes important baseline estimates for this region, provides a more complete characterization of GHG emissions and removals in the United States, and helps identify opportunities for mitigating GHG emissions in Alaska and other remote areas with limited information. Managed forests in Alaska represent 10 percent of the total managed forest land area in the Nation, but store 17 percent of the total carbon in forests. These forests also represent a net carbon sink over the last 27 years, but there is considerable interannual variability driven, in large part, by wildfire. Emissions from severe fire years in Alaska substantially reduce the contribution of U.S. forests as a carbon sink in those years.



Note: Error bars represent the 95-percent confidence interval of estimated net flux.
MMT CO₂e/yr = million metric tons of carbon dioxide equivalent per year.

Figure 11. Average annual net CO₂e flux in live trees from growth, harvest, and mortality by Oregon's ecological regions, 2001–2006 to 2011–2016 (MMT CO₂e/yr).

Outcome: Forests are the largest net carbon sink in the United States, offsetting more than 11 percent of total GHG emissions annually. Estimates of GHG emissions and removals from U.S. forests are based on national forest inventory data and have historically included forest land in the conterminous 48 States and Coastal Alaska. A recent analysis of the land sector indicates that more than 24 million hectares of forest land in Interior Alaska fits the managed land definition in the U.S. GHG inventory and therefore should be included in annual reporting.

Partners: Stephen Ogle, Colorado State University.

Contact: Grant Domke, grant.m.domke@usda.gov (NRS)

Engaging diverse undergraduate students in statistical challenges facing forest inventory

Accomplishment: FIA captured the talents and energy of a diverse group of undergraduate students to make headway on statistical challenges facing FIA. During an intensive 10-week forest inventory experience, students explored ways to: (1) improve FIA's current post-stratification process; (2) enhance FIA's new estimation engine FIESTA with improved model-

assisted methodologies; (3) provide templates for automated reporting; (4) solve long-running problems with FIA's systematic variance estimation; (5) automate small-area estimation models; and (6) create awareness to over-fitting tendencies when modeling with temporal data like Landsat.

Impact: FIA statistical challenges that have typically been assigned to graduate students, post-docs, or scientists were analyzed and solved by a different group of thinkers bringing a different perspective to their solutions. Results for this effort include: two candidate articles for peer-review outlets, four poster presentations at the FIA Science and Stakeholders Symposium, and winning first place in the national Best Video Presentation of the 2019 Electronic Undergraduate Statistics Project Competition.

Outcome: In addition to advancing the core FIA program and expanding to new areas at very low cost, FIA has gained solutions from a diverse group of young people thinking about forest inventory problems differently. Students participating in this program come from a variety of disciplines including mathematics, statistics, computer science, economics, English, philosophy, and even the classics. As a result of this experience,

a few of these undergraduates are considering pursuit of graduate education or careers involving natural resources.

Partners: Kelly McConville, Reed College, Portland, OR.

Contact: Gretchen Moisen, gretchen.g.moisen@usda.gov (RMRS)

Mangrove Inventory Comparisons, Findings from Multi-Agency Tests in Florida

Accomplishment: Increased the scientific knowledge on inventorying mangrove forests. Research findings were presented at the 5th International Mangrove, Macrobenthos and Management Meeting (MMM5); Singapore; July 1-5, 2019. Abstract published in Conference Program.

Impact: A study identified improvements in a methodology for inventorying mangrove forests to overcome the challenges related to ground measurements, including accessibility issues, time constraints, and hazardous conditions. To mitigate these issues and improve data collection, a collaborative multi-agency study compared two plot designs, two diameter methods, and remotely sensed data with ground data.

Outcome: Traditional ground-based inventory of mangrove forests can be difficult and time consuming. Tides, mud flats, prop roots, and tree densities impede foot travel. To mitigate these issues and improve data collection, the Southern Research Station initiated a collaborative study with the Florida Forest Service and the National Aeronautics and Space Administration (NASA) to test alternative methods for mangrove inventory. Consultation with Mexico's National Forestry Commission mangrove inventory provided the diameter method studied. Results support the following steps: (1) inventory a single point plot design to reduce extensive traverse involved with current

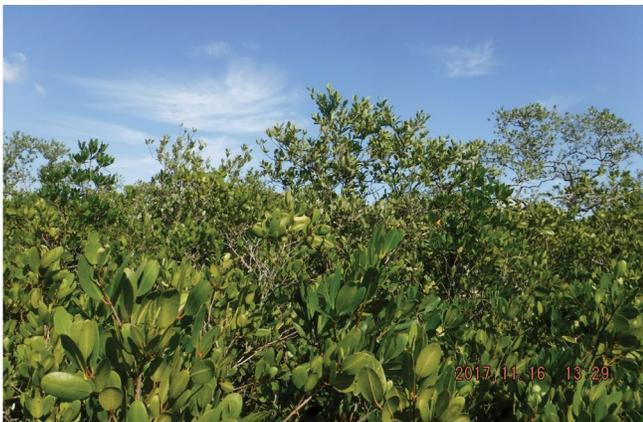


Figure 12. View across a mangrove forest canopy in south Florida. Photo courtesy of Florida Forest Service.

four-subplot design; (2) measure tree diameter at 1.0 feet above highest prop root when encountered at or above normal diameter at breast height, to alleviate difficult measurement at 3.5 feet above that point under current methods; (3) synchronize NASA flyovers of mangrove plot locations using global positioning system coordinates and Goddard LiDAR Hyperspectral Thermal airborne imaging to test viability of remotely sensed data to represent inaccessible mangrove plot locations in Florida. Partners: Jarek Nowak and Karen Cummins, Florida Forest Service; and Bruce Cook, NASA.

Contact: Mark J. Brown, mark.brown@usda.gov (SRS)

Brown, M; Nowak, J; Cummins, K; Schroeder, T; Cook, B. 2019. *Mangrove inventory comparisons, findings from multi-agency tests in Florida. Abstract in abstract book, at https://8749fb3b-6194-4f3a-baa0-47e2ca9d07b2.filesusr.com/ugd/462dcb_5c1470d1d8b443e8bd8d9235e90fc205.pdf*

Assessing the status of white oak advanced regeneration in forests of Kentucky and Tennessee

Accomplishment: An increase in the scientific knowledge on white oak regeneration enhances the assessment of the risk of decline of white oak (*Quercus alba* L.) forests. Research findings were presented at the 104th Annual Meeting of the Ecological Society of America; Louisville, KY; August 11-16, 2019. Abstract published in Conference Program.

Impact: A better understanding of white oak regeneration will assist forest management decisions to decrease the risk of current decline of oak forests in the Eastern United States. Much of this decline can be traced to maturing forests (succession), species replacement, cutting, and ineffective fire management.

Outcome: Findings revealed that even in those areas where white oak advanced regeneration was present, many stands showed densities of white oak saplings being too low for successful stand replacement after a disturbance (fig. 13). The study in oak forests of Kentucky and Tennessee found 255,320 ($\pm 16,722$ C.I.) ha (61 percent) with fewer than 500 accumulated white oak saplings ha⁻¹, an amount of vigorous rooted saplings considered adequate for successful stand replacement after disturbance. This means if these white oak stands were disturbed now, many would be in danger of not regenerating into a replacement white oak forest.

Contact: James F. Rosson, Jr., jim.rosson@usda.gov (SRS)

Rosson, J.F., Jr. 2019. *The status of white oak (Quercus alba L.) advanced regeneration in forests of Kentucky and Tennessee, USA. Abstract at <https://eco.confex.com/eco/2019/meetingapp.cgi/Paper/77523>*

Managing the FIA Program Nationally

The National FIA Program Office helps guide and coordinate the FIA field units in implementing the enhanced FIA program, and represents FIA for national and international efforts. Most of the National Office accomplishments include making presentations, preparing policy white papers and budget justifications, and providing input to reports for national and international organizations. Some of these accomplishments include:

- Led efforts to conduct and report FIA work by the field units more homogeneously across all regions and become a more accountable and efficient national program.
- Adopted the use of legally binding instruments, such as Material Transfer Agreement (MTA), Memorandum of Agreement (MOA) and Cooperative Research and Development Agreement (CRADA) to enter into future agreements between FIA and Federal and non-Federal collaborators. Adopting these instruments further protects FIA confidential information, such as plot location, personally identifiable information, and non-public corporate data, and to ensure the acknowledgment of the FIA program in products built with FIA data or FIA data derivatives.
- Provided budget coordination, briefing, and guidance for FIA field units.
- Collaborated with the Society of American Foresters and the National Council for Air and Stream Improvement in organizing two meetings: a national users group meeting for FIA partners, users, and research collaborators in Louisville, KY, in April 2019; and a National Woodland Owner Survey

meeting to better meet the information needs of FIA clients and stakeholders, hosted in September 2019 in Washington, DC.

- Facilitated one FIA management team meeting and dozens of briefings for internal and external partners, customers, collaborators, and supporters.
- Facilitated the Global Forest Resource Assessment (FRA) Advisory Group for the Food and Agriculture Organization of the United Nations, which focused on the Global Assessment for 2020.
- Worked with the Forest Service International Programs to provide inventory and monitoring technical expertise as needed.
- Served on the Federal Geographic Data Committee Land Use and Land Cover Theme, the Forest Service Information Management Advisory Board to identify FIA as a key agency program that is both externally and internally driven, and the Forest Service Geospatial Management Advisory Group to highlight key needs and authorities to implement FIA.

Contact: Mila Alvarez, Milagros.alvarezibanez@usda.gov

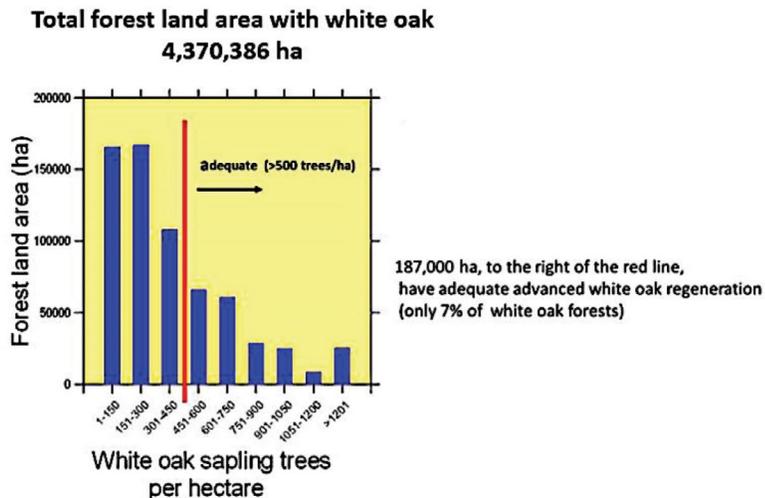


Figure 13. Forest land area of white oak advanced regeneration by density classes, Kentucky and Tennessee.

FIA Data Requests and Access for FY 2019

Spatial Data Services

The FIA Spatial Data Services (SDS) Team provides spatial data services to clients and operates as a virtual Spatial Data Services Center (SDSC), with staff located by FIA region throughout the country. In FY 2019, SDSC staff consisted of:

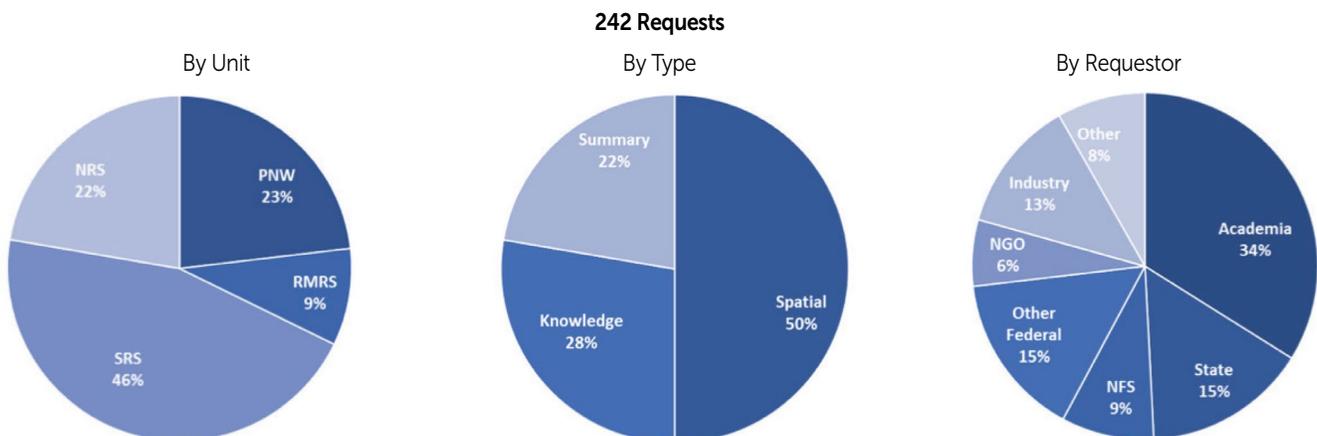
- Tom Thompson, National SDS Team Lead, PNW
- Liz Burrill and Justin Holgerson, NRS, National and Multi-Regional Projects
- Carol Perry and Tracy Roof, SRS
- Chris Toney and Karen Schleeweis, RMRS
- John Chase and Brett Davis, PNW

For most of FY 2019, Memoranda of Understanding (MOU) continued to be the agreement instrument used to establish a framework for cooperation for those clients whose access to the confidential data was critical for the project and the project clearly benefited FIA. By mid-summer 2019, FIA pioneered new legally binding instruments for transferring FIA data, such as the Material Transfer Agreement (MTA) and Memorandum of Agreement (MOA), to further protect confidential FIA data and ensure acknowledgment of FIA data, products, and work. The transition from MOUs to MTAs and MOAs put new agreements on hold for the last 2-3 months of the fiscal year because of the requirements to learn about their use and implementation within FIA, to process them administratively, and to update official policies and interim directives on the Forest Service handbook (planned to begin in 2020).

During FY 2019, FIA entered into new FIA data-sharing agreements (MOUs) with the University of Vermont, the University of Maryland, the University of Idaho, the University of Florida, the Research Foundation for the State University of New York, and the Oregon/Washington Bureau of Land Management Office, among others. FIA work continued with a variety of partners including: NASA, the U.S. Geological Survey, the University of Maine, the University of Maryland, the Cary Institute of Ecosystem Studies, other universities, and other non-FIA programs within the Forest Service.

In FY 2019, 242 requests were undertaken (fig. 14). National or multi-regional data requests accounted for 5 percent of all data requests. The number of data requests decreased from 503 requests from the previous year. Two reasons could explain this change. First, it was discovered this year that previous reporting differed among FIA regions, and the lower total may more accurately reflect spatial data requests and not a mixed total including nonspatial data requests. Second, as mentioned above, most units put new spatial data requests on hold for the last 2 to 3 months of the FY because of the transition to the new legally binding instruments adopted to enter into an agreement with the data requestor.

Spatial data requests are cataloged as one of three types: spatial, summary, or knowledge. Spatial requests are those where FIA spatial data are provided without additional analysis. Summary requests refer to FIA data aggregated for a specific geographic area(s). Knowledge requests are those that require additional spatial data analysis. Requests categorized as spatial types



FIA = Forest Inventory and Analysis; NFS = National Forest System; NGO = nongovernmental organization; NRS = Northern Research Station; PNW = Pacific Northwest Research Station; RMRS = Rocky Mountain Research Station; SRS = Southern Research Station.

Figure 14. Requests made to the FIA Spatial Data Services Center in 2019.

Table 4. Number of database retrievals using FIA web applications by fiscal year, 2003–2019.

Number of retrievals	Fiscal year										
	2003-2009 (Sum)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
	152,647	101,643	132,413	94,027	103,211	130,568	170,407	250,559	182,732	310,758	4,456,122

FIA = Forest Inventory and Analysis.

(fig. 14) increased as a percentage to 50 percent, with requests categorized as knowledge types increasing as a percentage from previous fiscal years, while summary type requests declined as a percentage of the total.

Academia continues to be SDSC’s largest client, with 34 percent of all new requests (fig. 14). Federal agencies (outside of the Forest Service) and States each accounted for 15 percent of requests. The Forest Service National Forest System comprised 9 percent of all requests.

Although the SRS continues to respond to the largest number of spatial data requests, 46 percent of the total (fig. 14), the unit continued to experience a downward trend since FY 2015, when SRS responded to 74 percent of all the data requests.

Web Tools and Use

The FIA program has come a long way since the FIA Data Base Retrieval System (DBRS) was introduced in 1996, allowing the public to query regional FIA data sets in Eastwide/Westwide format. Since then, a variety of web tools have been developed and retired, including the 2002’s Forest Inventory Mapmaker program (retired in FY 2009) and the 2008’s Forest Inventory Data Online (FIDO) tool (retired in FY 2018), to make way for the next generation of data retrieval programs. In FY 2015, a new tool was developed as a partnership between the NFS and FIA, the Design and Analysis Toolkit for Inventory and Monitoring (DATIM). DATIM 6.0 was released in January 2017 with public access and had 5,129 hits in FY 2019. An additional tool released in FY 2016 was the EVALIDator application programming interface (API), allowing users to enter hypertext markup language (HTML) to query the database. The number of database retrievals in 2019 reached 4,456,122 (table 4). This large increase over previous years’ totals is due to the high number of hits to the EVALIDator API as new data dashboard applications were developed and released.

In 2019, there were 2,194 queries of the NWOS database.

The number of Zip files users have downloaded from FIADB tables has steadily increased from 18,026 in 2010 to 436,119 in 2019.

The National Reporting and Data Distribution team continues to provide webinars and in-person trainings on our web tools and documentation for FIA’s publicly available data. In FY 2019, training and presentations on DATIM and FIA online tools included six different trainings offered—both virtual and in-person.

Consultations by FIA Staff

From FIA’s early days, consulting with the public has played a large part in how FIA conducts business. Consulting in 1930 meant face-to-face interaction with landowners or forestry professionals or answering handwritten questions received in the mail. While the interactions between customers and FIA may have changed, the reasons remain the same. The amount of information (both data and analyses) made available on the web continues to increase as customers demand more and varied information from the FIA data and analyses. Questions pertaining to a single administrative unit (e.g., a single State or national forest) are often referred to partners within that administrative unit (e.g., State foresters and National Forest analytical staff) who can often provide better context and better customer service. When questions span multiple administrative units, FIA staff assist the customer with finding an answer. FIA does not compete with private-sector consultants; rather, we answer questions about our methods and help customers (including private consultants) use FIA data to answer their own or their clients’ questions.

A significant consultation is defined as any dialog with a customer outside of FIA that requires more than 1 hour to address and that is not part of the normal course of business in collecting, analyzing, and reporting on FIA information. Historically, consultations have fluctuated slightly from year to year, depending on outside broader interests while showing regional variations. Since 2006, consultations with other government agencies, such as other Federal or State agencies, accounted for 14 percent of the time, remaining the most consistent major client nationally. This would also include any internal discussions within the Forest Service.

In 2019, FIA staff collectively addressed 950 significant consultations which required 7,764 staff hours to complete (table 5)—equivalent to 3.7 full-time staff years. Consultations

with government agencies accounted for 47 percent, while other major client groups included academic (18 percent), nongovernmental organizations (18 percent), and industry (10 percent). Appendix table B-6 shows the number of significant consultations that FIA staff provided in FY 2019, by unit and by type of customer.

Table 5. Number and hours of significant consultations by FIA staff, by customer group, FY 2019.

Customer group	Number	Percent	Hours	Percent
Academic	167	18%	797	10%
Government	448	47%	5,354	69%
Industry	98	10%	459	6%
NGO	167	18%	735	9%
NIPF	17	2%	36	0%
Media	40	4%	98	1%
Other	13	1%	285	4%
Total	950	100%	7,764	100%

FIA = Forest Inventory and Analysis; FY = fiscal year; NGO = nongovernmental organization; NIPF = nonindustrial private forest landowner.

FIA Program Features for FY 2019

National Inventory and Monitoring Applications Center

The National Inventory and Monitoring Applications Center (NIMAC) is responsible for providing national technical assistance on planning, conducting, processing, and analyzing forest inventories to FIA's broad range of customers, which include NFS, other Federal agencies, State governments, and other countries.

National Forest System Collaboration. NFS and FIA continue to fund NIMAC to develop DATIM. The design tool helps identify the range of inventory information needs, sampling designs (including intensification of FIA samples), and the development of monitoring plans as required by the 2012 Planning Rule. DATIM enables NFS to quickly analyze an enhanced form of FIA data that better serves their needs by adding NFS attributes computed using the Forest Vegetation Simulator (FVS). These analyses can be spatially customized using geographic information system (GIS), which can also be used to incorporate map attributes into analytical queries. DATIM training is offered via online training modules, webinars, and in person at select regional and national meetings. In October 2019, version 11.1 was released, with subsequent versions already in development. DATIM is publicly available at: www.fs.fed.us/emc/rig/DATIM/index.shtml.

With support from NIMAC, the NFS Southern Region devised intensification plans for about one-half of the national forests in the region. Similarly, the NFS Eastern Region intensified the FIA sample on all forests. The Southern and Eastern Regions are interested in working with the existing and intensified FIA data to develop status and trend reports for all national forests. The NFS Northern Region and Intermountain Region have collaborated with RMRS FIA, and the NFS Alaska Region has partnered with PNW FIA to further expand current FIA protocols to include collecting information on all land types, not just the forested portion. These regions are using an intensification system that integrates with the FIA base data, yet enables the regions to use NFS applications to collect intensified data and store them in FSveg, the NFS vegetation database.

Based on feedback from the nine NFS regions, FIA is meeting many of the needs of NFS partners. The development of streamlined vegetation and DWM protocols for use on all plots has helped the Western Regions define and collect a consistent set of regional variables on NFS lands to meet their needs. More effort is needed in getting FIA data from NFS lands into the hands of NFS staff and in developing data presentations, analyses, and reports tailored to the specific needs of NFS

managers. The DATIM developers are working to help automate this process and to create a more comprehensive and accessible database that will support shared stewardship. FIA will continue to work on these issues in FY 2020.

Fish and Wildlife Service Forest Inventory. NIMAC is working cooperatively with the U.S. Fish and Wildlife Service (FWS) Northeast Region to conduct forest inventories on a number of refuges. NIMAC provides assistance in forest inventory design and implementation, which varies among refuges depending on information needs and available resources. To date, completed or ongoing inventory work has been conducted on 13 refuges (Moosehorn, Umbagog, Great Dismal Swamp, Wertheim, Assabet River, Chincoteague, Rhode Island Refuge Complex, Iroquois, Patuxent, Canaan, Oxbow, Mashpee, and Aroostook), with additional refuges being added in future years. To support data analysis, NIMAC/FWS has developed analytical tools that assist in assuring data quality as well as producing statistically rigorous estimates and their sampling errors for a variety of attributes. The outputs are provided in both tabular and graphic formats for ease of interpretation. The results of these assessments are valuable for refuge managers to provide information that supports management and policy decision-making. Additional work is being undertaken to develop a monitoring protocol and analysis system that will accommodate evaluations of change on remeasured plots.

State Agency Technical Assistance. NIMAC has collaborated with several State agencies to pursue forest inventory endeavors. Completed projects include partners such as Kansas Forest Service, Nebraska Forest Service, South Dakota Department of Conservation of Environment and Natural Resources, North Dakota Forest Service (collectively under the Great Plains Initiative), and Massachusetts Department of Conservation and Recreation. Long-term ongoing projects include development and implementation of continuous forest inventories (CFI) on State-owned lands, as conducted by Missouri Department of Conservation, Indiana Department of Natural Resources, and Wisconsin Department of Natural Resources. For each CFI, NIMAC assisted in development of the inventory design as well as field guide preparation and associated data recorder software tailored to the plot measurement protocols. When the field work is completed each year, NIMAC conducts quality assurance checks and processes the data to add computed attributes such as tree volume and biomass. These data are then distributed back to the State agency via a customized version of the FIA PC-EVALIDator analytical tool, which allows State analysts to create the estimates for attributes that align with their specific information needs.

International Technical Assistance and Partnerships.

NIMAC is working cooperatively with the Forest Service International Program staff to assist partner countries that are developing forest monitoring systems. Assistance includes consultations, trainings, tool development, and transfer of FIA technology and institutional knowledge. In 2019, NIMAC worked with Mexico, Honduras, Colombia, Paraguay, El Salvador, Panama, Costa Rica, Peru, and Vietnam. NIMAC hosted a visiting scholar from Sierra Leone and helped develop a prototype forest monitoring system for that country. Technology transfer work is a multi-year commitment and will continue in 2020 with support from the Forest Service International Programs.

Urban Forest Inventory

Since the 2014 Farm Bill direction to assess the necessary resources to implement a nationwide inventory and monitoring of urban forests, FIA has inventoried cities, beginning with Baltimore, MD, and Austin, TX, in 2014, and expanding into 35 cities as of 2019. FIA continues its efforts to add more cities in the future as funding allows.

What is urban forest? Urban forests are the trees and other vegetation growing along streets and waterways, around buildings, in backyards and parks of our cities and towns. They are critical to the function and livability of these human habitats. For the purposes of FIA sampling, urban forests are those treed areas nested within U.S. Census core-based statistical areas (CBSAs, or metropolitan areas), urban areas and clusters (UAUC), and city/places. The distribution of urban areas is shown on the map in fig. 15.

Why monitor urban trees? Urban trees and natural spaces are critical to human health and well-being. Neighborhood trees moderate air and water pollution, reduce heating and cooling costs, and provide shade and shelter from the hot summer sun. Healthy trees can provide wildlife habitat and improve real estate values. Research shows that trees improve mental health, strengthen social connections, and reduce crime rates. Trees, parks, and other green spaces get people outside, helping to foster active living and neighborhood pride. We can all appreciate these benefits, and the more we know about the trees in our cities and towns the better we can nurture them and sustain their benefits. Yet, despite all their benefits and the need to know more about them, urban forests—unlike rural forests—have not previously been covered by a continuous comprehensive inventory and monitoring system.

What is the plan for Urban FIA? FIA will continue to add metropolitan areas as funding allows, with the goal of including all urban forests in the Nation, as directed in the FIA Strategic Plan. Once a city or urban area inventory within a State is initiated, it will continue to be measured in the future, just as

Table 6. Urban FIA plots by State and metro/urban area, FY2019.

State	Metro Area/Urban Area*	Plot count
CA	San Diego	23
CO	Denver, Colorado Springs, Front Range urban areas	31
CT	Bridgeport, Urban areas	58
DC	Washington, DC	26
DE	Dover, Urban areas	41
IA	Des Moines, Urban areas	51
IL	Chicago, Urban areas	162
IN	Chicago, Urban areas	5
KS	Wichita	30
MA	Providence, Urban areas	6
MD	Baltimore, Urban areas	74
ME	Portland, Urban areas	47
MI	Detroit, Urban areas	88
MN	Minneapolis, Urban areas	111
MO	Kansas City, Springfield, St Louis, Urban areas	162
ND	Fargo, Urban areas	37
NE	Lincoln	33
NJ	Trenton, Urban areas	112
NY	Buffalo, New York city, Rochester	142
OH	Cleveland	38
OR	Portland	45
PA	Philadelphia, Pittsburgh	101
RI	Providence, Urban areas	41
TX	Austin, Fort Worth, Houston, San Antonio	212
VA	Washington, DC, Urban areas	19
VT	Burlington, Urban areas	27
WI	Madison, Milwaukee, Urban areas	199
WV	Morgantown, Urban areas	47
Total		1,968

*Some metro areas / urban areas overlap State boundaries and are included more than once.
 Note: Table includes sampled plots and plots assessed through remote sensing analysis such plots located in water bodies. Totals do not match Table B-1, which only includes sampled plots.

traditional FIA plots are, thus creating a continuous inventory of the Nation’s urban forests.

- In 2019, statewide data collection started in Illinois, Michigan, and Missouri.
- In 2020, data collection is planned to start in Boston (MA), Columbus and Toledo (OH), Manchester (NH), Sioux Falls (SD), and the U.S. Virgin Islands.

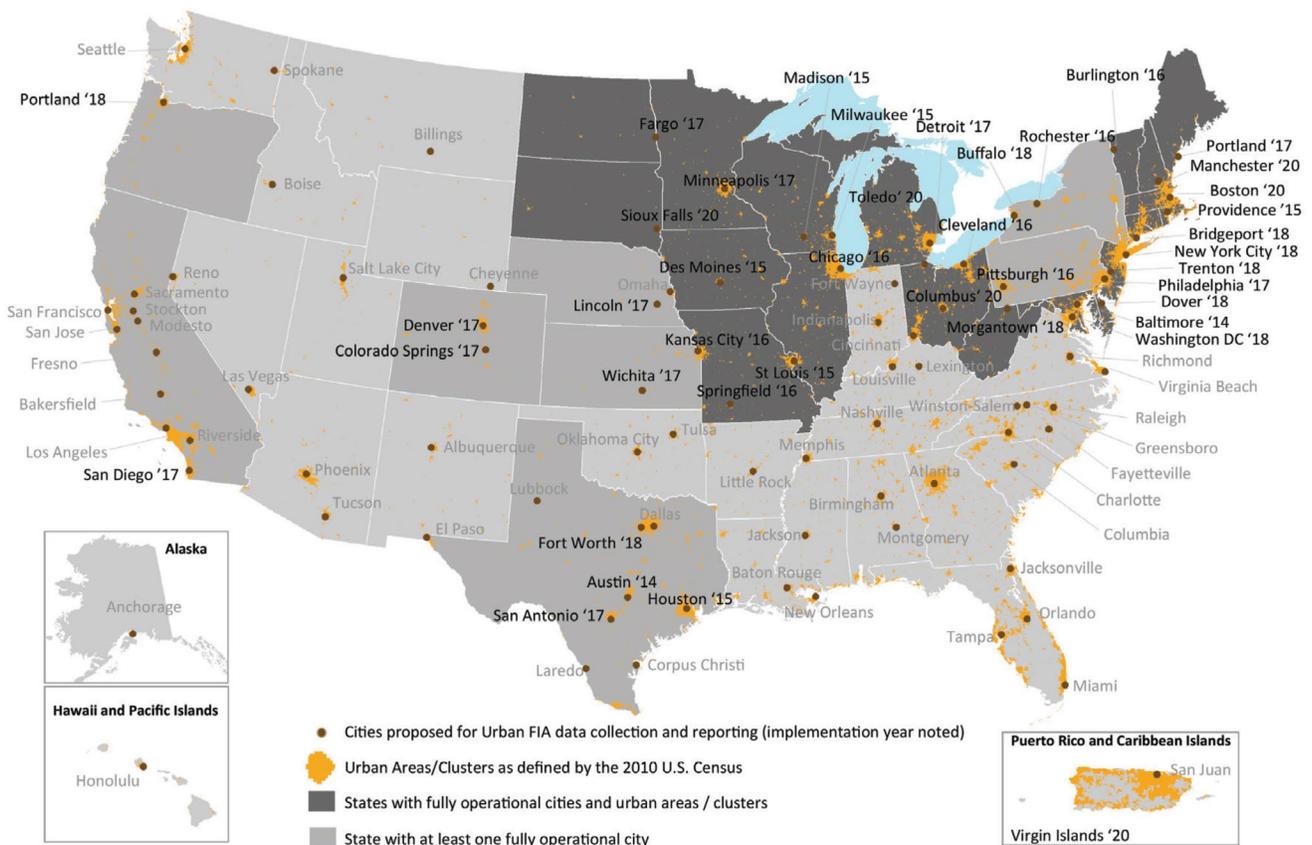


Figure 15. Urban forest inventory implementation status, FY 2019.

Forest Products and Utilization

FIA is charged with monitoring and reporting on the status, condition, and trends of all the Nation’s forests. Although plot-based field surveys provide most of this information, additional questionnaire and field-based surveys are conducted to report on Timber Products Output (TPO), fuelwood production, and characteristics and management objectives of the Nation’s private woodland owners. In FY 2019, 2,274 surveys were processed for mills and 9,920 for private woodland owners. About 132 utilization sites were visited (table B-8). Following is a brief overview of each survey type.

Primary mill surveys. FIA conducts TPO studies to estimate industrial and nonindustrial uses of roundwood in a State. To estimate industrial uses of roundwood, primary wood-using mills in a State are sampled. The sample may range from 40 percent to 100 percent, depending on partner contributions. TPO questionnaires are designed to determine location, size, and types of mills in a State; the volume of roundwood received by species and geographic origin; and the volume, type, and disposition of wood residues generated during primary processing.

Logging utilization studies. Logging utilization studies provide the information to convert TPO volumes to inventory volume. Utilization factors developed from the data translate a standard unit of product (1,000 board feet of sawlogs, one cord of pulpwood, etc.) into a common volume unit and type of tree harvested. Estimates are made of how much product came from sawtimber growing stock, poletimber growing stock, and nongrowing stock sources such as cull trees, dead trees, saplings, and limbwood. The overall process provides a cross-section of logging operations to characterize the sites logged, trees cut, products taken, and residues left behind.

More detailed information on forest products studies may be found in Dooley et al. (2015), Zarnoch et al. (2004), and Oswalt et al. (2014). Additional information and online data from all these surveys are available at www.fia.fs.fed.us.

Fuelwood surveys. Studies of fuelwood production from roundwood provide information to forest managers and users about the fuelwood harvest and its effect on the resource. The studies enable estimations of the amount and source of fuelwood

harvested from forest land, urban areas, fence rows, windbreaks, or other sources. No fuelwood studies were conducted in FY 2019.

Dooley, K.J.W.; Cooper, J.A.; Bentley, J.W. 2015. South Carolina harvest and utilization study. SRS-200. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 27 p. https://www.srs.fs.usda.gov/pubs/rb/rb_srs200.pdf

Oswalt, S.O.; Smith, W.B.; Miles, P.D. 2014. Forest Resources of the United States, 2012: a technical document supporting the Forest Service 2010 update of the RPA Assessment. Gen. Tech. Rep. WO-91. Washington, DC: U.S. Department of Agriculture, Forest Service. 218 p. https://www.srs.fs.usda.gov/pubs/gtr/gtr_wo091.pdf

National Woodland Owner Survey

It is ultimately the owners of the forest land, working within social, economic, and political constraints, who decide the fate of the forest. The FIA program conducts the National Woodland Owner Survey (NWOS) as a social complement to our biophysical forest inventory. The goals of the NWOS are to provide information about: who owns the forest, why they own it, what they have done with it in the past, and what they intend to do with it in the future. This information is used by forestry agencies, nongovernmental organizations, companies, educators, and researchers to design, implement, and analyze programs, services, and policies aimed at landowners.

The NWOS currently has three modules—Base, Corporate, and Urban—and two additional modules that are in development—Tribal and Islands. The Base NWOS is aimed largely at family forest ownerships and is implemented on an annual basis. The Corporate NWOS will be implemented every other year and is aimed at companies that own at least 45,000 acres of forest land across the United States. The Urban NWOS is aimed at residential landowners in urban areas, and annual implementation is occurring in Austin, TX; Baltimore, MD; Denver, CO; Portland, OR; St. Louis, MO; and Houston, TX. The Tribal NWOS will be developed in conjunction with Tribal organizations, and the NWOS Islands module is similar to the Base NWOS but is being customized for private landowners in the U.S. protectorates and territories.

i-Tree

i-Tree is a state-of-the-art, peer-reviewed software suite that provides urban and rural forestry analysis and benefits assessment tools worldwide. i-Tree tools can help strengthen forest management and advocacy efforts by quantifying forest structure and the environmental benefits that trees provide. Since 2006, i-Tree has been a cooperative effort between FIA, Davey

Tree Expert Company, The Arbor Day Foundation, Society of Municipal Arborists, International Society of Arboriculture, Casey Trees, and SUNY College of Environmental Science and Forestry.

The cumulative number of global i-Tree users has reached over 410,000 (fig. 16). In FY 2019, i-Tree added 90,000 new users worldwide, an increase of 28 percent from 2018 (fig. 17). The number of i-Tree eco-projects processed worldwide as of July 2019 totaled almost 9,000, with more than 5,000 in the United States (fig. 18). i-Tree eco-projects are required to collect and enter local tree inventory data for processing.

The cumulative number of U.S. users since the program's inception in 2016 total over 360,000. The five States with highest demand were Texas, Florida, Maryland, California, and Illinois (fig. 19).

In FY 2019, the i-Tree team worked on new developments, including:

- New international versions of i-Tree Eco for Colombia and South Korea, added to existing versions for Canada, Australia, Mexico, and Europe.
- Addition to i-Tree Eco of many individual city locations from around the globe.
- An updated and upgraded website that now uses a modern content management system for easier updates and mobile-friendly content delivery.
- i-Tree main web pages translated into Spanish and Korean.
- New i-Tree Canopy user interface and improvements, including hydrologic function estimates and ability to use included, standard boundaries (e.g., cities, census areas, etc.).
- Addition of many new i-Tree Landscape maps and high-resolution tree cover data.
- New report mapping functions in i-Tree Eco, as well as an improved tree inventory data importer from Excel, and new re-inventory capabilities.
- New mapping function in the i-Tree Mobile Data Collector for i-Tree Eco.
- Upgraded and improved estimates in i-Tree Design, Planting, and MyTree.
- Creation of a new i-Tree API (application programming interface) to standardize i-Tree benefit estimates across all official i-Tree tools, and allow third-party software developers to build official tree benefits estimates from i-Tree right into their own software tools.
- Release of i-Tree Cool River, which assesses the effects of riparian trees on stream temperatures.



Figure 16. Global i-Tree user distribution, 2006–2019.

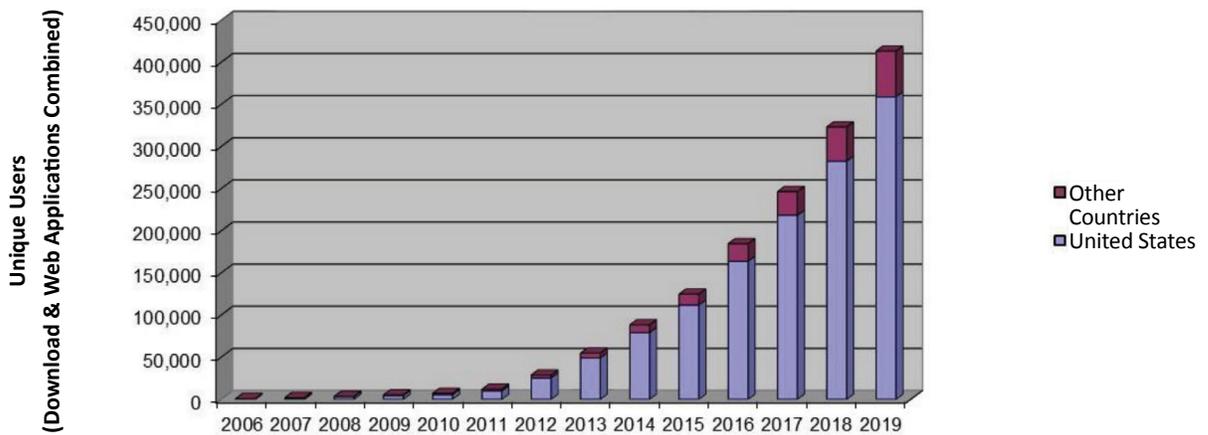


Figure 17. Cumulative i-Tree users by year, 2006–2019.

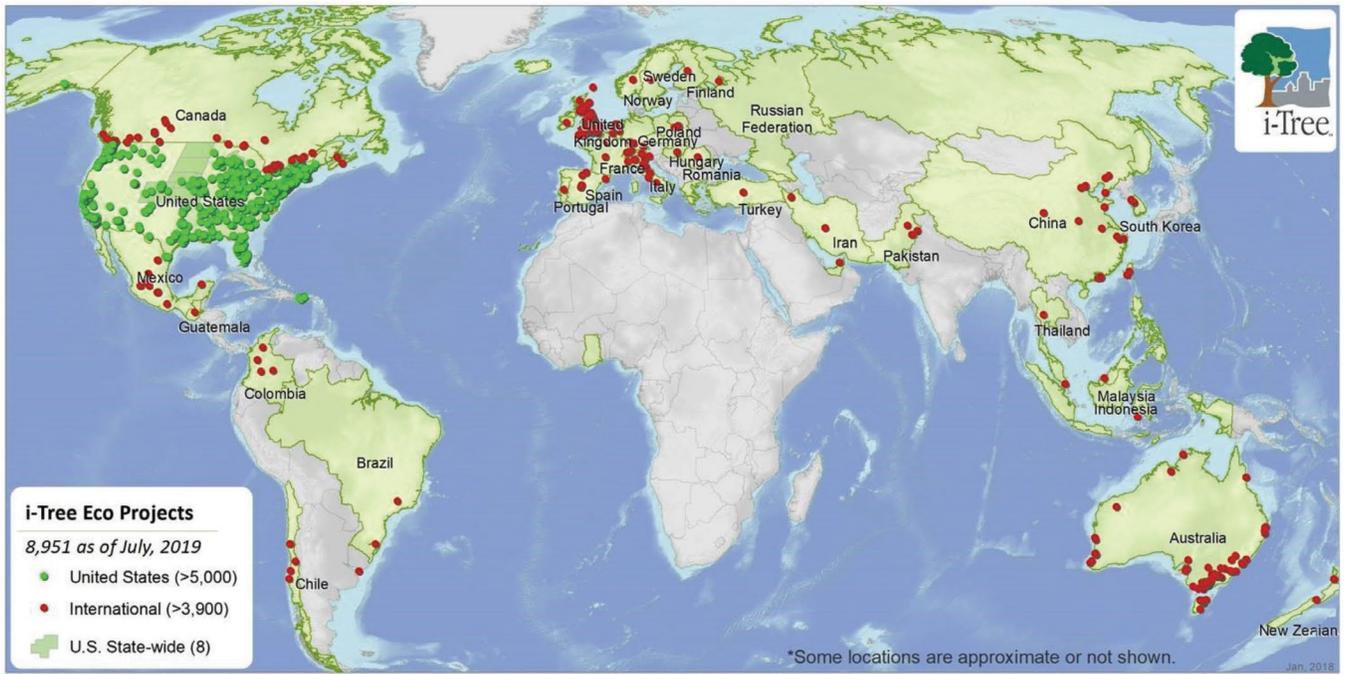


Figure 18. Distribution of i-Tree eco-projects processed as of July 2019.

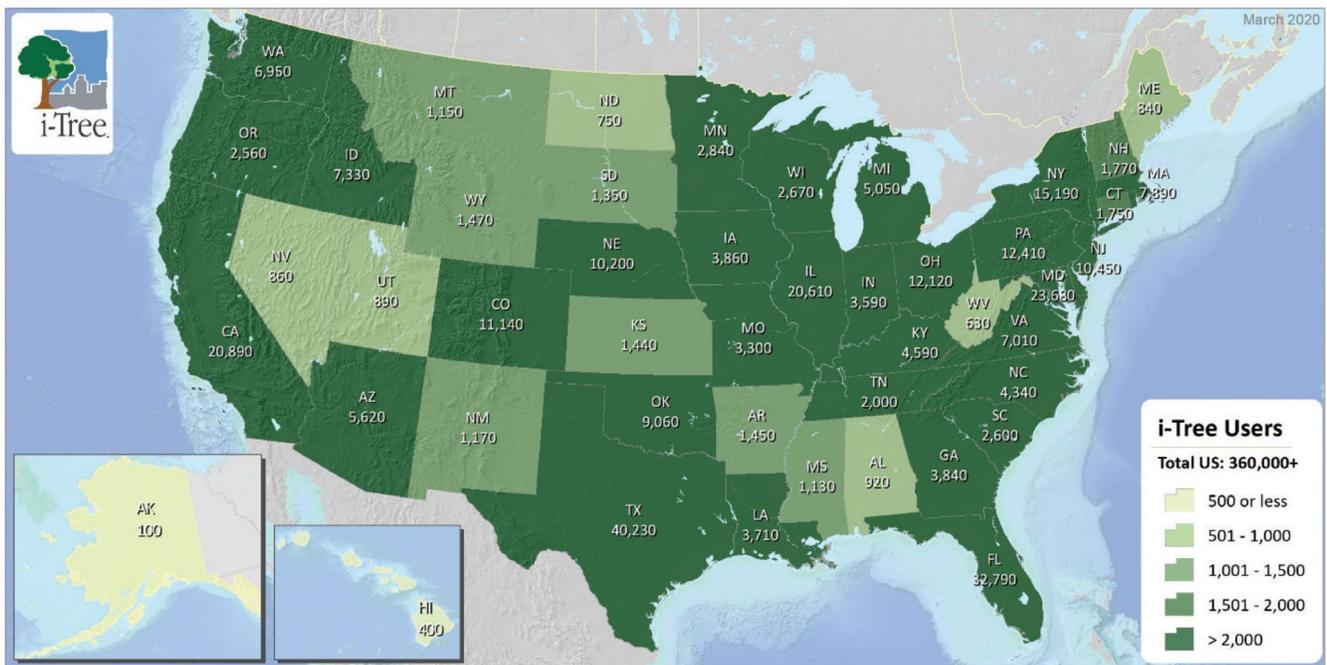


Figure 19. U.S.A. i-Tree usage and distribution, 2006–2019.

Ecosystem Health Indicator Surveys and Their Evolution

FIA began implementing a nationwide, field-based forest ecosystem health indicator monitoring effort in the 1990s, and it currently collects forest health measures in 47 States. Most indicators are well-documented in terms of sampling protocols, data management structures, and estimation procedures ([Bechtold and Patterson 2005](#)). Field data and indicators from most sample years are available online, with numerous analytical examples published both internally and externally. Field protocols associated with each indicator are available in the National Core Field Guide ([USDA Forest Service 2019](#)) and [field methods for forest health measurements](#).

Crown condition. Tree crowns are an important component of net primary production, and deteriorating foliage is a visible sign of stress that often precedes reduced growth and increased mortality. For this indicator, measurements are recorded on all sampled trees greater than 12.7-cm diameter at breast height, including uncompacted live crown ratio, crown dieback, and canopy position. The original crown indicator is described in [Schomaker et al. \(2007\)](#). The number of annual samples of the crown condition indicator has increased by 400 percent since 2012.

Vegetation profile. The vegetation diversity and structure indicator is designed to evaluate the composition, abundance, and spatial arrangement of all vascular plants and for assessing wildlife habitat, site productivity, and the effects of invasive species. The structure portion of this indicator measures the percent cover of vegetation life forms in varying height classes. For the more data-intensive part of this indicator, vegetation diversity, crews with previous botanical experience record both species and overall structural data for vascular plants, including their total canopy cover and cover in different height zones (0 to 2 m, 2 to 5 m, and more than 5 m). Specimens of species not readily identified in the field are collected for future identification by a specialist. The vegetation indicator is described in [Schulz et al. \(2009\)](#). The number of annual samples of the vegetation profile indicator has increased by 400 percent since 2012.

Down woody material. The DWM indicator is designed to estimate detrital aboveground biomass in the form of coarse woody debris, fine woody debris, litter, and duff pertaining to important fire, wildlife, and carbon issues. For this indicator, coarse woody debris (greater than 7.5 cm in diameter) is sampled on a series of transects across the plot totaling 15 m in length. Fine woody debris between 2.5 and 7.5 cm is sampled on a series of transects totaling 6 m in length. Fine woody debris less than 2.5 cm is sampled on a series of transects totaling 4 m in length. Duff and litter depth measurements are taken at 12 points located on the plot. The DWM indicator is described in

[Woodall and Monleon \(2008\)](#). The number of annual samples of the down woody material indicator has increased by nearly 700 percent since 2012.

Forest soils. Environmental stressors that interfere with soil function have the potential to influence the productivity, species composition, and hydrology of forest ecosystems. For this indicator, crews complete ocular estimates of the percentage and type of soil compaction or erosion, and they check for the presence of restrictive layers within the top 50 cm of soil. The crew then collects five soil samples—three forest floor samples to measure organic matter and carbon content, and a mineral soil core collected at two depths: 0 to 10 cm and 10 to 20 cm. Soil samples are sent to the laboratory immediately after collection and stored for future physical and chemical analysis. The soils indicator is described in [O'Neill et al. \(2005\)](#) and [Amacher and Perry \(2010\)](#). Due to the slow changes in soil characteristics, it is only sampled every other measurement.

Invasive plant species. This indicator assesses the percentage of cover and presence of select invasive plant species. The plants monitored vary by region and are determined based on their identification as species of regional concern on forested landscapes. The data collected provide information about presence and spread of invasive plant species, as well as changing growing conditions. Invasive plant species can affect ecosystem health by displacing native plants and altering wildfire risk, nutrient availability, and habitat suitability. These data help land managers and policymakers track the spread, abundance, and risk of these species in forests.

Lichen communities. Lichen communities. Long-term observation of epiphytic (i.e., tree-dwelling) lichen communities indicates changes in air quality, climate, and land use. For this indicator, field crews observe the presence of lichen species, estimate the abundance of each species, and collect specimens for identification by a specialist. Lichen community measurements are made within a 37-meter radius of each plot center (approximately 0.38-ha area). The lichen indicator is described in [Will-Wolf \(2010\)](#). This indicator is currently sampled in the PNW unit only due to funding shortfalls.

Other indicators. Other key indicators of forest health, such as tree mortality and growth and the abundance of invasive and nonnative tree species, are found in the basic plot data and subsequent remeasurements.

The evolution of FIA ecosystem health indicators. After nearly two decades of collecting, analyzing, and reporting on forest health, FIA updated its sampling techniques with flexible spatial and temporal intensities for some indicators to improve field operation efficiency, address emerging user demands, and adjust to evolving forest health science.

The new enhanced forest indicators are DWM, vegetation profile, invasive plant species, and crown conditions (included, but not separate, in appendix table B9). They were implemented in FY 2013 in a “Phase 2 Plus Program/Ecosystem Indicator Program” (P2+). The P2+ sampling scheme facilitates the collection of a national core set of indicator information on more plots for less cost than the original indicator protocols, with sampling based on a systematic subsample of each subpanel that can change in response to budgetary fluctuations (i.e., flexibility) without compromising long-term analytical capabilities. Although the enhanced indicator protocols collect less detailed information on each sampled plot, substantially more plots are sampled, increasing the statistical power of forest health analyses and improving the reliability of estimates in important national assessments. For example, the number of samples in the DWM indicator has increased to a nearly 7x intensity sample, whereas crown condition and vegetation diversity has increased to approximately a 4x intensity sample.

These changes represent a continuation of efforts to enhance efficiencies and adapt for the future while continuing to meet customer needs. The integrated Enhanced Forest Indicator Program continues to deliver a comprehensive survey of forest biomass, carbon pool, and ecosystem health data, while also working to integrate our tools and systems with those of our clients.

Amacher, M.C.; Perry, C.H. 2010. *The soil indicator of forest health in the Forest Inventory and Analysis Program.* In: Page-Dumroese, D.; Neary, D.; Trettin, C., tech. eds. *Scientific background for soil monitoring on national forests and rangelands: workshop proceedings.* Proc. RMRS-P-59. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 83–108.

Bechtold, W.A.; Patterson, P.L., eds. 2005. *The enhanced Forest Inventory and Analysis program—national sampling design and estimation procedures.* Gen. Tech. Rep. SRS-80. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 85 p.

O’Neill, K.P.; Amacher, M.C.; Perry, C.H. 2005. *Soils as an indicator of forest health: a guide to the collection, analysis, and interpretation of soil indicator data in the Forest Inventory and Analysis program.* Gen. Tech. Rep. NC-258. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 53 p.

Schomaker, M.E.; Zarnoch, S.J.; Bechtold, W.A. [et al.] 2007. *Crown condition classification: a guide to data collection and analysis.* Gen. Tech. Rep. SRS102. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 78 p.

Schulz, B.K.; Bechtold, W.A.; Zarnoch, S.J. 2009. *Sampling and estimation procedures for the vegetation diversity and structure indicator.* Gen. Tech. Rep. PNW-GTR-781. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 53 p.

U.S. Department of Agriculture, Forest Service. 2018. *Forest Inventory and Analysis national core field guide. Volume I: Field data collection procedures for phase 2 plots. Version 8.0.* Washington, DC: U.S. Department of Agriculture, Forest Service, Forest Inventory and Analysis. https://www.fia.fs.fed.us/library/field-guides-methods-proc/docs/2018/core_ver8-0_10_2018_final.pdf

Will-Wolf, S. 2010. *Analyzing lichen indicator data in the Forest Inventory and Analysis program.* Gen. Tech. Rep. PNW-GTR-818. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 62 p.

Will-Wolf, S.; Jovan, S. 2008. *Lichens, ozone, and forest health—exploring cross-indicator analyses with FIA data.* In: McWilliams, W.; Moisen, G.; Czaplowski, R., eds. 2008 *Forest Inventory and Analysis symposium.* Proc. RMRS-P-56CD. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Woodall, C.W.; Monleon, V.J. 2008. *Sampling protocols, estimation procedures, and analytical guidelines for down woody materials indicator of the Forest Inventory and Analysis program.* Gen. Tech. Rep. 22. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 68 p.

Special Partnerships Spanning Cultures

In FY 2019, there were a total of 573 Federally Recognized Tribes on 326 federally designated Indian reservations. Reservation lands are reserved for Native use under treaty or another agreement with the United States, executive order, Federal statute, or an administrative action.⁸ An estimated 56.2 million acres are held in trust by the United States, with an estimated 18 million acres of Tribal forest lands located on 305 reservations. Tribes need a broad spectrum of information, from timber to fuel loading, water quality, wildlife habitat to surveys of forest stewardship objectives.

A commitment of government-to-government relationship with Tribes, FIA is committed to assisting Tribes in assessing resource status, historical conditions, resource availability, and regional context for Tribal forests.

⁸ Note: Information obtained from the U.S. Department of the Interior, Bureau of Indian Affairs, www.bia.gov.

In the South, the SRS FIA Program, Bureau of Indian Affairs-Cherokee Agency (BIA-CA), Eastern Band of Cherokee Indians (EBCI), and the Oconoluftee Job Corps Civilian Conservation Center (OJCCCC) had a mutual interest in coordinating activities on Tribal land, mobilizing funds for resource management, and developing Tribal workforce through: sharing staff and staff expertise, providing resource skills training and on-the-job experiences, expanding the range of training opportunities through mentoring, and encouraging and supporting entry into new forestry careers by their younger Tribal members and other ethnic minorities. In FY 2019, the FIA partnership with BIA-CA forestry, EBCI, OJCCCC, and students supported forestry and natural resource Tribal needs, provided training, and helped manage the Qualla Boundary (Cherokee, NC) and other Tribal lands in the South. Some of these accomplishments include:

- FIA work with BIA-CA, EBCI and OJCCCC to help with the backlog of timber sales on EBCI lands by cruising timber and preparing timber sales requested by Tribal members.
- The completion of completed 39 monitoring missions by FIA field crews and OJCCCC students to determine the presence of various endangered bat species and to comply with forest management plans and NEPA requirements necessary for the harvesting of trees and clearing of the land for housing sites.
- FIA training to BIA-CA forestry staff, EBCI staff, OJCCCC Tribal and other ethnic students in areas of timber cruising, sale preparation, species identification, GPS mapping, GIS applications, and other natural resource management areas.
- FIA meeting with BIA-CA forestry staff and EBCI staff to discuss timber surveys and their contribution to a better understand of the existing natural resources in their Tribal (trust) lands.

On August 13, 2019, SRS FIA field staff received Certificates of Appreciation by the Superintendent of BIA-CA, William McKee, and a Cherokee ceremonial flute by EBCI Council Member Bo Crow.

In other regions, accomplishments included:

- Ongoing partnership with the Tanana Chiefs Conference and Alaska Native Corporations to implement forest inventory in Interior Alaska.
- Continuing to create custom databases for the Quinault Indian Nation and Sealaska Corporation in Alaska and Tribal lands in Nevada.
- Ongoing partnership with native Pacific Islanders to conduct inventory and monitoring work in the tropical Pacific Islands.
- Ongoing partnership with Ojibwe Tribes of the Great Lakes to assess the supply and quality of large paper birch within the territories ceded in the treaties of 1836, 1837, 1842, and 1854.

- Ongoing work to model a better representation of Tribal forests in the Great Lakes area.

Program Safety

FIA Program Safety has come a long way from the early days (fig. 20). In the 1930s, FIA field crews would travel many miles with large packs on their backs, ford rivers, and stay in unheated hunting shacks. It was not uncommon for injured field crew members to render first aid to themselves, stitching their own leg and arm gashes or creating a splint for their own broken bones. The field crews of today are equipped with mobile phones, InReach devices, hardened tablets, and satellite phones. The number of Job Hazard Analyses (JHAs) for field and office staff have multiplied since 2006 to include Boat/Canoe Safety, Working Alone, and Urban Field Collection. The emphasis on personal protective equipment has evolved from none in the 1930s to wearing hard hats, safety goggles, gloves, safety boots, carrying aerosol sprays for wild and domesticated animals, and tinted eyewear for office work (fig. 21). Office training has also evolved. Today, office safety focuses on workstation ergonomics, travel safety, and training on active shooter, sexual harassment, bullying, cybersecurity, first-aid, use of cardiopulmonary resuscitation (CPR) and automatic external defibrillator (AED), and preparedness for earthquakes, lightning strikes, and other weather disasters. For those who travel internationally, additional security training is required.



Figure 20. Two field crew members on Larsen Lake in Itaska County, MN, August 1934. USDA Forest Service historic photo.

FIA employees across the national program are active in their local and station-level safety committees and have been instrumental in getting the word that “Being Safe is Cool!” From newsletters to safety challenges to awards, active safety committees have changed the culture of FIA, making safety the number 1 priority. Safe practices in the field with check-in/ check-out for field and office and hiring full-time dispatchers are now the norm.

The 2011 safety initiative continues to sustain the core value of work and life, allowing employees to take responsibility for their own safety. Hard work and remaining diligent on safety have paid off. Since 2016, the total number of reported vehicle accidents have been 5 or fewer (fig. 22) and the total number of work-related injury or illness have been 10 or fewer for the entire FIA program (fig. 23). Table 7 summarizes the program’s safety record for FY 2019.



Figure 21. Sjana Schanning, Ecologist, USDA Forest Service, Northern Research Station, in full safety gear in Richland County, WI, 2015. USDA Forest Service photo.

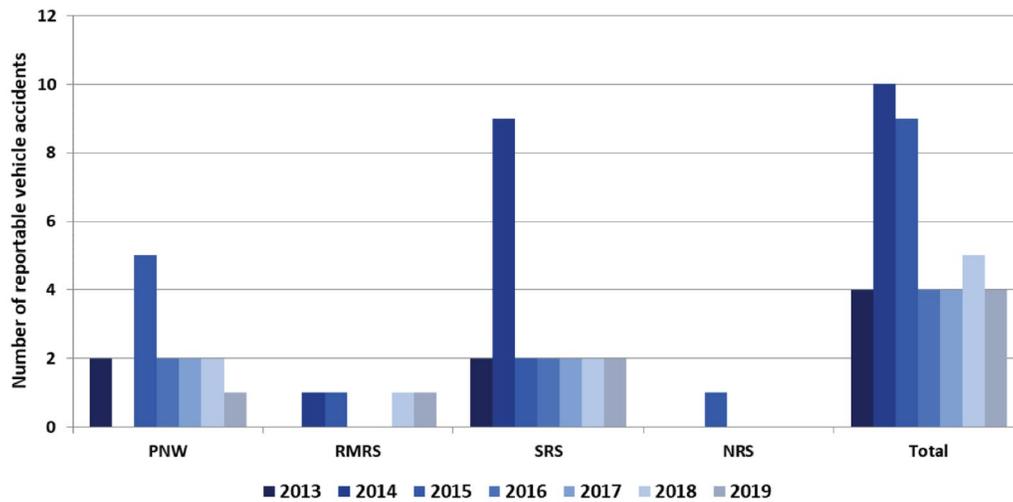
Table 7. FIA program Federal employee estimates for hours worked, miles driven, aircraft hours flown and safety incidents reported, FY 2019.

Category	FIA Unit					Total
	PNW	RMRS	SRS	NRS	WO	
Base data						
Federal FTE equivalents ^a	86	106	90	98	2	382
Total estimated hours worked ^b	177,959	220,688	188,074	202,800	4,160	793,681
Total vehicle miles driven	292,253	562,918	706,284	595,216	0	2,156,671
Total flight hours logged	596	12	0	0	0	608
Recordable incidents by class						
Time lost illness/injury incidents	3	2	1	0	0	6
Motor vehicle accidents	1	1	2	0	0	4
Aircraft accidents	0	0	0	0	0	0
Safety incident frequency rate						
Time lost illness/injury rate per 100 FTEs	3.5	1.9	1.1	0	0	1.6
Motor vehicle accidents per million miles driven	3.4	1.8	2.8	0	0	1.9
Aircraft accidents per 100,000 flight hours	0	0	0	0	0	0

^aBased on appendix table B-3 number of Federal employee estimated full time equivalents (FTE).

^bBased on appendix table B-3 number of Federal employees times 2,080 hours per FTE, small percentage of overtime not included in estimate.

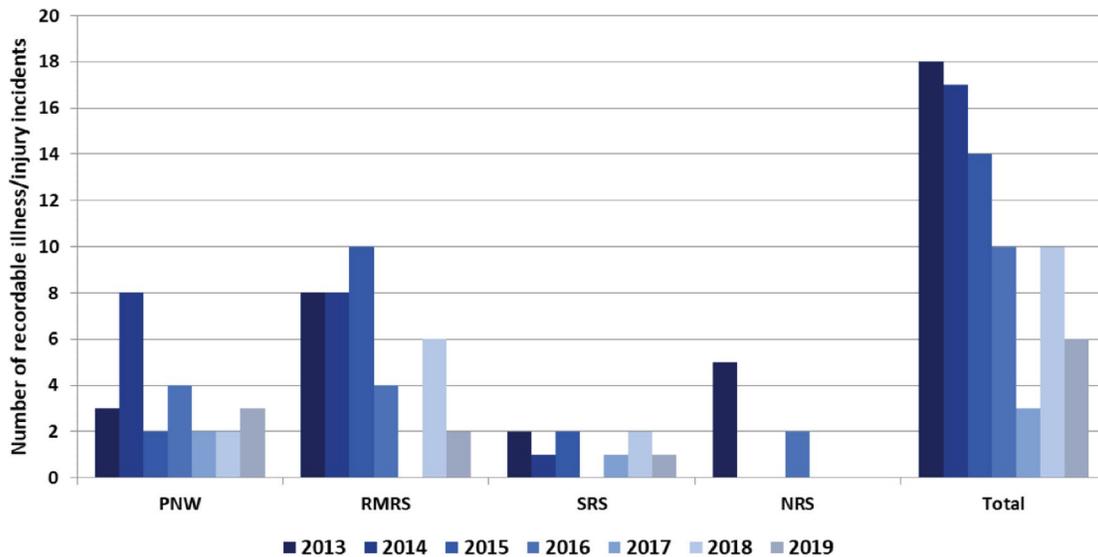
FIA = Forest Inventory and Analysis; FTE = full time equivalent; IW = Interior-West; NRS = Northern Research Station; PNW = Pacific Northwest Research Station; SRS = Southern Research Station.



FIA = Forest Inventory and Analysis; FY = fiscal year, NRS = Northern Research Station; PNW = Pacific Northwest Research Station; RMRS = Rocky Mountain Research Station; SRS = Southern Research Station.

Note: Any occurrence involving the use of a Government-owned or Government-leased motor vehicle (automobile, truck, or bus) that results in a total combined damage of \$1,500 or more. This definition also applies to privately owned vehicles when used on official Government business.

Figure 22. Number of motor vehicle accident incidents by Unit, 2013–2019.



FIA = Forest Inventory and Analysis; FY = fiscal year; IW = Interior-West; NRS = Northern Research Station; OSHA = Occupational Safety and Health Administration; PNW = Pacific Northwest Research Station; SRS = Southern Research Station.

Note: Work-related injury or illness resulting in any of the following: death, days away from work, restricted work or transfer to another job, medical treatment beyond first aid, and loss of consciousness.

Figure 23. Number of OSHA recordable cases by unit, 2013–2018.

Regional Safety Highlights for FY 2019

Northern Research Station FIA Safety Highlights

- The Data Collection crew continued to work hard to maintain safe driving practices. They collectively drove over 595,216 miles safely with no traffic accidents and only a few instances of minor cosmetic damage to vehicles.
- The Safety and Health Committee (composed of field, office, and management staff) continued to ensure staff is current on all safety and health-related trainings. In addition to monthly meetings, they annually reviewed JHAs documents to incorporate the changing needs of the office and field staff. The NRS Safety Plan was updated this year as well.
- Held a second Bystander Intervention Training for the Data Collection crew. The training reinforced ways to identify common tactics of sexual harassers and bullies. It introduced new tactics to intervene safely using the Direct, Distract, Delegate, Delay method.

Pacific Northwest Research Station FIA Safety Highlights

- Conducted the defensive driving training for data collectors. The 4-day training included a “Driving Rodeo” that provided hands-on experience practicing specific driving maneuvers on backcountry roads.
- Completed station’s annual Safety Survey of program employees with 66 responses— among the highest response rates achieved since inception in 2012.
- The Alaska Data Collection Team used the daily morning briefings to discuss, track, and report safety issues.
- Data collection teams in California, Oregon, and Washington continued to support the “Safety Challenge of the Month” program. Challenges in the 2019 field season included an informative video about how stress affects the body physiologically (<https://www.youtube.com/watch?v=RcGyVTAoXEU>) and a Google Form test of knowledge for all things related to vehicle maintenance.
- Supported a safety-buck program to recognize actions promoting health, safety, and wellness.
- Provided standing desks and other ergonomic office furniture for employees in our offices.
- Data Collection teams provided regular CPR, Wilderness First Aid, and Wilderness First Responders training to staff.
- Recorded and analyzed 182 Near Misses in FY 2019.

Rocky Mountain Research Station FIA Safety Highlights

- Continued to advance employee safety, health and wellbeing by utilizing an integrative approach to reducing environmental, organizational, and psychosocial risk factors in the workplace and reevaluating risks previously considered unrelated to work such as work-related risk factors for sleep disorders.
- Continued difficult conversations related to the access to plots that present challenges for data collection—a topic that has long been a concern but has been emerging lately as increasingly important.
- Developed a conversation starter by the safety committee to help employees and supervisors in deeper dialog, context, and understanding surrounding safety decisions made in the field.
- Researched various questions that arose from training, such as, “How long is that dead tree going to stand, and is it going to fall on me?” and reported the answers back to employees.
- Increased awareness and use of the free benefits provided through the Employee Assistance Program such as financial assistance, legal assistance, short-term counseling, and regular wellness webinars on topics such as burnout and handling stress.
- Continued the use of the Careful Chronicle, a monthly total worker health newsletter that included SOS—Sharing Our Stories of near misses, near hits, incidents, and injuries—as well as relevant safety, health and wellbeing information throughout the year.
- The program manager and data collection team leader, both standing members of the safety committee, attended all eight safety committee meetings, along with other data collection and office staff representatives.
- The safety manager and multiple team leaders worked alongside field employees to experience safety concerns firsthand and strengthen relationships and trust.
- Updated and modernized the Check-in/Check-out guidelines and began utilizing InReach devices in new ways to allow employees multiple methods of check-in/out (calls, texts, emails).
- Hosted regular meetings to evaluate new and existing field technology and gear.

Southern Research Station FIA Safety Highlights

- Improved communications in the field by transitioning from the SPOT SEND device to the Garmin In-Reach SE SEND device. This change provided a great technology improvement to the FIA field employees by providing two-way communication between field employees and up-to-date weather information, maps, and continuous location tracking.
- The FIA Safety Committee oversaw the production of an emerging newsletter to bring more safety ideas, reminders, and potential issues to our employees. Due to this initiative, bow saws were provided to the field crews to clear trees, branches, and other vegetation as needed to access field plots.
- Updated the SRS FIA safety charter to remain current and ensure duties were met.
- In collaboration with SRS headquarters, developed an Off-Road JHA for the Station using driving experiences unique to SRS FIA.
- Updated the SRS FIA Occupant Emergency Plan and Safety and Health Plan. Additionally, SRS FIA began looking at JHAs in order to transition them to Risk Assessments.
- Replaced all SRS FIA automatic external defibrillators in Knoxville with fully automatic AEDs and provided related training on CPR, first aid and AED.
- Hosted an annual training meeting in August where the Tennessee Wildlife Resource Agency provided boating training. Information on off-road driving skills, tactics related to getting a vehicle out of different situations, and solutions on minimizing windshield cracks were discussed.
- Elected a new chair and vice-chair for the SRS FIA Safety Committee.
- Updated the winch policy and placed a placard in government official vehicles to help with understanding policy for use of the fleet fuel cards. Placards improved getting vehicle repairs, towing, and fueling completed in a timely manner.
- Revised the SRS FIA ongoing tick collection efforts in collaboration with the University of Tennessee

Portfolio Leads Business Plan Updates

FY 2018 Plans with FY 2019 Accomplishments and FY 2020 Plans

Interior Alaska Inventory: Business Plan Update

In the FY 2018 business report, we said that in FY 2019 we would—	In FY 2019, we—	In FY 2020, we will—
Surveying Interior Alaska		
Continue field inventory moving to the Susitna/Copper unit to begin forest measurement operations there.	Initiated and completed three-quarters of the field inventory in the Susitna-Copper unit of Interior Alaska.	Complete field inventory of the Susitna-Copper unit and initiate inventory in the Southwest unit, the third unit of six in the Interior inventory.
Continue NASA/FIA G-LiHT acquisition in new areas of Interior Alaska.	Began NASA/FIA-G-LiHT acquisition in the Southwest unit and completed acquisition in the Susitna-Copper unit.	Continue NASA/FIA G-LiHT acquisition in new areas of the Southwest unit.
Continue transition to higher-precision global positioning systems for field plot integration with remotely sensed data.	Adapted use of higher-precision global positioning systems on all 2019 field plots.	Build on relationships with other Federal agency partners including U.S. Fish and Wildlife Service and the National Park Service, and regional/village Alaska Native groups in preparation for increased field inventory activities on their lands in upcoming years.
Develop estimators utilizing G-LiHT data with field plot data, including peer review and publication of the methods.	Continued developing estimators incorporating G-LiHT data with field plot data in preparation for publishing Tanana data.	Continue outreach activities with local communities and partners.
Enhance outreach with Alaska Native communities, universities, and other partners for training, conducting, and analyzing inventory information.	Continued outreach opportunities within Interior Alaska including wrapping up a Citizen Science project with University of Alaska and a school in the Tanana unit, hosting a forests and community session at the Alaska Forum on the Environment, and numerous other outreach events and activities in Interior Alaska FIA hub communities.	Publish Tanana unit data collected from 2014 to 2018, making it available for public use.
Process the data and estimators of the Tanana unit through quality assurance and quality control protocols.		

NASA = National Aeronautics and Space Administration.

Timber Products Output: Business Plan Update

In the FY 2018 business report, we said that in FY 2018 we would—	In FY 2019, we—	In FY 2020, we will—
Publishing Timber Products Output Reports and Fact Sheets		
Publish TPO reports for Alaska, Idaho, and Montana.	Submitted TPO reports for Alaska, Idaho, and Montana to PNWRS and RMRS publications groups.	Submit national TPO conversion factor report for publication.
Publish harvest utilization reports for New Mexico and Arizona.	Submitted harvest utilization reports for New Mexico and Arizona to RMRS for publication.	Submit NRS State TPO factsheets for publication.
Complete TPO reports for each Southern State, Kansas, Michigan, Minnesota, Missouri, New York, California, and Oregon.	Submitted the final, reviewed Four Corners (AZ, CO, NM, UT) TPO report for publication. Completed California TPO report and external review process. Completed Oregon TPO draft report for peer review.	Submit 2017 and 2018 Southern pulpwood reports and 2012–2018 National pulpwood reports for publication.
Complete 2017 Southern pulpwood report and 2012–2017 National pulpwood report.		Publish Tableau TPO one-click factsheets for 2017 and 2018.
Implement annual TPO in Eastern United States and California.	Implemented the annual TPO design in the Eastern United States and California. Conducted periodic surveys in Montana and Wyoming.	Make the Tableau core table tool available to public. Submit a Southern TPO report for 2017, presenting changes from four survey periods since 2009. Submit final California, Montana, Wyoming, and Oregon TPO reports and Alaska logging utilization report for review and publication. Implement annual TPO nationwide in all participating States. A 100 percent sample will be conducted in Idaho and Alaska. Conduct research on modeling approaches to estimate mill receipts under non-response.
Testing and Processing TPO System		
Complete loading all historical NRS TPO studies into the national compilation system.	Twenty-four percent of Northern States TPO studies loaded into the national compilation system. Completed loading of all West legacy TPO data, and two most recent years of mill-level data for each Pacific Northwest and Interior West State. Developed tableau TPO one-click factsheets and tableau core table tool (not available to the public yet).	Complete loading all historical NRS TPO studies into the national compilation system. Test new system's processing and reporting of West's legacy TPO and recent mill-level data. Test annual California data loading and processing. Add West data for annual and periodic surveys as completed.

NRS = Northern Research Station; PNWRS = Pacific Northwest Research Station; RMRS = Rocky Mountain Research Station; TPO = Timber Products Output.

National Woodland Owner Survey: Business Plan Update

In the FY 2018 business report, we said that in FY 2019 we would—	In FY 2019, we—	In FY 2020, we will—
Implement NWOS Base/Family		
<p>Publish initial results from the 2017–2018 Base NWOS.</p> <p>Initiate the Base NWOS using an annualized approach.</p>	<p>Participated in a NWOS Stakeholders meeting.</p> <p>Completed data processing of NWOS 2017–2018 Base results.</p> <p>Contacted more than 5,000 private ownerships as part of the annual implementation of the Base NWOS.</p>	<p>Implement recommendations from the stakeholder meeting, including publication of additional results, investigation of methods for increasing response rates, and investigation of methods for providing results for smaller areas.</p> <p>Publish results from the 2017–2018 Base NWOS.</p> <p>Continue implementation of the Base NWOS using an annualized approach.</p>
Implement NWOS Urban		
<p>Implement NWOS Urban in four more cities.</p>	<p>Urban NWOS was implemented in six cities.</p>	<p>Continue implementation of the Urban NWOS. No additional cities are planned.</p> <p>Publish initial Urban NWOS results.</p>
Implement NWOS Corporate		
<p>Complete implementation of NWOS Corporate.</p> <p>Publish initial results of NWOS Corporate.</p>	<p>A pilot test of the Corporate NWOS was completed.</p>	<p>Publish results of the Corporate NWOS pilot test.</p> <p>Develop a plan for further implementation of the Corporate NWOS.</p>

NWOS = National Woodland Owner Survey; OMB = Office of Management and Budget.

Carbon Accounting: Business Plan Update

In the FY 2018 business report, we said that in FY 2019 we would—	In FY 2019, we—	In FY 2020, we will—
Carbon Pilot Work		
Explore alternative estimators for annual area estimation.	Tested alternative estimators for area estimation – publication in review.	Continue to explore alternative estimators and other methods for annual estimation.
Evaluate GRM for biomass estimation and attribution for carbon reporting.	Test alternative database structure to facilitate individual tree GRM across all annual measurements.	Begin testing alternative database structure for annual and dynamic estimation of carbon attributes.
Evaluate computational tools for characterization of interannual variability in carbon stocks and fluxes.	Began working with LANDIS model, a computer model designed to simulate forest growth, competition, seed dispersal succession, and disturbances; contributed to the development of rFIA tool, a software package for the estimation of forest attributes with the FIA database – Stanke et al. (In review) ; and working with NCASI to get the Carbon Online Estimator (COLE) tool back online.	Continue working on calibrating and validating LANDIS for carbon estimation, expand the rFIA tool to include alternative estimators and more database variables, and expand functionality of COLE in collaboration with NCASI.
Carbon Publications		
Contribute as a lead author on: 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories; 2nd State of the Carbon Cycle Report (for North America; Forests); 4th National Climate Assessment (Forests and Land Cover and Land Use).	2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories; 2nd State of the Carbon Cycle Report (for North America; Forests); 4th National Climate Assessment (Forests and Land Cover and Land Use Change) were all published. Beginning to explore soil remeasurements.	Contribute to the USDA GHG Reporting, Sustainability Report. Work on manuscript documenting soil carbon changes based on available remeasurements.
Conduct matrix modeling for characterizing carbon dynamics associated with land use change and disturbance.	<i>Publications:</i> Ma, W.; Domke, G.M.; D'Amato A.W.; Woodall C.W, Walters, B.F; Deo, R.K. 2019 . sing matrix models to estimate aboveground forest biomass dynamics in the eastern USA through various combinations of LiDAR, Landsat, and forest inventory data. Environmental Research Letters 13 (12).	Publish book chapter on digital soil mapping within the context of global change and carbon.
Publish article on the spatially continuous litter and soil carbon data products at 1 km resolution.	Ma, W.; Domke, G.M.; Woodall, C.W.; D'Amato A.W. 2020 . Ecological Indicators 110 (2020) 105901.	Contribute to global carbon stock change mapping paper.
Evaluate soil carbon remeasurements in the Northern region.	Cao, B.; Domke, G.M.; Russell, M.B.; Walters, B.F. 2019 . Spatial modeling of litter and soil carbon stocks on forest land in the conterminous United States. Science of The Total Environment 654: 94-106.	Zambia emissions and removals paper for REDD+ reporting (International Program request). Work on regional soil assessments.
		Emissions avoidance and carbon sequestration capacity in the United States. State and regional-level carbon reports (PNW).

International Carbon Reporting

<p>2019 NIR will include, for the first time, GHG estimates for all managed forest land in Alaska (Tier I and II methods) as well as complete disaggregation of Forest Land Remaining Forest Land, Land Converted to Forest Land, and Forest Land Converted to Other Land Uses for the CONUS.</p> <p>Begin 2-year agreement with California Air Resources Board to develop and document approaches for carbon estimation across spatial scales.</p> <p>Methodological improvements on the estimation of fire emissions</p> <p>Continued improvements on uncertainty characterization in all categories of the NIR.</p>	<p>Included, for the first time, more than 24.5 million hectares of managed forest land in Interior Alaska.</p> <p>2019 NIR had complete disaggregation of Forest Land Remaining Forest Land, Land Converted to Forest Land, and Forest Land Converted to Other Land Uses for the CONUS.</p> <p>Developed a Resource Bulletin to summarize Forest Service contributions to UNFCCC reporting.</p> <p>Consistently estimated carbon stocks and changes for the entire 1990 to 2017 time series in all States with remeasurements.</p> <p>Resolved unbalanced area estimates.</p> <p>Incorporated plot-level fuel estimates and combustion factors specific to fire severity in the compilation of fire emissions estimates.</p> <p>Improved consistency in estimates of urban trees in settlements.</p> <p>Continued working to establish agreement with CA ARB.</p> <p>Worked on manuscript to describe improvements to fire emissions estimation.</p>	<p>Work on including the U.S. Territories and Hawaii in the NIR.</p> <p>Begin transition to take over the Land Representation in the NIR—work with inventory team to develop a single harmonized data product for the time series.</p> <p>Continue testing and prototyping annual estimation system for all lands— begin working on manuscripts.</p> <p>Expand Resource Bulletin to include State-level estimates.</p> <p>Finalize CA ARB agreement and begin work to develop a decision support system for the Forest Carbon Offset Protocol. Submit paper of fire emissions estimation and continue to improve methods for more resolved estimates over space and through time.</p>
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CA ARB = California Air Resources Board; CONUS = Continental United States; GHG = Greenhouse Gas; GRM = Growth, Removals, Mortality; IPCC = Intergovernmental Panel on Climate Change; LiDAR = Light Detection and Ranging; NCASI = National Council for Air and Stream Improvement; NIR = National Inventory Report; PNW = Pacific Northwest Research Station; REDD+ = reducing emissions from deforestation and forest degradation, and foster conservation, sustainable management of forests, and enhancement of forest carbon stocks; UNFCCC = United National Framework Convention on Climate Change.

Digital Engagement: Business Plan Update

In the FY 2018 business report, we said that in FY 2019 we would—	In FY 2019, we—	In FY 2020, we will—
Forest Atlas of the United States (print and online)		
Secure approval of images and publish print document.	Submitted database of image permissions for the Forest Service Office of Communications review.	Secure final text approval from agency and department. Publish print document.
Begin development on Version 2 of the web application by publishing three new features in it and AGOL.	Completed no reportable activity on this topic.	Begin development on Version 2 of the web application by publishing three new features in it and AGOL.
Finish migration of website to VDC.	Finished migration of website to VDC.	
Massive Raster Processing Environment		
Host a working meeting to assemble a functioning workflow converting FIA plots and remotely sensed imagery into new, authoritative data products.	Collaborated on a cloud-based workflow integrating FIA plot information, auxiliary data, and predictors extracted from the Landsat archive to create authoritative map products.	Refine environment configuration and workflows to increase their respective efficiency and utility to other potential users. Publish workflow documenting cloud processing and analytics.
Use the workflow established above to produce content for each of the four use cases in the six prototype States.	Produced forest proportion and carbon maps for six pilot States (23 percent of CONUS) and published several demonstrations of decision-support tools.	Produce national-scale maps relevant for carbon assessments and related inventory reporting while exploring novel ways to host and distribute the resulting content.
Complete IRDB Business Case Assessment and secure funding for FYs 2019 and 2020.	Partnered with CIO to secure authority to operate for cloud computing environment and collaborated with them to prioritize future IRDB investments.	Continue our collaboration with CIO while completing a CRADA to formalize the public-private partnership with Esri.
Digital Analysis and Reporting Tools		
End publication of annual reports as story maps (see below) and renew emphasis on State and regional analysis of special topics to be published in this format.	Ended publication of annual reports as story maps and migrated this content to one-click dashboard (see below). Published story maps for the Western Pacific Islands , Hawaii and the Forest Legacy Program .	Assemble a team to develop standard procedures for producing 5-year reports.
Revise “Bill Board” and add content to facilitate national dashboard tracking FIA data from plots to publication.	Developed and demonstrated a plot-tracking dashboard using JavaScript.	Expand and explore national tools contingent upon nationally consistent data formats.
Integrate QA/QC data into comprehensive FIA dashboard (see above).	Completed no reportable activity on this topic.	Integrate QA/QC data into comprehensive FIA dashboard (see above).
Implement Tableau as technology supporting new FIA one-click national reporting dashboard. Version 1 will be published in FY 2019 with additional development and content in the future.	Published a new FIA one-click reporting dashboard with demonstrations to several regional and national user groups.	Explore additional content and development for a national reporting dashboard.
Enable other units to use templates and automated web maps (above). Outcomes will depend upon regional adoption.	Prototyped updated layouts in Esri’s newly published and improved story map guidelines and templates.	Enable other units to use templates and automated web maps (above). Outcomes will depend upon regional adoption.
Create a story map to accompany the upcoming RPA Assessment program’s Forest Resources Report.	Published several Tableau dashboards to accompany the RPA Assessment program’s Forest Resources Report.	Publish FIA performance metrics as interactive content in story maps and/or dashboards.
Publish additional story maps and dashboards to highlight manuscripts and novel data products.	Published a story map highlighting trees outside forests and continue work on an invasives application.	Publish additional story maps and dashboards to highlight manuscripts and novel data products.
Safety Application for Check-in/Check-out		
Develop additional applications in consultation with regional safety teams.	Continue to use the application for field crew check-in/out. No changes or updates to the applications to report.	Develop additional applications in consultation with regional safety teams.

In the FY 2018 business report, we said that in FY 2019 we would—	In FY 2019, we—	In FY 2020, we will—
Increase Access to FIA's Geospatial Content		
Apply established workflow to continue publication of FIA data as geospatial products in EDW, AGOL, and open data portals.	Published nation-wide county-level estimates and several additional data products into EDW, AGOL, and open data portals.	Apply established workflow to continue publication of FIA data as geospatial products in EDW, AGOL, and open data portals.
Release v1 of Forests in Focus.	Released v1 of Forests in Focus.	Collaborate with American Forest Foundation on geospatial tools of mutual interest.
Use related content to develop and release beta version of a similar tool addressing agency needs.	Developed and demonstrated applications focusing upon the white oak stove resource, wood baskets, and direct linkages to the EVALIDator API.	Use related content to develop and release beta version of a similar tool addressing agency needs.
Collaborate with internal and external partners, as well as the Community Engagement portfolio. Continue to identify needs for additional data and applications.	Received feedback and direction at national and regional user group meetings.	Collaborate with internal and external partners, as well as the Community Engagement portfolio. Will continue to identify needs for additional data and applications.
Staff Planning		
The Analysis Band will continue to support teams addressing portfolio tasks.	NRS and SRS staff supported efforts to address portfolio tasks.	NRS charter and workforce planning will create a new team dedicated to portfolio tasks.
Applications for International Partners		
Continue consultations with international partners and collaborate as appropriate.	Conducted Technical Assistance visit to Tanzania.	Continue consultations with international partners and collaborate as appropriate.

AGOL = ArcGIS Online; API = Application Programming Interface; CIO = Chief information Officer; CRADA = Cooperative Research and Development Agreement; EDW = Enterprise data warehouse; Esri = Environmental Systems Research Institute; IRDB = Information Resource Direction Board; NRS = Northern Research Station; QA/QC = Quality Assurance/Quality Control; RPA = Resources Planning Act; SRS = Southern Research Station; VDC = Virtual Data Center; v1 = Version 1.

Urban Inventory: Business Plan Update

In the FY 2018 business report, we said that in FY 2019 we would—	In FY 2019, we—	In FY 2020, we will—
Continued Urban Monitoring		
Continue data collection activities: CA—San Diego CO—Denver, Colorado Springs, Front Range CT—Bridgeport, statewide DC—Washington DE—Dover, statewide IA—Des Moines, statewide IL—Chicago, start statewide KS—Wichita ME—Portland, statewide MD—Baltimore MI—Detroit, start statewide MN—Minneapolis, statewide MO—Kansas City, Springfield, St. Louis, start statewide NE—Lincoln NJ—Trenton, statewide NY—Buffalo, NYC, Rochester ND—Fargo, statewide OH—Cleveland OR—Portland PA—Philadelphia, Pittsburgh RI—Providence, statewide TX—Austin, Fort Worth, Houston, San Antonio VT—Burlington, statewide WV—Morgantown, statewide WI—Madison, Milwaukee, statewide	Continued data collection activities: CA—San Diego CO—Denver, Colorado Springs, Front Range CT—Bridgeport, statewide DC—Washington DE—Dover, statewide IA—Des Moines, statewide IL—Chicago, statewide KS—Wichita ME—Portland, statewide MD—Baltimore MI—Detroit, statewide MN—Minneapolis, statewide MO—Kansas City, Springfield, St. Louis, statewide NE—Lincoln NJ—Trenton, statewide NY—Buffalo, NYC, Rochester ND—Fargo, statewide OH—Cleveland OR—Portland PA—Philadelphia, Pittsburgh RI—Providence, statewide TX—Austin, Fort Worth, Houston, San Antonio VA—Washington, DC metro area VT—Burlington, statewide WV—Morgantown, statewide WI—Madison, Milwaukee, statewide	Continue data collection activities: CA—San Diego CO—Denver, Colorado Springs, Front Range CT—Bridgeport, statewide DC—Washington DE—Dover, statewide IA—Des Moines, statewide IL—Chicago, statewide KS—Wichita ME—Portland, statewide MD—Baltimore MI—Detroit, statewide MN—Minneapolis, statewide MO—Kansas City, Springfield, St. Louis, statewide NE—Lincoln NJ—Trenton, statewide NY—Buffalo, NYC, Rochester ND—Fargo, statewide OH—Cleveland OR—Portland PA—Philadelphia, Pittsburgh RI—Providence, statewide TX—Austin, Fort Worth, Houston, San Antonio VA—Washington, DC metro area VT—Burlington, statewide WV—Morgantown, statewide WI—Madison, Milwaukee, statewide
Additional Urban Locations		
Add statewide Urban Areas inventories: Illinois, Michigan, and Missouri.	Added statewide Urban Areas inventories: Illinois, Michigan, and Missouri.	Add Boston, MA; Columbus and Toledo, OH; Manchester, NH; Sioux Falls, SD; and U.S. Virgin Islands.
Publish Urban Reports (print and online)		
Finalize national reporting template.	Continued to work on the reporting template.	Finalize national reporting template.
Update Field Guide to 9.0.	Updated Field Guide to 9.0	Update Field Guide to 9.1.
Start reporting of San Diego, San Antonio, Springfield, St. Louis, Kansas City, Portland, OR, and Washington, DC.	Continued work on reporting of San Diego, San Antonio, Springfield, St. Louis, Kansas City, Portland, OR, and Washington, DC.	Report on San Diego. Continue reporting efforts in San Antonio, Springfield, St. Louis, Kansas City, Portland, OR, and Washington, DC.
Release updated My City's Trees app, add new cities to the app.	Released an updated My City's Trees app.	Add San Diego and San Antonio to the My City's Trees app.
Test draft version of Urban EVALIDator.	Continued work on a draft version of Urban EVALIDator.	Release draft version of Urban EVALIDator.

FIA = Forest Inventory and Analysis.

National Inventory and Monitoring Applications Center (NIMAC): Business Plan Update

In the FY 2018 business report, we said that in FY 2019 we would—	In FY 2019, we—	In FY 2020, we will—
Technology Transfer Activities		
Continue to support international technology transfer needs and build partnerships with international cooperators through the development and deployment of technology transfer activities with partners from within FIA, NGOs, and other Federal agencies. Work will include both formal and informal consultations, training class development and participation, creation of multimedia didactic material like instructional videos, and participation in multi-agency international monitoring projects in several partner countries.	Designed, led, or contributed to several technology transfer activities in various countries, including Mexico, Honduras, Colombia, Paraguay, and El Salvador. Remote assistance was provided to several other countries including Panama, Costa Rica, Peru and Vietnam. NIMAC hosted a visiting scholar from Sierra Leone and worked on developing a forest monitoring system for that country. Activities with partner countries included trainings, biometric and inventory method consulting, review of inventory plans, production of inventory calculation software tools, and providing direct training in use of data distribution tools.	Continue to provide a leadership role in helping fulfill the forest monitoring component of the Forest Service’s international technology transfer and partnership mission. Activities will include follow-up of ongoing activities from previous years and development of improved training and education materials as new monitoring technologies become available. NIMAC staff will contribute to international research projects as they become available, including reviewing proposals and consulting on science topics.
Digital Publishing of Forest Inventory Data		
Process and make available completed panels of CFI data via EVALIDator for Missouri, Wisconsin, and Indiana.	Updated and made available via PC-EVALIDator the latest CFI data for Missouri, Wisconsin, and Indiana.	Continue to support CFI work in Missouri, Wisconsin, and Indiana via data processing and technical assistance. Provide analytical tool for special project on tree regeneration in Wisconsin.
Release publicly available version 10.0 of DATIM in January 2019, version 10.1 in April 2019, and version 11.0 in July 2019.	Released publicly available version 10.0 of DATIM (January 2019), version 10.1 (April 2019), and version 11.0 (July 2019).	Further development of DATIM and releases of four new versions per year. FY 2020 plans are to implement versions 11.1, 12.0, 12.1 and 13.0 by October 2020.
Finish U.S. FWS analytical tool and assist in implementation of forest inventories on additional refuges.	Completed work on U.S. FWS analytical tool and assisted in implementation of forest inventories on five additional refuges.	Continue existing CFI work on refuges and add new refuges per FWS needs. Begin development of monitoring protocol and supporting analysis tools.
Technology Partners		
Provide a leadership role in the Forest Service contribution to the SilvaCarbon efforts, including serving on review panels for methods and guidance documents; developing and coordinating the staffing of technology transfer activities; representing the Forest Service and SilvaCarbon at multinational meetings; and otherwise supporting SilvaCarbon program goals in several countries around the world.	In 2019, NIMAC staff and others in NRS FIA participated in several Forest Service International Programs and SilvaCarbon-funded activities involving multinational partners, including coordination and delivery of technology transfer activities. For example, NIMAC staff helped organize and deliver an international session at the FIA Stakeholders Meeting in December 2019, which was attended by representatives from eight countries.	FIA will continue to provide leadership for coordination of national FIA activities with international partners, contributions to international meetings on forest inventory science, and the development of partnerships and new technologies to advance inventory science within FIA and share them with partner countries.

CFI = Continuous Forest Inventory; DATIM = Design and Analysis Tool for Inventory and Monitoring; NGO = nongovernmental organization; NIMAC = National Inventory and Monitoring Application Center; U.S. FWS = U.S. Fish and Wildlife Service.

Land Use Land Change: Business Plan Update

In the FY 2018 business report, we said that in FY 2019 we would—	In FY 2019, we—	In FY 2020, we will—
Continued Image-based Change Estimation Data Collection		
Provide the Management Team with a matrix of options for improved FIA monitoring of LULC.	Using results of the Georgia pilot, provided options to the Management Team for augmenting non-forest land use and land cover estimates.	Work with the Analysis Band to develop a centralized, national LULC reporting tool based upon Tableau.
Publish at least two options for LULC monitoring (from the Georgia pilot work). Use Forest Service/USGS national sample of historical LULC change in at least one publication.	Produced paper on the Forest Service/USGS national sample of historical LULC change (Pengra, B.W.; Stehman, S.V.; Horton, J.A.; Dockter, D.J.; Schroeder, T.A.; Yang, Z.; Cohen, W.B.; Healey, S.P.; Loveland, T.R. Quality control and assessment of interpreter consistency of annual land cover reference data in an operational national monitoring program. Remote Sensing of Environment. In review.)	Publish the Forest Service/USGS national sample of historical LULC change (Pengra et al., 2020) Demonstrate the above tool to the Management Team.
Produce National Disturbance Maps (digital)		
Complete disturbance map data delivery portal.	National disturbance maps completed under the Landscape Change Monitoring Program. Map portal designed in collaboration with GTAC.	Publish national-level results related to forest disturbance and recovery.

GTAC = Geospatial Technology and Applications Center; LULC = Land Use and Land Cover; USGS = U.S. Geological Survey.

Small Area Estimation: Business Plan Update

In the FY 2018 business report, we said that in FY 2019 we would—	In FY 2019, we—	In FY 2020, we will—
Identify Immediate Need and Develop Team		
Increase team communication and visibility.	<p>Tracked progress in diverse small-area projects nationwide.</p> <p>Engaged diverse undergraduates in FIA statistical challenges.</p>	<p>Conduct a user community survey.</p> <p>Hold a panel discussion at FIA Symposium on small-area estimation needs featuring NFS, State, industry, academic, and international representatives.</p> <p>Hold a small-area estimation focus day at the 2020 FIA National User Group meeting.</p>
Build Estimation Tools		
<p>Finalize Green Book 2 sections.</p> <p>Publish methodologies for several FIA applications.</p> <p>Showcase production-ready processes designed for NFS and timber industry.</p> <p>Plan for integration of more advanced methodologies.</p>	<p>Included Alternative Estimators chapter in Green Book 2 describing model-assisted, model-based, small-area, photo-based, and other estimation strategies.</p> <p>Developed small-area and model-assisted modules in FIESTA.</p> <p>Began development of FIESTA-powered app for NFS applications.</p> <p>Gained accelerated Esri support of BIGMAP with supplemental access to Amazon Web Services.</p> <p>Automated stratification to include bias reduction due to nonresponse in Interior West.</p> <p><i>Publications:</i> Goerndt, M.E.; Wilson, B.T.; Aguilar, F.X. 2019. Comparison of small area estimation methods applied to biopower feedstock supply in the Northern U.S. region. <i>Biomass and Bioenergy</i>. 121: 64-77. Available at https://www.nrs.fs.fed.us/pubs/57620.</p> <p>Nagle, N.N.; Schroeder, T.A.; Rose, B. 2019. A regularized raking estimator for small area mapping from forest inventory surveys. <i>Forests</i>. 10 (11).</p> <p>Wilson, B. 2018. Making national forest inventory data relevant for local forest management. Retrieved from the University of Minnesota Digital Conservancy.</p>	<p>Present and publish methodologies for several FIA applications.</p> <p>Distribute FIESTA for beta-testing.</p> <p>Continue BIGMAP advances.</p> <p>Publications in review or in process: McConville, K.S.; Moisen, G.C.; Frescino, T.S. [In review]. A tutorial in model-assisted estimation with application to forest inventories. <i>Forests</i>.</p> <p>Coulston, J.W.; Green, P.C.; Radtke, P.J.; Prisley, S.P.; Brooks, E.B.; Thomas, V.A.; Winn, R.H.; Burkhart, H.E. [In review]. Enhancing the precision of broad-scale forestland removals estimates with small area estimation techniques. <i>Forestry</i>.</p> <p>Frescino, T.S.; Moisen, G.G.; Patterson, P.A.; Toney, J.C.; Freeman, E.A. [In press]. Demonstrating a progressive FIA through FIESTA: a bridge between science and production. <i>FIA 2019 Science and Stakeholders Proceedings</i>.</p> <p>Rintoul, M.; Maebius, S.; Alvarado, E.; Lloyd-Damnjanovic, A.; Toyohara, M.; McConville, K.; Moisen, G.; Frescino, T. [In press]. An alternative post-stratification scheme to decrease variance of forest attribute estimates in the Interior West. <i>FIA 2019 Science and Stakeholders Proceedings</i>.</p>

Esri = Environmental Systems Research Institute.

Community Engagement: Business Plan Update

In the FY 2018 business report, we said that in FY 2019 we would—	In FY 2019, we—	In FY 2020, we will—
Engaging the Public		
<p>As a core team, continue work on these objectives and assign specific tasks to ensure their completion. The core team will also reassess objectives and task relevance quarterly.</p> <p>Help start the “Forest Census in Action” social media campaign resulting in frequent FIA-related social media posts. Also create a searchable Twitter handle used whenever FIA is referenced: #USDA_FIA.</p> <p>Help facilitate community engagement activities by providing materials and resources (e.g., presentations) to encourage participation. The core team will also report on these activities via the Community Engagement Newsletter.</p> <p>Distribute a monthly newsletter highlighting FIA accomplishments as well as community engagement activities. Newsletter will be available to the public via a website.</p>	<p>The core team continued to work on the objectives of the Community Engagement portfolio and assign specific tasks to ensure their completion. The core team also continued to reassess objectives and task relevance on a quarterly basis.</p> <p>The core team helped start the “Forest Census in Action” social media campaign resulting in frequent FIA-related social media posts. Also, the team created a searchable Twitter handle that is used whenever FIA is referenced: #USDA_FIA.</p> <p>The core team continued to help facilitate community engagement activities by providing materials and resources (e.g., presentations) to encourage engagement participation. The core team also reported on these activities via the Community Engagement Newsletter.</p> <p>The core CE team distributed a monthly Community Engagement newsletter highlighting FIA accomplishments as well as community engagement activities. Newsletter has been made available to the public via the national website.</p>	<p>The core CE team will continue work on portfolio objectives and assign specific tasks to ensure their completion. The core CE team will also reassess objectives and task relevance quarterly.</p> <p>The core CE team will continue pushing social media presence through the “Forest Census in Action” social media campaign.</p> <p>The core CE team will also emphasize diversity recruitment to the program by advertising the existing “FIA 101” training module. FIA 101 is an introduction to the FIA program including data collection protocol to data analysis.</p> <p>The core CE team will continue to distribute monthly newsletters to ensure the internal engagement and consistency.</p> <p>The core CE team will also participate in the national FIA website update and re-design to help ensure internal collaboration and information sharing as well as ensure an updated external client information source.</p>
Discover, Organize, and Share Existing Materials – Objective 1		
<p>Continue to archive existing CE material from each unit and share in a single, accessible location.</p> <p>Core team to continue to meet regularly and identify new tasks as old tasks related to each objective are completed.</p> <p>Continue to feature FIA national portfolios in monthly newsletters to increase awareness of existing shared location and related portfolio information.</p> <p>Create shared location of all materials related to Community Engagement that is accessible to all FIA staff.</p>	<p>The core CE team continued to organize existing CE material from each unit and share in a single, accessible location.</p> <p>The core CE team continued to meet regularly and identify new tasks as old tasks related to each objective are completed.</p> <p>The core CE team continued to feature FIA national portfolios in monthly newsletters to increase awareness of existing portfolios, shared locations of the portfolios, and related updates to portfolios.</p> <p>Created shared location of all materials related to Community Engagement that is accessible to all FIA staff.</p>	<p>The core CE team will continue to organize and share CE material for internal use by the all staff within the FIA program. These materials include items such as “off-the-shelf” FIA presentations as well as outreach material (e.g., FIA brochures, etc.).</p> <p>The core CE team will continue to track, archive and share information on funding opportunities for CE-related events.</p>
Document existing activities – Objective 2		
<p>Continue to document CE events in NICE database as well as assist others in documenting CE activities through communication and outreach.</p> <p>Share CE-related activities to the national FIA program via monthly CE newsletter.</p>	<p>Continued to document CE events in NICE database as well as assist others in documenting CE activities through communication and outreach.</p> <p>Shared CE-related activities to the national FIA program via monthly CE newsletter.</p>	<p>The core CE team will continue to archive CE-related events and share event information via the monthly CE newsletter.</p>

In the FY 2017 business report, we said that in FY 2018 we would—	In FY 2018, we—	In FY 2019, we will—
Facilitate Further CE Projects – Objective 3		
Continue to track and share information on funding opportunities for CE events. Also share ideas on ways to utilize funding for events.	Continued to track and share information on funding opportunities for CE events. Also shared ideas on ways to utilize funding for events.	The core CE team will continue to track, archive, and share information on funding opportunities for CE-related events.
Continue to share information and ideas to facilitate CE events at each unit by encouraging individuals through a support network.	Continued to share information and ideas to facilitate CE events at each unit by encouraging individuals through a support network.	
Increase Internal & External Communication – Objective 4		
Increase social media presence by increasing posts. Garner interest from FIA employees by reaching out for photos and ensuring one post per month related to “U.S. Forest Census in Action” social media project.	Increased social media presence by increasing posts. Garnered interests from FIA employees by outreaching for photos and ensuring one post per month related to “U.S. Forest Census In Action” social media project.	The CE core team will continue pushing social media presence through the “Forest Census in Action” social media campaign.
Continue to ensure all FIA-related posts use #USFS_FIA, #USDA_FS.	Continued to ensure all FIA related posts use #USFS_FIA, #USDA_FS.	The core CE team will also emphasize diversity recruitment to the program by advertising the existing “FIA 101” training module. FIA 101 is an introduction to the FIA program including data collection protocol to data analysis.
Continue monthly newsletters to ensure national consistency and information-sharing. Ensure these are accessible to outside collaborators via national website.	Continued monthly newsletters to ensure national consistency and information-sharing. Ensured that all newsletters were accessible to outside collaborators via national website. Updated the format of the newsletter to enhance readability.	The core CE team will continue to distribute monthly newsletters to ensure the internal engagement and consistency and publish on the national website to ensure information applicable to external clients is available.
Produce a second FIA video focused on FIA field staff recruitment.	Starting production on a second FIA video focused on FIA field staff recruitment. Video link: https://www.fia.fs.fed.us/ .	

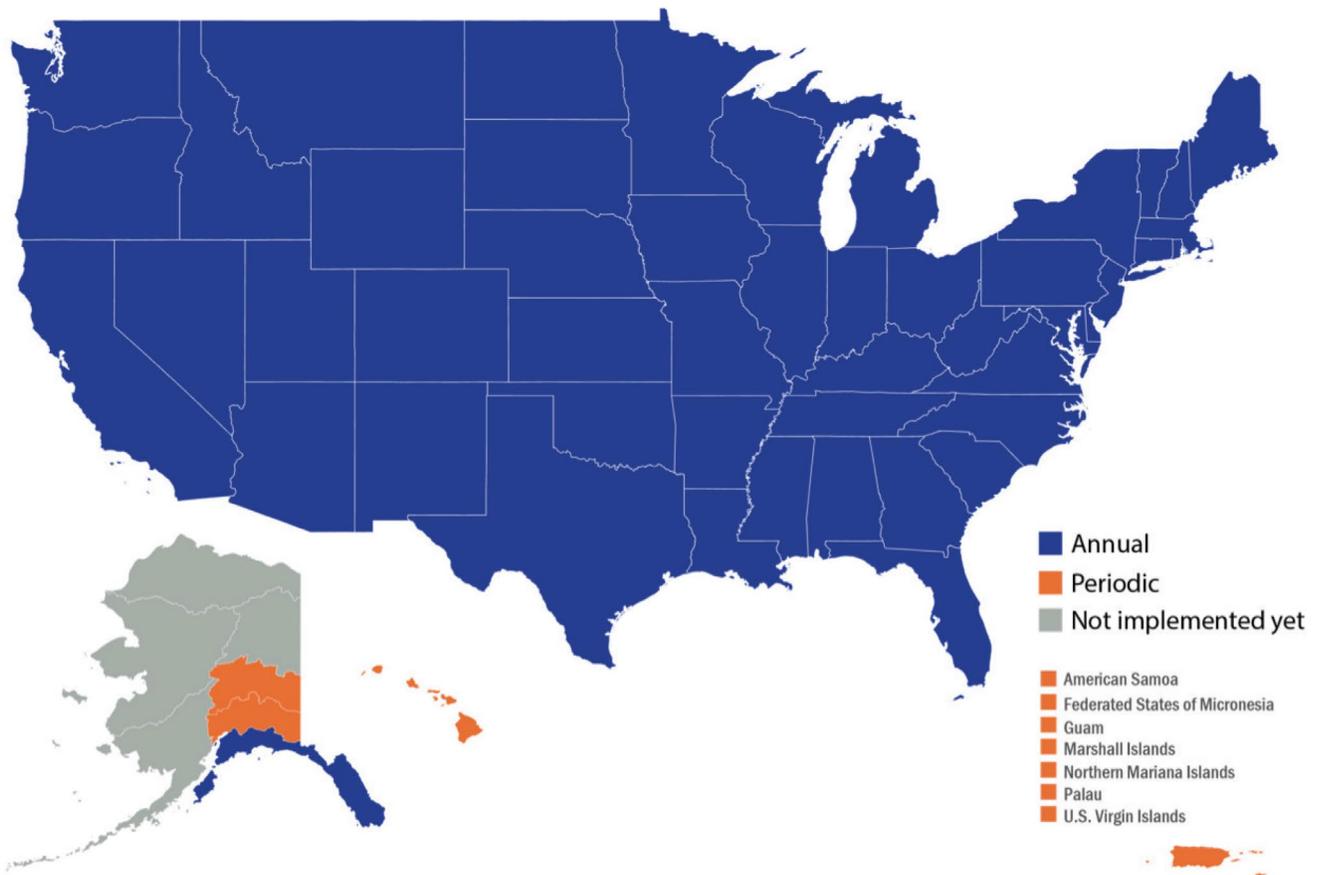
CE = community engagement; FIA = Forest Inventory and Analysis; NICE = NatureWatch, Interpretation and Conservation Education.

Fiscal Year 2020 Anticipated FIA Program Direction

In recent years, the FIA program budget came with considerable uncertainties. The FY 2019 budget was set at \$77.0 million, all from R&D appropriations.

The FIA program will continue inventory operations in 50 States, with Alaska focused on an annualized survey in Coastal Alaska, and a periodic survey including LiDAR techniques for efficiency in Interior Alaska (fig. 24). After finalizing inventory operations in the Tanana Valley, operations will start in the Susitna-Copper unit, the second unit of six in Interior Alaska. Other major activities planned for 2020 include: achieving full compliance of State 5-year reports; publishing results from

NWOS Base, Urban, and Corporate pilot and developing two additional survey modules on Tribal and Islands; continuing to modernize the program’s TPO operations and reporting; continuing the implementation of the Image-Based Change Estimation, or ICE, project for improving land cover and land use classification; expanding urban forest inventory; further developing DATIM; and exploring digital technologies and interactive ways to share FIA data. Accomplishment of these goals will depend on the continued strong support of our partners, their commitment to an efficient and productive FIA, and the adequate funding for full program implementation of 2014 Farm Bill options A through C.



FIA = Forest Inventory and Analysis; FY = fiscal year.

Figure 24. Planned FIA implementation status, FY 2020.

Long-Term Strategic Direction

The FIA program initially intended to implement the *Strategic Plan for Forest Inventory and Analysis* by achieving a base Federal program of 10 percent per year in the West and 15 percent per year in the East by FY 2003. Aggressive financial support from partners has enabled FIA to achieve full implementation and 5-year cycles throughout most States from the Great Plains eastward. This support has been impacted as Federal budgets continue to fluctuate, and along with budget impacts of some State governments, partners' matching funding has been affected also. Stronger Federal support is needed to continue and expand as partners find exceptional value in leveraging Federal resources to provide improved information and service to their constituents. Recent budget increases have provided stability and a platform to move forward with new Farm Bill demands.

In late 2013, FIA drafted a new strategic plan to update the 2007 plan, in response to preliminary language that eventually formed the final text of the 2014 Farm Bill and its requirements for FIA. The new plan is forward-looking and attempts to balance emerging client demands for new information, tools, and values with necessary decisions on priorities and budget constraints. The new FIA strategic plan was developed in cooperation with partners and stakeholders and identifies the base program, potential enhancements to the base, priorities for new programs, and areas for increased flexibility in the future. The final plan was delivered to the agency and USDA in mid-2014, with a final submission delivered to Congress in March 2015.

Passage of the 2014 Farm Bill and FIA Requirements. On February 7, 2014, Congress passed the Agricultural Act of 2014 (Public Law 113-79), also referred to as the 2014 Farm Bill. Section 8301 of this legislation required the Forest Inventory and Analysis program to revise its previous strategic plan, approved by Congress in 1999, and submit the new plan to the Committee on Agriculture of the House of Representatives and the Committee on Agriculture, Nutrition, and Forestry of the Senate within 180 days of the passage of the law.

Farm Bill provisions that were addressed in the revised strategic plan:

1. Complete the transition to a fully annualized forest inventory program and include inventory and analysis of Interior Alaska.
2. Implement an annualized inventory of trees in urban settings, including the status and trends of trees and forests, and assessments of their ecosystem services, values, health, and risk from pests and diseases.

3. Report information on renewable biomass supplies and carbon stocks at the local, State, regional, and national levels, including by ownership type.
4. Engage State foresters and other users of information from the Forest Inventory and Analysis in reevaluating the list of core data variables collected on FIA plots, with an emphasis on demonstrated need.
5. Improve the timeliness of the TPO program and accessibility of the annualized information on that database.
6. Foster greater cooperation among the FIA program, research station leaders, State foresters, and other users of information from the Forest Inventory and Analysis.
7. Promote availability of and access to non-Federal resources to improve information analysis and information management.
8. Collaborate with the USDA Natural Resources Conservation Service, National Aeronautics and Space Administration, National Oceanic and Atmospheric Administration, and the U.S. Geological Survey to integrate remote sensing, spatial analysis techniques, and other new technologies in the FIA program.
9. Understand and report on changes in land cover and use.
10. Expand existing programs to promote sustainable forest stewardship through increased understanding, in partnership with other Federal agencies, of the more than 10 million private forest owners, their demographics, and the barriers to forest stewardship.
11. Implement procedures to improve the statistical precision of estimates at the sub-State level.

Passage of the 2018 Farm Bill and FIA Requirements.

On December 11, 2018, Congress passed the 2018 Farm Bill. Section 8632 requested to find efficiencies in the FIA program through the improved use and integration of remote sensing technologies and to partner with States and interested stakeholders.

To comply with congressional direction, FIA has been working with scientists in the geospatial and remote sensing research community developing techniques which benefit from the use of cloud computing and access to massive satellite data archives. Following are some examples.

FIA has been integrating observations of land use, land cover from the National Agriculture Imagery Program (NAIP) that collects sub-meter imagery on a reoccurring 3-year basis for each

State. The NAIP imagery provides more frequent measures than field measurements occurring every 5 years in the East and 10 years in the Western States. The national data collection process is implemented through the image-based change (ICE) project and is fully implemented in 28 States and will be expanded to all States as resources allow.

The recent initiation in FY 2019 of a national standard for Light Detection and Ranging (LiDAR) data by a consortium of Federal, State, and local agencies coordinated by USGS (3DEP) has the potential to yield substantial benefits, especially in characterizing forest structure. The FIA program seeks to capitalize on these resources along with NAIP-derived and satellite-derived point clouds for nationwide coverage to cooperatively develop tree canopy height products.

Since 2016, FIA has supported and advanced a methodology designed to efficiently inventory the boreal forests of Interior Alaska, a region that occupies about 110 million acres. In 2018 and in collaboration with the State of Alaska Department of Natural Resources and NASA, FIA finalized the 2.5 million-acre pilot project conducted in the Tanana River Valley of Interior Alaska that have led to the final inventory design for the region. To increase the precision and efficiency of the inventory estimates, as mandated by Congress, the relatively sparse field plot sample was augmented with G-LiHT data, a type of remote-sensing data that combines LiDAR, imaging spectroscopy, and thermal imaging. This airborne imaging system maps the composition, structure, and function of terrestrial ecosystems at high resolution, about 1-meter data. The design and protocols tested during this pilot were refined for implementation of the large-scale inventory of Interior Alaska's forests. This is a significant step toward improving the use and integration of remote-sensing technologies in the FIA program.

FIA continues to prioritize and enhance the collaboration with States and Federal agencies to improve and efficiently provide assessment and analysis of fundamental information for Nation's forest resources and investments.

FIA Backdrop. During its entire 90-year history, FIA has spent a grand total of about \$1.4 billion from U.S. taxpayers for inventory, monitoring, and assessment of U.S. forest lands. During that time, multi-billions of dollars have been invested by forest industries and tens of thousands of jobs created from logging, primary wood processing, and manufacturing, construction, and retail sales of wood-based products. Since 2000, FIA has provided grants totaling in excess of \$260.7 million to partners, including States, dozens of universities, and nongovernmental organizations, to collect data, conduct research, and perform analyses to improve program efficiency and

support client information needs. Since 2000, FIA partners have contributed about \$170 million to leverage the program to collect and process more data and information to meet local needs. FIA is a proven, cost-efficient partnership program that has consistently delivered significant value added to the taxpayers for more than 8 decades. The following summaries outline the range of implementation opportunities provided in the new strategic plan. In the coming year, Congress will review these options, ask questions, and suggest adjustments that will determine its future support for the FIA program.

OPTIONS A and B, Status Quo Option: This option maintains the 7-year East (15 percent), 10-year West (10 percent) paradigm for measurement, and these combined options place the program at the previous strategic plan target funding level.

OPTION C, National Core Option: This option maintains the 7-year East (15 percent), 10-year West (10 percent) paradigm for measuring base plots with improved remote-sensing support plus continuing the timber product output and ownership studies with enhancements and urban forest survey.

OPTIONS D and E, Full Farm Bill Option: This option implements the full 5-year (20 percent) measurement program nationally for base plots with improved remote sensing, continued timber product output and ownership studies with enhancements, and all the other items except small-area estimation based on sample intensification.

OPTION F, Leveraged Partner Option: This option is a partner opportunity. Currently States and other partners contribute nearly \$11 million annually to intensify data collection, research, and analyses to improve estimates for smaller planning areas. FIA processes, maintains, and distributes the enhanced data and information.

The Government Performance and Results Act (GPRA) of 1993 directs Federal entities to develop long-term goals and performance measures to monitor progress toward those goals. Although intended for application at the agency level, the GPRA framework also provides an excellent tool for guiding progress at the project level. The following table shows our key goals, performance measures, and benchmarks for the FIA program for 2013 through 2019 and targets for a fully implemented program. In future business reports, we will repeat this table to show how we are progressing toward our goals.

Table 8. National performance measures of the FIA Program by fiscal year, 2013–2019.

Goal	Performance measure	2013 level (%)	2014 level (%)	2015 level (%)	2016 level (%)	2017 level (%)	2018 level (%)	2019 level (%)	Target
Inputs									
Maintain sufficient funding to support the base Federal FIA program ^a	Percentage of total Federal funding necessary for annualized inventory received	85	85	89	82	82	82	84	100
Outputs									
Include 100 percent of U.S. forest lands in the FIA sample population	Percentage of Nation's forest land included in the target FIA sample population	100	100	100	100	100	100	100	100
Keep fieldwork current	Percentage of States actively engaged in the annualized inventory program	100	100	100	100	100	100	100	100
Make data accessible to national forest customers	Percentage of national forest land for which FIA data are loaded into NRIS	100	100	100	100	100	100	100	100
Outcomes									
Keep analysis current	Percentage of States with FIA State report less than 6 years old	88	90	94	96	96	96	90	100
Keep online data current	Percentage of States with FIA online data less than 2 years old	92	96	96	96	96	96	86	100
Partners' participation	Partners' financial contributions expressed as percentage of total program funds	10	10	10	12	16	16	28	20

FIA = Forest Inventory and Analysis; NRIS = Natural Resource Information System.

^a Revised percentage based on congressional target of \$97.2 million, adjusted for inflation, for 2014–2018 FIA Strategic Plan options A, B, and C in FY 2019.

Note: Available Federal funding increased in FY 2019 beyond \$77 million due to hurricane supplemental, R&D contribution towards IRDB and small contributions from other Federal sources.

Conclusions

We continue to operate in an era of partnership and collaboration in which Federal and State agencies and other colleagues work together to plan, manage, implement, and continually improve the FIA program. We are gathering and disseminating information on a wider array of ecological attributes, while continuing to serve our traditional customers who require timely information on forest resources. We are increasing the timeliness of our surveys and of our reporting to provide a continually updated, publicly accessible information base that includes meaningful reports, analyses, and elemental data for others to use. We are exploring and using the latest technology to expand

the scope of our products and to deliver them more efficiently. We are also openly reporting on our progress, accomplishments, successes, and challenges.

In summary, we are committed to working collaboratively with our partners to deliver the best program possible with the resources that we have at our disposal. We hope this report gives you a transparent view of the business practices of the FIA program, and we encourage you to help us improve the program with your feedback.

Glossary of Terms Used in Appendixes

base Federal FIA program. A level of FIA program delivery that includes sampling 10 percent of base grid (Phase 2) plots per year in the Western United States, 15 percent of base grid plots per year in the Eastern United States, with data compiled and made available annually and complete State analyses done every 5 years. A subsample of these plots also provides data on key ecosystem health indicators.

base grid plots sampled. The base grid consists of one sample location per approximately 6,000 acres (Phase 2) and one location per approximately 96,000 acres provides data on key ecosystem health indicators. Some partners chose to intensify beyond the base grid.

buy down. Plots installed at State expense to reach 20-percent implementation level of the base grid.

core reports. A class of publications that summarizes forest status and trends for a complete administrative unit, such as a whole State or a national forest. Examples include survey unit reports, State statistical and analytical reports, and national forest reports. Congressionally required 5-year State reports are part of the FIA's core reporting.

direct expenses. All expenses directly attributable to the FIA unit incurred as a part of doing FIA business. Excludes indirect business costs (such as rent, telephones, and administrative overhead outside the FIA unit staff), which are included in the "effective indirect expenses" definition. Includes work done for other units as a normal part of FIA business and the following items:

equipment. Costs for durable goods used for FIA, includes the following:

computer/telecommunications. Additional computer hardware, software, communications costs.

imagery. Aerial photos, satellite imagery data files.

field equipment. Measurement tools and equipment, such as data recorders, carried by field crews.

other. Any cost that does not fit into one of the previous equipment categories.

vehicles. All vehicle costs, including items such as operating costs, depreciation, and leases.

grants and agreements. Cost of cooperative grants and agreements that directly support the FIA mission.

office space and utilities. Charges for rent, lease, or other real estate costs for FIA staff, plus utilities.

other direct expenses. Any cost that does not fit into one of the previous categories, including training costs, unemployment, office supplies, postage, awards, moving expenses, and other expenses related to delivering the FIA program.

publications. Costs for laying out, editing, printing, and distributing publications.

salary. Includes direct salary and costs, plus benefits charged to the FIA unit, broken into the following categories:

administration. Program manager, project leader, and administrative staff.

analysts. Staff who analyze data and write publications.

Phase 2 Prefield production. Aerial photo-interpreters, satellite image analysts engaged in Phase 1 stratification.

data collection. All staff spending at least 50 percent of their time measuring regular plots.

field support. Field-crew supervisors who spend less than 50 percent of their time measuring plots; others involved in supporting and coordinating field crews.

information management. Forestry data managers and data compilers with support staff to build data views and analytical data queries.

QA (quality assurance) crews. All staff spending at least 50 percent of their time doing QA fieldwork.

techniques research. Staff who conduct FIA-related research on methods and techniques.

travel. Broken into the following categories:

field/QA travel. Travel costs for field and QA crews.

office travel. Travel costs for all staff except field and QA crews.

effective indirect expenses. Include items such as research station management and administrative salaries, operating expenses, research station budget shortfalls, and other items for which the FIA unit is assessed by their research station. Each station has its own means for determining these assessments. Rather than reporting the different rates, we simply calculate the “effective indirect expenses” item by subtraction:

$$\text{Effective indirect expenses} = (\text{total available funds}) - (\text{total direct FIA expenses} + \text{end of year balance})$$

effective indirect rate. Effective indirect expenses divided by total available funds, which is not necessarily the same as the standard station overhead rate; instead this rate reflects the total indirect cost as a fraction of the total funds available to FIA.

ecosystem indicators. Data collected on a subset of Phase 2 sample locations measured for a more extended set of ecosystem attributes, including tree crown condition, lichen community diversity, soil data, and down woody debris.

FY (end-of-the-year) balance. Funds reported in the previous fiscal year business report as unspent at the end of that fiscal year and presumably available for use in the current fiscal year.

intensification. Plots installed at the expense of State, National Forest System, or other partner to achieve higher-quality estimates for smaller areas or to buy the base Federal sample down to a 5-year cycle.

management meetings held. Number of national or regional management team meetings held by each FIA unit. Each regional management team consists of partners who share in funding and implementing the FIA program. The team typically consists of representatives from the FIA unit, NFS regional offices, State and Private Forestry offices, and State forestry agencies.

NGO (nongovernmental organization). A class of customers with whom FIA staff are asked to consult, includes environmental organizations, professional societies, and other, generally nonprofit, organizations.

NIPF (nonindustrial private forest land owners). Private individuals or organizations that own forest land for purposes other than industrial operations.

percentage of full funding. Total available funds divided by the funding needed to fully implement the base Federal program for a given year’s target funding.

percentage of region covered by annual FIA. Sum of forested acres in States currently implementing annual FIA, divided by the total number of forested acres in each FIA region; a measure of the degree to which the FIA region has moved from periodic to annual inventory.

percentage of total plots sampled. Total number of base grid plots sampled divided by the total number of plots in the base grid. Set by Congress, the current target in the East is 15 percent and 10 percent in the West.

Phase 1. Stratification of the land base into forested and nonforested classes by using remotely sensed imagery (aerial photographs or satellite imagery). Done to increase the efficiency of fieldwork and estimation.

Phase 2. A set of sample locations, approximately 1 for every 6,000 acres of land, measured for basic mensurational forest attributes.

publications. Number of publications per unit, by type of publication, as reported in official agency attainment reports. Publications are among the major outputs of the FIA program. Types of publications include:

core report. A report pertaining to reporting inventory results for a complete geographic entity. Includes the following:

national forest report. A complete analysis for a single national forest.

national report. A report for the entire Nation, such as the Resource Planning Act report.

regional report. A report for a group of States or other contiguous unit larger than a single State, such as a regional assessment.

State resource report. A complete statistical or analytical summary of the forested resources within a single State.

State timber product output (TPO) report. A complete analysis of TPO data for a single State.

other. Publication that does not fit into any of the previous categories, such as an abstract, book, or other government publication.

other station publication. A manuscript published by the Forest Service, for example, a general technical report.

peer-reviewed journal article. An article appearing in a refereed or peer-reviewed journal.

proceedings paper. An article appearing in the proceedings from a meeting or symposium.

significant consultations. Cases in which an FIA staff person spent at least 1 hour in discussion, analysis, or research to address a specific question or need raised by an external FIA program customer, and which is not part of our normal course of business in collecting, analyzing, and reporting FIA information.

total available funds. Total funds available for delivering the FIA program, including funds appropriated by Congress for the FIA program, other funds made available by Forest Service partners, and previous year carryover funds. These funds are a measure of Federal funding for the base Federal program.

users group meetings held. Number of users group meetings sponsored or attended by each FIA unit. A users group meeting is an open meeting in which a complete regional cross-section of FIA partners and customers are invited to attend. Users group meetings differ from the usual smaller meetings with one or two partners that all FIA units call as a normal course of business.

Appendix A: Contacts

For information about the status and trends of America’s forests, please contact the appropriate office below.

Northern FIA Program

Program Manager, FIA
 USDA Forest Service
 Northern Research Station
 1992 Folwell Avenue
 St. Paul, MN 55108
 651-649-5139

Interior West FIA Program

Program Manager, FIA
 USDA Forest Service
 Rocky Mountain Research Station
 507 25th Street
 Ogden, UT 84401
 801-625-5407

Southern FIA Program

(includes Commonwealth of Puerto Rico and the U.S. Virgin Islands)
 Program Manager, FIA
 USDA Forest Service
 Southern Research Station
 4700 Old Kingston Pike
 Knoxville, TN 37919
 865-862-2000

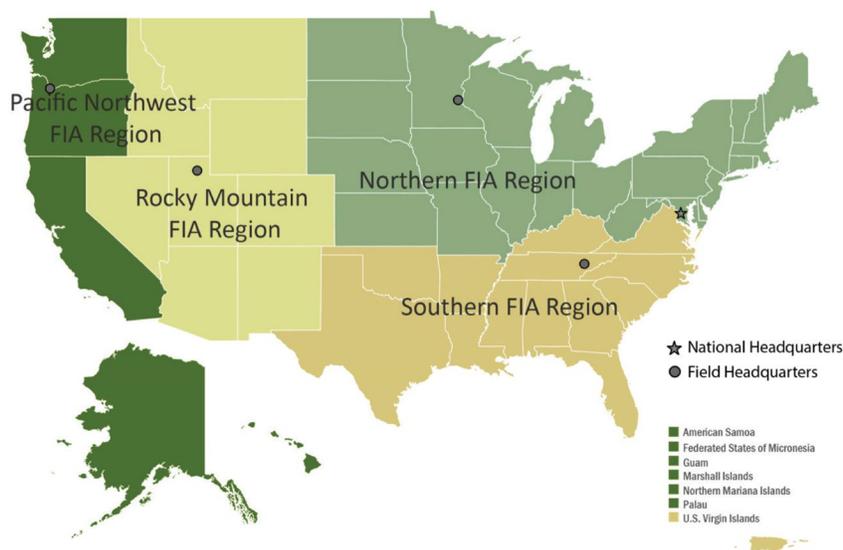
Pacific Northwest FIA Program

Program Manager, RMA (FIA)
 USDA Forest Service
 Pacific Northwest Research Station
 620 SW Main St., Suite 502
 Portland, OR 97205
 503-808-2019

National FIA Program Office

National Program Leader, FIA
 USDA Forest Service
 201 14th Street, SW
 Washington, DC 20250
 703-605-4177

All of our regional internet home pages and a wealth of statistical and other information are available through the national FIA home page at www.fia.fed.us.



FIA = Forest Inventory and Analysis.

Figure A-1. FIA regions and headquarters.

Appendix B: Tables

Table B-1.	Performance measures for the FY 2019 FIA program.
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Table B-3a.	Federal staffing, in full-time equivalent (FTE) hours, for the FY 2019 FIA program.
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Table B-10.	Status of FIA survey in U.S. islands and territories.
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Table B-12.	FIA summary statistics and performance measures, FYs 2011–2019.

Table B-1. Performance measures for the FY 2019 FIA program.

	Pacific Northwest	Rocky Mountains	Southern	Northern	National Office	Total
Total available Federal funds, FY 2019	\$16,590,521	\$14,127,322	\$19,847,421	\$17,588,910	\$13,462,392	\$81,616,566
Total appropriated FIA funds, FY 2019 ^a	\$16,518,521	\$13,967,322	\$18,931,155	\$17,631,410	\$10,951,592	\$78,000,000
Appropriated as % of 2014 Farm Bill target ^b						80%
Contributions from partners:						
Supporting the 20% FIA program	\$1,090,812	\$85,341	\$2,389,626	\$817,414	\$0	\$4,493,404
Value-added contributions	\$673,813	\$994,327	\$768,517	\$4,914,759	\$0	\$7,194,470
Total contributions	\$1,764,625	\$1,079,668	\$3,158,144	\$5,732,173	\$0	\$11,734,610
Total all available funds, FY 2019	\$18,355,146	\$15,206,990	\$23,005,565	\$23,321,083	\$13,462,392	\$93,351,176
Forest plots sampled:						
Base Federal grid	2,288	2,535	6,115	3,948	-	14,886
Spatial intensification	955		378	1,436	-	2,769
Temporal intensification	-	18	1,570	454	-	2,042
Total forest plots sampled	3,243	2,553	8,063	5,838	-	19,697
Forest plots with one or more health indicators	3,243	2,553	1,610	691	-	8,097
Number of base forest quality assurance plots	239	268	869	463	-	1,839
Percent base forest quality assurance plots	10%	11%	14%	12%	-	12%
Urban plots (forested and nonforested)	63	28	202	1,440	-	1,733
Special Studies plots (forested and nonforested)	-	77	-	1,541	-	
Total base grid plots and percent sampled ^c						
Total base grid plots	43,824	91,282	88,839	101,140		325,085
Average percent of land with forest cover	37%	24%	46%	29%		34%
Estimated percent of base grid sampled	14%	12%	15%	13%		13%
Percentage of States with annual FIA activity ^d	100%	100%	100%	100%		100%
Number of publications:						
National forest reports	-	-	-	-	-	-
State/island resource reports	-	-	-	13	-	13
State timber product output reports	-	-	-	2	-	2
Regional reports	-	-	-	4	-	4
National reports	-	-	1	1	-	2
5-Year State reports	3	3	1	-	-	7
Subtotal – core reports	3	3	2	20	-	28
Peer-reviewed journal articles	23	13	33	43	-	112
Proceedings articles	-	-	10	1	-	11
Other station publications	4	1	30	4	-	39
Other publications	2	-	4	8	-	14
Subtotal – non-report publications	29	14	77	56	-	176
Total publications	32	17	79	76	1	204
Number of publications per Federal FTE	0	0	1	1	1	1
Consulting activities:						
Number of significant consultations	197	29	11	653	60	950
Total hours of significant consultations	2,815	1,061	115	3,413	360	7,764
Meetings:						
User-group meetings held	5	1	-	1	2	9
Management meetings held	2	-	1	3	4	10

FIA = Forest Inventory and Analysis; FTE = full-time equivalents; FY = fiscal year.

^a Includes supplemental appropriation for hurricane relief.

^b Farm Bill target adjusted for inflation.

^c Includes all plots where trees were measured, except denied access and hazardous plots.

^d Base grid targets shown are 20 percent of samples per year as stated in the Farm Bill. Congressional conference notes recommended annual Federal targets of 15 percent in the East and 10 percent in the West. Interior Alaska as well as the Caribbean and Pacific Island inventories are periodic and excluded from the annualized mandate in compliance with Congressional recommendations.

Table B-2. Financial statement for the FY 2019 FIA program Federal funds.

	Pacific Northwest	Rocky Mountains	Southern	Northern	National Office	Total
Available funds:						
	Dollars					
Previous year end-of-year balance	14,178	59,289	27,694	35,910	-	137,071
Post-year adjustments ^a	(14,178)	(59,289)	497,306	(35,910)		387,929
Subtotal pre-year adjustments	-	-	525,000	-	-	525,000
FY appropriated FIA funds						
Initial FIA funds added to base	16,518,521	13,967,322	17,931,155	17,272,410	10,951,592	76,641,000
Secondary FIA funds added to base ^b	-	-	-	359,000	-	359,000
Hurricane supplemental appropriation ^c			1,000,000			1,000,000
Subtotal appropriated FIA funds	16,518,521	13,967,322	18,931,155	17,631,410	10,951,592	78,000,000
Inter-FIA Unit transfers	72,000	85,000	(114,500)	(42,500)	-	-
Other Forest Service R&D funds	-	-	-	-	2,510,800	2,510,800
Other non-Forest Service funds ^d	-	75,000	505,766	-	-	580,766
TOTAL AVAILABLE FEDERAL FUNDS	16,590,521	14,127,322	19,847,421	17,588,910	13,462,392	81,616,566
Direct expenses:						
Salary—	7,716,796	7,897,647	8,327,124	9,979,159	321,000	34,241,726
Administration	764,155	782,678	725,371	494,342	321,000	3,087,546
Phase 1 production	22,112		257,529	701,021	-	980,662
Field support	1,063,157	839,676	1,006,177	866,663	-	3,775,673
Data collection	2,959,416	2,572,599	357,359	2,645,609	-	8,534,982
Quality assurance	545,518	526,823	1,790,654	352,517	-	3,215,512
Information management	776,554	1,261,517	914,846	1,580,437	-	4,533,354
Analysis	965,739	1,043,071	1,795,569	2,648,968	-	6,453,347
Techniques research	620,145	871,283	1,479,619	689,603	-	3,660,650
Travel—	1,017,282	710,778	598,180	617,633	20,000	2,963,873
Office travel	85,028	111,233	125,760	284,111	20,000	626,131
Field/quality assurance crew travel	932,254	599,545	472,420	333,522	-	2,337,741
Equipment—	345,763	711,584	354,040	510,700	-	1,922,087
Vehicles	196,815	359,831	207,582	185,582	-	949,810
Field equipment	104,770	53,104	136,062	146,488	-	440,424
Information technology/communications	19,330	259,404	10,396	159,295	-	448,425
Other	24,849	39,245	-	19,335	-	83,429
Publications	10,485	19,693	-	146,284	-	176,462
Grants and agreements ^e	3,809,236	1,652,388	7,306,721	4,007,205	2,585,800	19,361,350
Field work/data	2,952,442	1,504,325	6,058,600	2,616,263	-	13,131,630
Information management	-	26,640	-	401,188	2,510,800	2,938,628
Research	856,794	121,423	976,141	989,754	75,000	3,019,112
Office space and utilities	630,116	549,625	475,548	132,732	-	1,788,021
Other direct expenses	429,157	239,650	-	-	-	668,807
Total direct expenses	13,958,835	11,781,365	17,061,613	15,393,713	2,926,800	61,122,326
Effective indirect expenses:						
Total effective indirect ^f	2,594,955	2,234,772	1,648,701	2,010,350	10,535,592	19,024,370
Total effective indirect rate	16%	16%	8%	11%	78%	23%
End of year balance ^g	36,731	111,185	1,137,107	184,847	-	1,469,870
TOTAL FEDERAL EXPENSE	16,590,521	14,127,322	19,847,421	17,588,910	13,462,392	81,616,566

EOY = end of year; FIA = Forest Inventory and Analysis; FY = fiscal year; R&D = Research and Development.

^a Some bookkeeping is not completed until after the new FY begins, which may affect beginning balances. These adjustments include items such as carryover, return of unused prior year grants, Station adjustments, etc.

^b Mid-year additions to base funding from National Office-FIA.

^c Supplemental appropriation for hurricane Michael relief. Because the funds were received at the end of FY 2019, this appropriation was carried over into FY 2020.

^d Includes special projects and funding from other Federal agencies.

^e Grants and Agreements include general allocation of grants to basic thematic categories.

^f Program-wide charges for cost pools, including the Albuquerque Service Center, and other cost pools, were paid by the National Office and included as program indirect expenses.

^g End of the year balance for the SRS includes the \$1 million Hurricane Michael appropriations supplemental.

Note: The main cost pools are a function of the number of all FIA program's employees, including those holding permanent, temporary, intermittent, and other types of positions. This cost is estimated using Full Time Equivalents (FTEs) included in Table B-3a. Charges of other cost pools, were calculated as a function of the number of FIA program's permanent employees only, estimated with permanent FTEs.

Table B-3a. Federal staffing (FTEs) for the FY 2019 FIA program.

	Pacific Northwest	Rocky Mountains	Southern	Northern	National Office	Total
Administration	6.8	8.3	6.7	4.6	2.0	28.4
Phase 1 production work	0.3	0.0	0.0	7.4	0	7.7
Field support	11.1	10.0	0.0	6.7	0	27.8
Data collection	42.8	40.9	16.7	28.7	0	129.1
Quality assurance crew	6.1	3.6	20.0	3.6	0	33.3
Information management	6.2	11.2	7.8	12.4	0	37.6
Analysis	7.6	10.8	14.7	19.5	0	52.6
Techniques research	4.8	7.8	10.8	3.7	0	27.1
Indirect support ¹	0.0	13.5	13.7	10.9	0	38.1
Total	85.6	106.1	90.4	97.5	2.0	381.6

FIA = Forest Inventory and Analysis; FTEs = full-time equivalents; FY = fiscal year.

¹ Note: Indirect support FTEs are salary charges of FS staff that support the FIA Program indirectly. FY 2019 is the first year that the business report can track and include this information. For comparison with previous years, discount this value from totals.

Table B-3b. Estimate of cooperator staffing funded by FIA grants and agreements (FTEs) for the FY 2019 FIA program.

	Pacific Northwest	Rocky Mountains	Southern	Northern	National Office	Total
Administration	1.0	0.6	0.0	0.0	0	1.6
Phase 1 production work	0.0	0.0	0.0	0.0	0	0
Field support	3.5	0.7	0.0	2.3	0	6.5
Data collection	23.5	19.5	95.0	22.3	0	160.3
Quality assurance	2.0	0.1	0.0	0.3	0	2.4
Information management	0.2	0.0	0.0	6.6	15.8	22.5
Analysis	11.7	3.7	0.0	4.2	4.8	24.4
Techniques research	4.0	1.0	0.0	12.8	1.3	19.1
Total	45.9	25.6	95.0	48.5	21.9	236.8

FIA = Forest Inventory and Analysis; FTE = full-time equivalents; FY = fiscal year.

Table B-3c. Estimate of total federally funded staffing (FTEs) for the FY 2019 FIA program.

	Pacific Northwest	Rocky Mountains	Southern	Northern	National Office	Total
Administration	7.8	8.9	6.7	4.6	2.0	30.0
Phase 1 production work	0.3	0.0	0.0	7.4	0	7.7
Field support	14.6	10.7	0.0	9.0	0.0	34.3
Data collection	66.3	60.4	111.7	51.0	0.0	289.4
Quality assurance crew	8.1	3.7	20.0	3.9	0.0	35.7
Information management	6.3	11.2	7.8	19.0	15.8	60.1
Analysis	19.3	14.5	14.7	23.7	4.8	77.0
Techniques research	8.8	8.8	10.8	16.5	1.3	46.2
Indirect support	0.0	13.5	13.7	10.9	0	38.1
Total	131.4	131.7	185.4	146.0	23.9	618.4

FIA = Forest Inventory and Analysis; FTE = full-time equivalents; FY = fiscal year.

Table B-4. Partner contributions toward implementing FIA in FY 2019.

Unit	Partner	Contributions toward the base program	Contributions that add value
		Dollars	
Rocky Mountains	Colorado State Forest Service		25,000
	University of Montana, Bureau of Business and Economics Research	85,341	
	USDA Forest Service R1		67,149
	USDA Forest Service R2		50,000
	USDA Forest Service R4		210,823
	USDA PNW Research Station		125,755
	USDA Rocky Mountain Research Station		13,150
	WO Forest Service (LANDFIRE)		85,000
	NASA (Africa)		194,726
	NASA (Other)		222,724
RMRS total		85,341	994,327
National Office		0	0
NO total		0	0
Northern	Auburn University		1,250
	Dartmouth University		2,500
	Kansas State University		3,750
	Michigan State University		21,250
	Northern Arizona University		13,750
	Plymouth State University		10,000
	State University of New York		17,175
	Syracuse University		8,250
	University of Georgia		12,250
	University of Maine		18,750
	University of Massachusetts		77,673
	University of Minnesota		57,286
	University of Nebraska-Lincoln		3,724
	University of New Hampshire		24,521
	Connecticut Department of Conservation	2,000	
	Delaware Department of Conservation	4,392	
	Illinois Division of Forest Resources	19,039	
	Indiana Department of Natural Resources	40,440	
	Iowa Department of Natural Resources	15,203	
	Kansas State Forest Service	16,938	
	Maine Forest Service	169,195	233,905
	Maryland Department of Natural Resources	20,730	
	Massachusetts Department of Conservation and Recreation	7,700	
	Michigan Division of Forest Management	40,200	
	Minnesota Department of Natural Resources	126,388	285,550
	Missouri Department of Conservation	55,092	244,383
	Nebraska Department of Forestry, Fish and Wildlife	5,880	
New Hampshire Department of Resources & Economic Development	19,600		
New Jersey Forest Service	21,249	132,630	
New York Department of Environmental Conservation	18,195		

	North Dakota Forest Service	4,590	
	Ohio Department of Natural Resources	13,687	
	Pennsylvania Department of Conservation & Natural Resources	43,000	6,123
	Rhode Island Department of Environmental Management	6,471	6,471
	South Dakota Department of Forestry and Natural Resources Management	13,554	
	Vermont Department of Conservation	8,500	4,000
	West Virginia Division of Forestry	22,271	
	Wisconsin Department of Natural Resources	54,600	475,000
	American Forest Foundation		100,000
	Conservation Biology Institute		6,600
	Davey Tree Expert Company		153,981
	Trout Unlimited		68,663
	City of Delta, British Columbia, Canada		4,310
	National Institute for Forest Science		45,455
	Environmental Protection Agency		909,300
	National Aeronautics and Space Administration		69,800
	U.S. Fish and Wildlife Service		24,397
	USDA Forest Service Geospatial Technology and Applications Center		134,850
	USDA Forest Service National Forest Systems	500	755,795
	USDA Forest Service Research & Development		69,948
	USDA Forest Service Resource Planning Act		50,000
	USDA Forest Service State and Private Forestry	68,000	861,469
NRS total		817,414	4,914,759
Pacific Northwest	Alaska Department of Natural Resources	595,120	
	Alaska Pacific University	9,650	
	Ecotrust		7,038
	Hawaii Division of Forestry and Wildlife		81,279
	Mississippi State University	32,391	
	NASA Goddard Space Flight Center		400,000
	Oregon State University	159,801	
	Portland State University		13,629
	University of Alaska Anchorage	41,315	
	University of Alaska Fairbanks		5,000
	University of Guam	51,575	
	University of Hawaii	88,320	
	University of Montana	60,172	
	University of Washington	27,468	6,867
	Pacific Southwest Research Station, Institute for Pacific Island Forestry	25,000	
	USDA Forest Service, S&PF, Landscape Restoration Grant, Micronesia Challenge		20,000
	USDA Forest Service, Region 10, Coastal Alaska Non-Forest Veg Plots		140,000
PNW total	1,764,625	1,090,812	673,813
Southern	Alabama Forestry Commission match	175,404	
	Alabama Forestry Commission match NF plots & TPO	3,755	
	Arkansas Forestry Commission match	149,069	
	Arkansas Forestry Commission match NF plots & TPO	2,347	
	DOI BIA Cherokee fund OT Train Timber Cruisers	7,000	
	Florida Dept of Agriculture and Consumer Serv TPO & NF plots	47,662	

Florida Dept of Agriculture and Consumer Services match	141,108	3,478
Georgia Forestry Commission match	194,188	
Institute for Sustainable Foraging - FRXNN818 - Ramp study	5,000	
International Institute of Tropical Forestry (IITF) match	100,000	
Kentucky Division of Forestry match	115,054	345,839
Kentucky Division of Forestry match TPO	6,453	
North Carolina over match state plots		54,025
Oklahoma Department of Agriculture, Food & Forestry match	117,556	
Region 8 NFHF Florida Plots	28,200	
Region 8 NFHF supplies	9,800	
Region 8 NFMP funding, Biomass carbon study	35,000	
Region 8 NFMP funding, Florida NF plots	14,244	
Region 8 NFMP funding, Georgia Plots	65,408	
Region 8 NFMP funding, rent Florida	12,500	
Region 8 NFMP funding, supplies	5,888	
Region 8 NFMP funding, Virginia Plots	29,580	
Region 8 NFMP funding, Garmin service field	23,507	
Region 8 NFMP funding, South Carolina Plots	12,420	
Region 8 NFMP funding, Texas Plots	10,280	
Region 8 NFTM funding, Texas NF plots	31,000	
Region 8 NFVW funding, OpenView HD	7,000	
Region 8 NFVW funding, Tree Seedling Survey Purdue, Auburn Idaho	30,000	
Region 8 NFVW funding, Virginia survey NF plots	38,000	
Region 8 NFWF funding, South Carolina Forest Service	38,000	
Region 8 SPFH funding, salaries Asheville, Athens, Pineville	28,000	
South Carolina Forestry Commission match	112,714	55,394
South Carolina Forestry Commission match NF plots and TPO	3,007	
Texas A&M Forest Service, Implementation of Annual FIA match	432,662	309,781
University of Georgia - Improved Biomass match	18,781	
USGS FRXF cover FIA other direct supplies and salary	12,600	
Virginia Department of Forestry match	131,185	
Virginia Tech Enhancing U.S. Ability Monitor Timber Stats	20,000	
Virginia Tech from NCASI FRXN for Fine Scale Modeling	19,167	
Virginia Tech, Forest Dynamics Projections	86,670	
Virginia Tech, National Scale Biomass	21,667	
Virginia Tech, small area estimation match	5,750	
WO IDP4RP19 VT New Improved Reporting	30,000	
WO NFMP funding, RPA Forest Dynamics	5,000	
WO NFVW funding, RPA Forest Dynamics	7,000	
SRS total	\$2,389,626	\$768,517
Total, all FIA units	\$4,383,193	\$7,351,416
Grant total (base program and added value)		\$11,734,610

BIA = Bureau of Indian Affairs; DOI = Department of Interior; FIA = Forest Inventory and Analysis; FY = fiscal year; IITF = International Institute of Tropical Forestry; NASA = National Aeronautics and Space Administration; NCASI = National Council for Air and Stream Improvement; NF = national forests; NFHF = National Forest Hazardous Fuels; NFMP = National Forest Management Plan; NFTM = National Forest Timber Management; NFVW = National Forest Vegetation and Watershed Management; NFWF = National Forest Wildlife and Fisheries; NO = National Office; NRS = Northern Research Station; PNW = Pacific Northwest Research Station; RMRS = Rocky Mountain Research Station; RPA = Resources Planning Act; SRS = Southern Research Station; S&PF = State and Private Forestry, USDA Forest Service; SPFH = State and Private Forestry Hazardous Fuels; TPO = Timber Products Output; USDA = United States Department of Agriculture; USGS = United States Geological Survey; USGS FRXF = United States Geological Survey Research Federal External Reimbursement.

Table B-5. Grants and agreements entered into by FIA units, FY 2019.

Unit	Amount	Recipient	Purpose
	Dollars		
Rocky Mountains	207,360	Integrated Resources Inventory (Contract)	Annual FIA implementation
	80,300	Michael Kasio (Contract)	Annual FIA implementation
	24,665	Wesley Winslow (Contract)	Annual FIA implementation
	985,000	Colorado State University	Annual FIA implementation in Colorado/Wyoming
	8,399	Synergy/RTL Contracting	Carbon accounting tool development
	26,640	Red Castle Contracting	FIA-NFS data analysis system development
	10,000	Reed College	FIESTA model assisted method analyses
	15,000	USDA Forest Service GTAC	FIESTA Support
	11,985	University of Arizona	Inventory and tree ring data workshop
	45,000	USDA Forest Service GTAC	Landscape Change Monitoring System (LCMS)
	31,039	Utah State University	Tree ring analyses
	207,000	USDA RMRS Forest and Woodland Ecosystems Program	Western soils analyses
	RMRS total	1,652,388	
National Office	1,300,000	Joint Venture agreement with UNLV	FIA maintenance for public facing tools
	82,104	Digital Map Products	National Woodland Owner Survey - ownership data layer
	230,000	Esri CIO Contract support	FIA Digital Engagement, displaying of FIA Data
	100,000	University of Massachusetts	National Woodland Owner Survey
	390,000	Forest Service Chief Information Office	Enterprise Application Development
	285,000	GTAC	FIA Land Use / Land Change, Image-based Change Estimation (ICE), Landscape Change Monitoring System (LCMS) and Timber Products Output (TPO)
	62,200	Utah State University	TimeSync data analysis of FIA plots
	4,589	Multiple vendors	Miscellaneous purchasing of COTS Software licensing
	56,907	Multiple vendors	Miscellaneous purchasing of COTS IT Hardware
	75,000	Nature Serve	Developing tools and materials for implementing the National Vegetation Classification
National Office total	2,585,800		
Northern	25,645	Access Ability, Inc.	Prefield document imaging services
	56,045	Skylight Forestry Inc.	Mid-Atlantic Urban Plots
	222,929	Chandler B. Johnson	Implementation of annual FIA, Michigan
	1,431	Chandler B. Johnson	Implementation of annual FIA, North Dakota
	25,000	Conservation Biology Institute, Inc.	Protected Database
	115,256	Daniel Huberty	Kansas Plots
	147,308	Davey Tree Expert Company	Enhancing i-Tree Spatial Simulation
	183,426	Department of Energy, Oakridge	ORISE Research Participation Program
	55,448	DJM Ecological Services, Inc.	Pittsburgh/Cleveland/DC/W Virginia P2 & P2+ Core Urban, Urban Plots
	103,700	Mark Webb	West Virginia Plots
	83,225	Indiana Department of Natural Resources	Implementation of annual FIA
	25,084	Joel Fyock	Mid-Atlantic Plots
	57,696	Joel Fyock	New York City, Bridgeport CT Urban Plots
	27,016	Joel Fyock	Vermont Plots
98,380	Kansas State University	High-res land cover & windbreak assessment	

	630,713	Maine Forest Service	Implementation of annual FIA
	70,000	Michigan State University	FIA Biomass Study
	655,532	Minnesota Department of Natural Resources	Implementation of annual FIA
	24,995	New Jersey State	NJFS Support for FIA Analytical Science Delivery
	60,000	NRS, Grand Rapids	Soil analyses
	44,799	Daniel Huberty	Nebraska Plots
	27,000	Research Foundation of State University of New York	i-Tree Application Support
	21,220	South Dakota Agriculture Department	South Dakota Plots
	33,000	Syracuse University	i-Tree Application Support
	107,575	Summers Glynn	New York Plots
	120,000	University of Maine	FIA Biomass Study
	157,504	University of Massachusetts	NWOS/Family Forest Research Center
	30,444	University of Minnesota	FIA Biomass Estimation Data Access
	203,885	University of New Hampshire	FIA Urban Analytical Support
	50,000	Michigan State University	Carbon Accounting Support
	50,000	Purdue University	Carbon Estimation in U.S.
	110,000	The University of Minnesota	Characterization of land area, ecosystem, and dynamics in the United States
	166,120	Mark Webb	Ohio Plots
	74,351	Chandler B. Johnson	Illinois, Indiana, and Nebraska Plots
	80,854	Thomas Bergstrom	North Dakota P2, P1, P2+ Solis, and Urban Plots
	61,624	Chandler B. Johnson	Nebraska Plots
Northern total	4,007,204.73		
Pacific Northwest	2,253,326	Alaska Department of Natural Resources	Interior Alaska FIA Implementation in the Susitna-Copper and Southwest Units in Cooperation with the State of Alaska Division of Forestry
	23,343	Alaska Pacific University	Using Advanced Remote Sensing to Estimating Woody Shrub Biomass: a Pilot Study in the Susitna-Copper Inventory Unit of Interior Alaska
	1,725	Department of Interior	Hawaii Forest Inventory Helicopter Dispatch Service Agreement
	23,190	Ecotrust	Modeling Ecological, Economic and Climate Impacts of Forest Restoration Management
	49,817	Mississippi State University	Fitting Live Tree Aboveground Biomass Equations for the U.S.
	84,000	NASA Goddard Space Flight Center	Interior Alaska FIA G-LiHT Collection in the Susitna-Copper Unit
	165,500	Oregon State University	Assessing Forest Ecosystem Health with Long-Term Plots and High Resolution Remote Sensing
	75,000	Oregon State University	Evaluating Biomass Equations for Pacific Northwest Tree Species
	85,000	Oregon State University	Application and Expansion of FIA Monitoring Data and Protocols to Answer New Questions
	43,390	Portland State University	Modeling Economic Drivers and Restoration Strategies on Forest Resilience
	28,999	Student Conservation Association	Urban Forest Inventory and Analysis 2019
	35,693	Student Conservation Association	Forest Inventory and Analysis 2019
	144,054	University of Alaska Anchorage	Using Tree Rings to Understand Changes in Tree Growth in Interior Alaska
	53,895	University of Alaska Fairbanks	Analyzing Soil Samples to Understand Belowground Composition in Interior Alaska

	176,804	University of Guam	Enhancing Local Knowledge to Sustain a Forest Inventory and Monitoring Program throughout the Pacific Islands
	318,000	University of Hawaii	Forest Inventory and Analysis Program of Hawaii's Forests
	180,000	University of Montana	Pacific West Timber Products Output (TPO) and Forest Industry Analysis
	42,500	University of Washington	Using Advanced Remote Sensing to Estimating Woody Shrub Biomass: a Pilot Study in the Susitna-Copper Inventory Unit of Interior Alaska
	25,000	University of Washington	Analysis and Data Management to Support the Application of LiDAR and DAP to Forest Management
Pacific Northwest total	3,809,236		
Southern	526,212	Alabama Forestry Commission	Implementation of Annual FIA
	11,264	Alabama Forestry Commission	TPO Survey Alabama
	447,207	Arkansas Forestry Commission	Implementation of Annual FIA
	7,040	Arkansas Forestry Commission	TPO Survey Arkansas
	200,000	Eastern Forest Environmental Threat Assessment Center (EFETAC)	SRS 4854 EFETAC ISA
	190,000	Eastern Forest Environmental Threat Assessment Center (EFETAC)	SRS 4854 EFETAC ISA - Hurricane survey
	423,324	Florida Department of Agriculture and Consumer Services	Implementation of Annual FIA
	5,544	Florida Department of Agriculture and Consumer Services	TPO Survey Florida
	95,000	Florida Department of Agriculture and Consumer Services	Hurricane disaster plots
	36,900	Florida Department of Agriculture and Consumer Services	Intensification survey NF Plots
	582,564	Georgia Forestry Commission	Implementation of Annual FIA
	16,808	Georgia Forestry Commission	TPO Survey Georgia
	48,000	Georgia Forestry Commission	Hurricane disaster plots
	48,600	Georgia Forestry Commission	Intensification survey NF Plots
	80,000	International Institute of Tropical Forestry (IITF)	Experimental Forest Study
	345,162	Kentucky Division of Forestry	Implementation of Annual FIA
	19,360	Kentucky Division of Forestry	TPO Survey Kentucky
	328,885	Mississippi Forestry Commission	Implementation of Annual FIA
	95,400	Mississippi Forestry Commission	Intensification survey NF Plots
	485,356	North Carolina Dept. of Agric. And Consumer Services	Implementation of Annual FIA
	18,260	North Carolina Department of Agriculture and Consumer Services	TPO Survey North Carolina
	352,669	Oklahoma Department of Agriculture, Food & Forestry	Implementation of Annual FIA
	338,143	South Carolina Forestry Commission	Implementation of Annual FIA
	9,020	South Carolina Forestry Commission	TPO Survey South Carolina
	41,400	South Carolina Forestry Commission	Intensification survey NF Plots
	366,144	Tennessee Department of Agriculture	Implementation of Annual FIA
	40,500	Tennessee Department of Agriculture	Intensification survey NF Plots
	1,075,684	Texas A&M Forest Service	Implementation of Annual FIA
	5,280	Texas A&M Forest Service	TPO Survey Texas
	36,000	Texas A&M Forest Service	Intensification survey NF Plots
	82,308	The University of Tennessee Knoxville	Evaluate Phodar (NiMBios Post-Doc)

	62,500	University of Auburn	Biomass study
	40,000	University of Auburn	Ground based LIDAR study
	42,500	University of Auburn - funds from NRS	Biomass study
	30,000	University of Georgia	Improved Volume Biomass & Carbon Data Base Tree
	393,554	Virginia Department Forestry	Implementation of Annual FIA
	51,300	Virginia Department Forestry	Intensification survey NF Plots
	3,833	Virginia Tech	Fine Scale Modeling
	260,000	Virginia Tech	RPA Small Area Estimate Forest Dynamics Projections
	65,000	Virginia Tech	Improved National Scale Volume Biomass & Carbon Data
Southern total	7,306,721		
Grand total	19,361,350		

CIO = chief information officer; EFETAC = Eastern Forest Environmental Threat Assessment Center; ESRI = Environmental Systems Research Institute; FIA = Forest Inventory and Analysis; FY = fiscal year; GTAC = Geospatial Technology and Applications Center, Forest Service; IITF = International Institute of Tropical Forestry; NASA = National Aeronautics and Space Administration; NF = national forest; NRS = Northern Research Station; NWOS = National Woodland Owner Survey; ORISE = Oak Ridge Institute for Science and Education; PNW = Pacific Northwest Research Station; RMRS = Rocky Mountain Research Station; RPA = Resources Planning Act; SRS = Southern Research Station; TPO = Timber Products Output; UNVL = University of Nevada, Las Vegas; USDA = United States Department of Agriculture.

Table B-6. Number and hours of significant consultations by FIA staff by customer group, FY 2019.

Customer Group	Pacific Northwest		Rocky Mountains		Southern		Northern		WO		Total			
	No.	Hours	No.	Hours	No.	Hours	No.	Hours	No.	Hours	No.	%	Hours	%
Academic	20	63	6	59	3	40	129	580	9	55	167	18%	797	10%
Government	142	2,668	17	839	4	24	265	1,702	20	121	448	47%	5,354	69%
Industry	13	35	1	5	4	51	73	324	7	44	98	10%	459	6%
NGO	7	20	3	5	-	-	142	620	15	90	167	18%	735	9%
NIPF	6	12	-	-	-	-	8	8	3	16	17	2%	36	0%
Media	9	17	-	-	-	-	28	64	3	17	40	4%	98	1%
Other	-	-	2	153	-	-	8	115	3	17	13	1%	285	4%
Total	197	2,815	29	1,061	11	115	653	3,413	60	360	950	100%	7,764	100%

FIA = Forest Inventory and Analysis; FY = fiscal year; NGO = nongovernmental organization; NIPF = nonindustrial private landowner.

Table B-7. FIA data access by online tools and spatial data center requests, 2000–2019.

Indicator	Number of annual accesses											Total 2000-2019
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
Online tools												
DATA downloads	2,014	3,033	1,929	1,512	7,383	19,768	66,000	69,025	53,315	195,836	436,119	855,934
DATIM									37,000	1,605	5,129	43,734
EVALIDator	3,920	2,900	55,468	34,901	33,759	35,839	36,532	34,082	38,597	42,625	46,349	364,972
EVALIDator API								75,449	38,313	63,162	3,963,560	4,140,484
FVS	683	-	-	-	-	-	-	-	-	-	-	683
FTE	50	-	-	-	-	-	-	-	-	-	-	50
FIDO	93,586	70,943	72,946	52,099	57,567	57,974	47,263	33,293	11,898	4,500	-	502,069
Mapmaker	45,834	-	-	-	-	-	-	-	-	-	-	45,834
National TPO Tool						69,600	18,544	37,000	1,092	2,652	2,771	129,037
NWOS	6,560	1,700	2,070	5,515	4,502	2,994	2,068	1,710	2,517	3,000	2,194	34,830
Online accesses total	152,647	78,576	132,413	94,027	103,211	186,175	170,407	250,559	182,732	313,380	4,456,122	6,117,627
Spatial data requests												
Academia	109	114	121	168	143	155	160	162	163	158	82	1,535
State	49	47	36	45	29	55	91	56	43	61	37	549
NFS	16	32	17	46	31	32	29	40	37	26	21	327
Other Federal	105	116	92	169	175	131	136	130	134	105	37	1,330
NGO	41	31	23	41	35	31	38	35	38	44	15	372
Industry	28	35	34	61	41	94	84	54	65	78	30	604
Other	57	48	91	75	67	88	66	55	59	31	20	657
Spatial data requests total	405	423	414	605	521	586	604	532	539	503	242	5,374

API = Application Program Interface; DATIM = Design and Analysis Toolkit for Inventory and Monitoring; FIA = Forest Inventory and Analysis; FIDO = Forest Inventory Database Online; FY = fiscal year; FTE = Fuel Treatment Evaluator; FVS = Forest Vegetation Simulator; NFS = National Forest System; NWOS = National Woodland Owner Survey; NGO = nongovernmental organization; TPO = Timber Products Output.
 Note: FIDO support was discontinued on March 2018; FIDO support was no longer provided in FY2019.

Table B-8. Mill, fuelwood, and ownership surveys processed and utilization sites visited, FYs 2000–2019.

Survey or site	Year initiated	Number of annual survey questionnaires or sites											Total 2000-2019
		2000-2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2018	
Timber products	1947	17,753	1,727	3,521	1,375	2,675	1,142	2,750	1,341	130	2,359	2,274	37,047
Fuelwood	1947	2,919	0	0	0	2,360	0	0	0	0	0	0	5,279
Ownership surveys	1978	17,281	0	7,960	4,028	5,262	0	0	0	5,254	27,137	9,920	76,842
Utilization sites	1947	503	66	58	162	189	105	216	162	39	219	113	1,832

FY = fiscal year.

Table B-9. Forest health indicator, year of initiation, and number of samples collected FYs 2000–2019.

Indicator	Year initiated	Number of annual samples											Total 2000-2019
		2000-2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
Crown condition	1991	9,444	761	0	1,510	5,031	3,813	4,437	5,399	5,723	6,438	4,705	47,261
Lichens	1998	2,955	167	0	33	0	0	8	193	0	351	257	4,312
Soils	1999	6,215	266	2	595	565	439	487	456	716	0	791	10,958
Vegetation profile	2001	17,471	2,097	1,624	7,145	6,703	7,098	6,666	6,757	6,294	7,025	7,000	75,880
Ozone	1994	10,055	1,018	107	0	0	0	0	0	0	0	0	11,180
DWM	2001	22,489	1,392	1,414	6,263	8,271	8,635	8,186	8,459	9,234	9,277	8,143	91,763
Mortality ^a	2001	72,677	15,293	15,858	20,275	13,859	17,308	16,825	14,606	17,083	16,825	16,116	236,725

FY = fiscal year; DWM = down woody material.

^a Number of re-measured annual inventory plots from which tree mortality can be estimated.

Note: Data correction: soil data for 2018, and lichens data for 2014, 2015, and 2017 included in this table update previously reported estimates.

Table B-10. Status of FIA survey areas excluded from annualized inventory.

Region and area	Land area in inventory	Forest Area	Percent forest	Number of major islands	Year of current inventory	Year of inventory available in database	Year of published report	Number of base field plots	Number of intensified plots	Available online Data
Acres										
Pacific (PNW)										
American Samoa	48,434	43,631	90%	4	2012	2012	2019	24		Yes
Guam	135,660	63,833	47%	1	2013	2013	2004	61		Yes
Palau	110,028	90,685	82%	10	2014	2014	2007	56		Yes
Commonwealth of the Northern Mariana Islands	75,546	51,009	68%	3	2015	2015	2011	37		Yes
Federated States of Micronesia	161,917	143,466	89%	4	2016	2006	2011	85		Yes
Marshall Islands	33,182	23,230	70%	10	2018	2008	2011	65		Yes
Hawaii	4,141,469	1,990,000	48%	8	2019	2015	2015	246	104	Yes
Atlantic (SRS)										
Commonwealth of Puerto Rico	2,192,327	1,219,178	56%	4	2019	2014	2019	506	134	Yes
U.S. Virgin Islands	82,164	46,967	57%	3	2019	2014	in review*	106	0	Yes
Total	6,980,727	3,671,999	53%	47				1,186	238	

FIA = Forest Inventory and Analysis; PNW = Pacific Northwest Research Station; SRS = Southern Research Station.

* State report of the Virgin Islands was completed in 2019 but not published in 2019 (it did in 2020). The previous report was published in 2013.

Table B-11. Land/forest area and FIA annualized implementation status by State and region, FY 2019.^a

Region and State	Bureau of the Census land area	Forest land area defined by 2017 RPA Assessment	Annual inventory entry date	State annualized as of 2018
	Thousand acres		Year	
Northern	606,841	182,587		24
Connecticut	3,099	1,808	2003	Yes
Delaware	1,247	361	2004	Yes
Illinois	35,532	4,980	2001	Yes
Indiana	22,929	4,876	1999	Yes
Iowa	35,749	2,923	1999	Yes
Kansas	52,326	2,527	2001	Yes
Maine	19,739	17,579	1999	Yes
Maryland	6,252	2,463	2004	Yes
Massachusetts	4,992	3,025	2003	Yes
Michigan	36,185	20,311	2000	Yes
Minnesota	50,961	17,413	1999	Yes
Missouri	43,995	15,409	1999	Yes
Nebraska	49,167	1,532	2001	Yes
New Hampshire	5,730	4,758	2002	Yes
New Jersey	4,707	1,990	2004	Yes
New York	30,161	18,887	2002	Yes
North Dakota	44,161	789	2001	Yes
Ohio	26,151	8,077	2001	Yes
Pennsylvania	28,635	16,898	2000	Yes
Rhode Island	662	370	2003	Yes
South Dakota	48,519	1,949	2001	Yes
Vermont	5,899	4,511	2003	Yes
West Virginia	15,384	12,077	2004	Yes
Wisconsin	34,661	17,074	2000	Yes
Southern	533,031	245,513		13
Alabama	32,413	23,127	2001	Yes
Arkansas	33,303	19,040	2000	Yes
Florida	34,447	17,253	2001	Yes
Georgia	36,809	24,635	1998	Yes
Kentucky	25,271	12,442	1999	Yes
Louisiana	27,650	14,984	2000	Yes
Mississippi	30,031	19,380	2007	Yes
North Carolina	31,115	18,829	2003	Yes
Oklahoma	43,901	11,911	2008	Yes
South Carolina	19,239	12,931	1998	Yes
Tennessee	26,390	13,967	1999	Yes
Texas	167,188	40,970	2000	Yes
Virginia	25,274	16,043	1998	Yes
Interior-West	547,691	123,844		8
Arizona	72,700	10,934	2001	Yes
Colorado	66,331	20,063	2002	Yes
Idaho	52,892	21,386	2004	Yes

Montana	93,149	25,517	2003	Yes
Nevada	70,260	7,487	2010	Yes
New Mexico	77,631	16,619	2008	Yes
Utah	52,589	12,087	2000	Yes
Wyoming	62,140	9,751	2010	Yes
Pacific Coastal	573,389	213,391		4
Alaska, Coast	39,041	14,426	2004	Yes
Alaska, Interior	326,575	114,151	2016	Periodic
California	99,699	31,515	2001	Yes
Hawaii	4,110	1,471	2010	Periodic
Oregon	61,432	29,653	2001	Yes
Washington	42,532	22,174	2002	Yes
TOTAL	2,260,953	765,335		49
Forest area performance measure, excluding Interior Alaska				100%
Forest area performance measure, including Interior Alaska				90%
State activity performance measure, includes all active States				100%

FIA = Forest Inventory and Analysis; FIADB = Forest Inventory and Analysis Database; FY = fiscal year; RPA = Research Planning Act.

^a Based on area defined as forest in FIADB plus area defined as forest by 2012 RPA Assessment.

Table B-12. FIA summary statistics and performance measures, FYs 2010–2019.

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AVAILABLE PROGRAM FUNDS										
Apropriated FIA funds ^a	71,817	71,452	69,186	65,567	66,805	70,000	75,000	77,000	77,000	78,000
Other Federal funds ^b	930	856	528	2,668	3,077	743	304	85	2,377	3,036
Total Federal funds	72,747	72,308	69,714	68,235	69,882	69,882	75,304	77,085	79,666	81,036
Total non-Federal funds ^c										581
Total partner funds ^d	7,516	9,109	10,129	7,772	7,833	8,972	10,176	10,906	10,883	11,735
Total available funds	80,263	81,417	79,843	76,007	77,715	77,715	85,480	87,991	90,549	93,351
% Full Federal appropriated funding ^e	89%	92%	89%	84%	86%	78%	83%	86%	86%	80%
PROGRAM EXPENSES AND BALANCES										
Administration	3,262	3,233	2,735	2,854	3,036	2,703	2,759	3,632	3,532	0
Image processing	916	724	519	589	597	635	761	680	833	0
Field support	3,594	3,917	3,946	4,151	4,082	3,782	4,029	3,797	3,770	0
Data collection ^f	26,162	27,057	24,387	22,559	23,590	22,807	26,888	28,369	26,952	0
Information management ^f	7,476	6,794	6,740	5,933	6,737	7,680	7,962	7,599	8,807	0
Analysis	5,357	6,105	6,570	6,695	7,058	6,907	6,800	6,534	6,575	-
Research ^f	6,903	5,444	6,075	6,690	7,072	6,111	7,084	8,482	7,050	0
Miscellaneous/other	4,473	4,417	3,882	3,652	3,864	5,025	4,342	2,909	2,933	0
Total direct expenses	58,143	57,692	54,854	53,124	56,037	55,651	60,625	62,002	60,452	0
Total indirect expenses	14,189	13,958	14,180	14,704	13,461	14,708	14,652	15,083	19,076	19,024
Indirect rate	19.8%	19.5%	20.5%	22.4%	20.2%	21.0%	19.5%	20%	24%	24%
Total Federal expense	72,332	71,650	69,034	67,828	69,498	70,359	75,277	77,085	79,529	19,025
Fire Transfer	-	0	0	0	0	449	181	0	0	-
Total EOY balance	415	658	680	407	384	312	452	120	137	632
Total Federal funds	72,747	72,308	69,714	68,235	69,882	71,119	75,910	77,205	79,666	19,656
Other measures										
% States with annual activity	100	100	100	100	100	100	100	100	100	100
% States with FIADB 1-2 yrs old	88	94	94	94	96	96	96	98	94	86
Federal employees	392	397	372	366	366	338	352	341	339	382
Other employees	205	201	203	184	204	185	213	209	220	237
Total employees	596	598	575	550	570	523	565	550	559	618
P2 base forest plots	19,272	21,233	19,673	21,263	19,789	18,346	14,308	15,543	14,598	14,848
P2 base QA plots	4,020	4,550	4,417	5,465	2,312	3,083	1,529	2,199	2,171	1,839
Percent QA plots	9%	21%	22%	26%	12%	17%	11%	14%	15%	12%
All publications	203	204	272	238	234	236	371	208	211	204
Journal publications	74	62	90	90	87	122	122	92	122	112
Percent journal publications	36%	30%	33%	38%	37%	52%	33%	44%	58%	55%
Consultations, number	991	1,753	848	824	945	1,350	1,289	1,341	1,648	950
Consultations, hours	10,381	8,584	8,807	8,124	7,987	13,806	7,547	8,781	8,000	7,764
User/mangement meetings	10	14	15	12	14	13	12	9	14	19
Spatial data requests filled	423	414	605	605	586	604	532	539	503	5,374
Online accesses	104,676	132,413	94,027	103,211	186,175	170,407	250,559	182,732	310,758	4,456,122

FIA = Forest Inventory and Analysis; FIADB = Forest Inventory and Analysis Database; FY = fiscal year; EOY= end of year.

^a Includes supplemental appropriation for hurricane relief.

^b Includes return of previous year carryover, return of fire transfers, and additional Forest Service Research commitments.

^c Includes non-Federal funds that are not part of grants and agreement.

^d Includes partner contributions towards the base program and partner contributions that add value.

^e Considering full program implementation funding to achieve 2007 Strategic Plan for FY 2007 through 2013, and 2014 Farm Bill options A through C for FY 2014 through 2019. Full funding was adjusted for inflation and differs from previously reported data not adjusted for inflation.

^f Includes Federal grants and agreements.

Note: Indirect expenses rate jumped in FY 2018 because of the Forest Service approach, adopted that year, to charge costs pools, which are considered an indirect expense rather than a direct expense in this report.

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