USDA

United States Department of Agriculture

Forest Inventory and Analysis

Fiscal Year 2017 Business Report

Forest Service FS-1131 May 2019

Cover photo: *Granite Chief, Tahoe National Forest, Placerville, CA. Photo courtesy of Rand Snyder, USDA Forest Service, Pacific Northwest Research Station.*

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Executive Summary

For almost 90 years, the Forest Inventory and Analysis (FIA) program has played an integral role in providing the information vital to managing 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, forest product sector and employment trends, biomass availability, land cover and land use change, pollutant effects, 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 make the transition from an approach in which each State is surveyed periodically to one in which each State is inventoried annually. FIA developed these plans, in concert with its partners, to carry out the congressional mandate. FIA's Strategic Plan for Forest Inventory and Analysis includes a requirement for an annual business report that outlines the status and progress of the national annual inventory program.

This annual business report, our 20th, tells the taxpayers, partners, and clients what the program has accomplished with the financial resources provided and what the program will accomplish in 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 demanded by the communities we serve. Some key findings of this annual report are—

Annualized progress. In fiscal year (FY) 2017, FIA maintained annualized inventory activity in all 50 States, including the Tanana Valley in interior Alaska. Travel restrictions, late budget allocations, and hiring delays contributed to a lag in FIA annual plot production in FY 2016 to FY 2017. 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.

Funding. Total funding from all sources for the FIA program in FY 2017 was $88.0 million, a net increase of $1.5 million from FY 2016. FY 2017 funding consisted of $77.0 million appropriated by Congress and $10.9 million in partners' funds. State partners' funds are used to maintain annual measurement and 5-year State report cycles. In FY 2017, total appropriated funding was 14 percent less than the amount needed for full program implementation of 2014 Farm Bill options A through C.

Partners' support. Partners contributed $10.9 million to the program in FY 2017. Of the $10.9 million, 36 States contributed $5.2 million toward buying down their measurement and reporting cycles to 5 years or to intensify their plot network.

Grants and agreements. When external cooperators can complete critical FIA work with equal quality for less cost, FIA contracts for these services—a total of $20.7 million was spent in this way in FY 2017. Table 2 summarizes FIA funding activity to and from States from FY 2007 through FY 2017 for data collection, and appendix table B-5 provides details on all FIA partnership agreements.

Data availability. Data for all States, excluding Hawaii and interior Alaska are now online and less than 2 years old. These data supplied information for 539 spatial data requests and 182,732 online data requests.

Five-year reports. By FY 2017, FIA had completed at least one 5-year report or periodic report for 96 percent of the States and 100 percent of the islands since annualized inventory began in 1999. In all, FIA had 208 publications, 92 of which were peer reviewed in FY 2017.

Quality assurance. FIA field-checked 11 percent of all field plots measured in FY 2017 to ensure that FIA databases comprise only the highest quality data. All plots are further checked for consistency when loaded into the FIA database.

Users groups. FIA relies heavily on periodic meetings with users and clients to ensure that the program is providing the highest quality service and meeting its planned objectives. In 2017, FIA held two national and seven regional users group meetings to gauge how well it is meeting the goals stated in the strategic plan and the previous year's annual report.

Personnel. FIA, directly and through cooperators, employed 550 people in FY 2017. Cooperators are integral to the efficient delivery of the FIA program, comprising 209 of the 550 employees, or 38 percent of the total workforce. Total FIA Federal employment was down 48 positions in 2017. Of the total FIA workforce, 182 were employed in information

management, techniques research, or resource analysis; they provided 1,341 consultations (8,781 hours) to help users and clients effectively use FIA data.

Other 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, fuelwood production, the characteristics and management objectives of the Nation's private woodland owners through the National Woodland Owner Survey (NWOS), and several indicators of forest health. Since FY 2000, FIA has collected such data from more than 85,000 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 provisions to be 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.

Looking to 2018. FIA had a productive year in FY 2017 and looks forward to further progress in FY 2018. Important goals for FY 2018 include—

- Continue annualized inventory of 50 States, with focused attention on completing the Tanana Valley in interior Alaska and compilation of data for the inventory of Hawaii.
- Report U.S. forest carbon numbers to the United Nations Framework Convention on Climate Change.
- Publish the 2017 *Forest Resources of the United States* report for the Resource Planning Act (RPA) and post tables to Federal Register.
- Expand urban inventory to cities in all FIA regions.
- Print the *Forest Atlas of the United States* (FIAtlas).
- Complete at least 10 State 5-year reports.
- Implement 2017 NWOS base, urban, and corporate surveys. Finalize and pre-test corporate NWOS.
- Publish Hawaii NTFP report. Publish 2012, 2013, 2014, and 2015 National Pulpwood Reports.
- Continue to implement the Image-based Change Estimation (ICE) project to improve land cover and land use change classification and analysis.
- Continue work on Design and Analysis Toolkit for Inventory and Monitoring (DATIM) and continue work to implement changes from field guide version 7.0 in Forest Inventory and Analysis Database (FIADB) and the online tools.
- Fill vacant positions with quality recruits at levels required for successful program delivery.

For additional detail, see Comparing FY 2016 Plans with FY 2017 Accomplishments and FY 2018 Plans.

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) 2017 (October 1, 2016, through September 30, 2017), 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. (Note: This business report does not include statistical information about the forests of the United States. Those who want to obtain such information should contact the appropriate regional or national FIA office listed in appendix A of this report or go to http://www.fia.fs.fed.us.).

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, and predicting the effects of climate change. 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 to project how forests are likely to appear in 10 to 50 years under various scenarios to evaluate whether current forest management practices are sustainable in the long run and to assess whether current policies will enable our grandchildren and their grandchildren to enjoy the benefits provided by America's forests as we do today.

Changes From Previous Years' Business Reports

This year, in the section on comparing work accomplishments to plans and identifying plans for next year, sections are presented for what FIA now calls portfolios. The portfolios generally correspond to elements identified in the 2015 FIA Strategic Plan.

Fiscal Year 2017 Program Overview

In FY 2017, the FIA program completed the 17th year of implementing the annual inventory system 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 [PL] 105–185). The FIA program includes two basic sample levels: Phase 1 (P1), which consists of remote sensing for stratification to enhance precision; and Phase 2 (P2), which 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 appendix table B-9. Our 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 of P1 and P2 elements of the FIA sample for the United States. The numbers in this table 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 2017, the total appropriated funding of $77 million was $13 million below the target level outlined in the FIA strategic plan[1] to complete the transition of the base program to full implementation of options A through C. The following sections highlight current outputs and products, program resources, and partners' contributions.

Table 1. Overview of land area, FIADB forest area, RPA forest area, estimated P1 pixels and estimated P2 plots by region in FY 2017.

Region	Land area	Forest area (FIADB)	Forest area (RPA)	Forest	All P1[a]	All P2
	Mil. acres	*Mil. acres*		*Percent*	*Mil. pixels*	*Plots*
North	607	182	182	30	39.5	101,140
South	533	267	245	50	34.8	88,839
Interior West	548	154	125	27	35.6	91,282
Pacific Coast (California, Oregon, Washington)	204	85	84	42	13.2	33,944
Coastal Alaska	39	14	14	35	2.7	6,507
Interior Alaska	327	114	114	35	21.0	3,373
Islands (including Hawaii)	7	4	4	53	0.5	1,163
Total	2,264	821	768	33	147.2	326,247

FIADB = Forest Inventory and Analysis Database; FY = fiscal year; Mil. = million; P1 = Phase 1; P2 = Phase 2; RPA = Resource Planning Act.
*Moderate-resolution Imaging Spectroradiometer (MODIS) 250 meter pixels at 15.4 acres each.

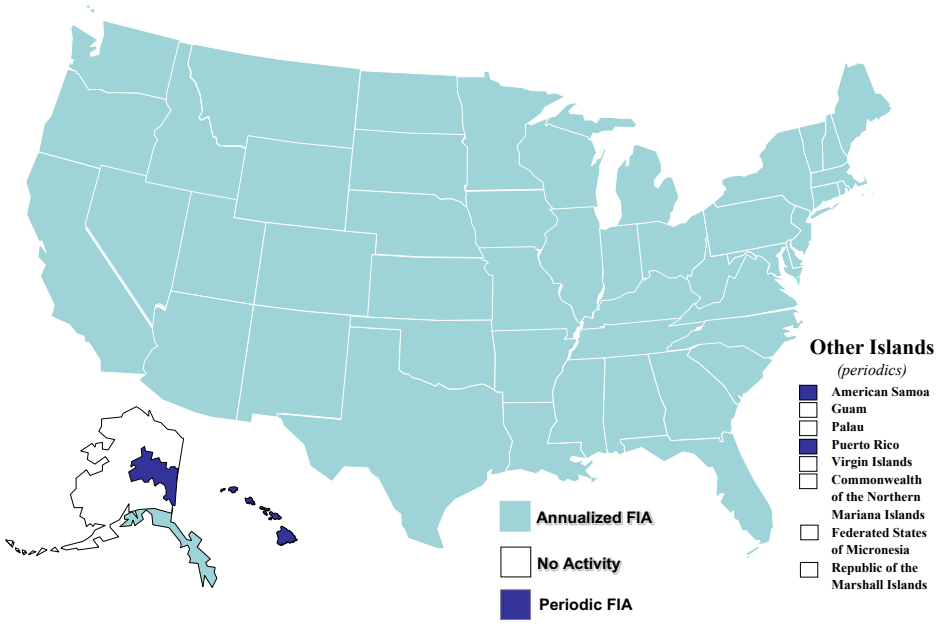
[1] U.S. Department of Agriculture, Forest Service. 2016. Forest Inventory and Analysis strategic plan. FS-1079. Washington, DC: U.S. Department of Agriculture, Forest Service. 46 p.

Outputs and Products

Appendix table B-1 shows some comparisons across FIA regional units in the rates, costs, and performance of implementing the FIA program. In FY 2017, we were active in all 50 States including coastal and Tanana Valley of Alaska (fig. 1), measuring 15,543 base grid forest sample locations, or 12 percent of the total. At the end of FY 2017, all States were covered by some level of annual FIA program activity, but only 49 States were fully implemented, with interior Alaska being implemented on a periodic survey unit basis. Appropriated funding saw an increase of $2.0 million in FY 2017 and partners' support increased $339,990. 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 [illegible] Federated States of Micronesia in 2017.

The FIA program produced 208 reports and publications in FY 2017, significantly fewer than in FY 2016. Of these publications, 79 were core publications consisting of reports specific to a complete survey unit, complete State, national forest, or national report. Core reports include 5-year State reports as required by legislation. FIA also published 92 articles in peer-reviewed journals and 8 articles in proceedings from scientific meetings and conferences. FIA staff participated in 1,341 significant consultations with FIA customers, requiring 8,781 hours of staff time—equivalent to more than six full-time staff positions. The FIA technical staff met on several occasions to further refine the national core FIA program, resulting in continued improvement of the FIA *National Core Field Guide* and enhancement of internet tools for accessing and analyzing FIA data, including the National Information Management System (NIMS), which provides a single national platform for processing FIA data and posting it on the web. Our internet resources processed more than 182,732 data retrievals in which FIA customers obtained user-defined tables, data downloads, and maps of interest. Overall numbers are up as the program improved interactive tools and added refinements to online user access.

Figure 1. FIA implementation status, FY 2017.



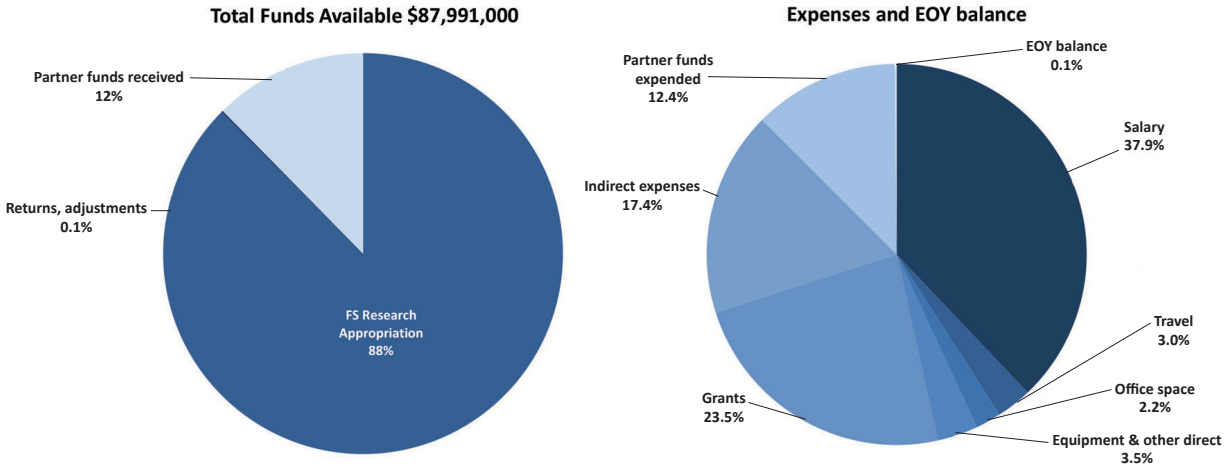
FIA = Forest Inventory and Analysis; FY = fiscal year.

Program Resources

Congress appropriated funds for the FIA program in one Forest Service deputy area: research and development (R&D), which had $77 million in appropriated funds in FY 2017, a net increase of $2.0 million from FY 2016 (appendix table B-12). In FY 2017, States and other partners provided an additional $10,906,318 for plot intensification and other program enhancements.

In its annual appropriation, Congress intends for FIA to make funds available for cost-sharing with States to help implement the FIA program. In turn, States take advantage of FIA's on-the-ground resources, contracted or dedicated, to contribute funds for additional data collection to meet their local needs. Table 2 demonstrates the financial side of this partnership in the Grants section. Nearly one-third of all FIA fieldwork is accomplished using these partnerships.

Figure 2. FIA program available funds and expenses by category, FY 2017.



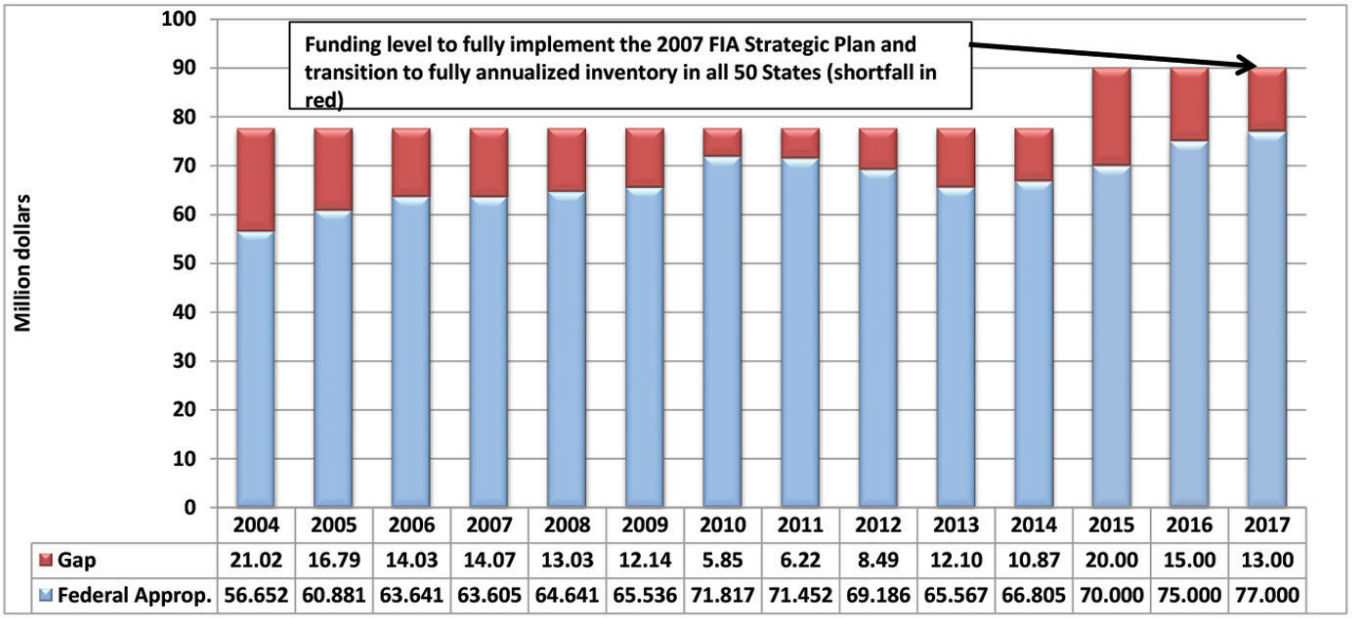
EOY = end of year; FIA = Forest Inventory and Analysis; FY = fiscal year.

Table 2. Annual FIA appropriations and allocation of FIA-appropriated and State-contributed funds for fieldwork only for FYs 2007–2017.

Category	Fiscal Year										
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	Thousand dollars										
Total FIA appropriation	63,605	64,641	65,536	71,817	71,452	69,186	65,567	66,805	70,000	75,000	77,000
FIA data collection grants to States	**6,146**	**5,590**	**6,971**	**7,278**	**8,002**	**7,475**	**5,338**	**7,098**	**5,173**	**8,428**	**8,945**
Number of States receiving grants	**18**	**18**	**19**	**20**	**17**	**18**	**16**	**17**	**16**	**18**	**17**
Average grants to participating States	**341**	**311**	**367**	**364**	**471**	**415**	**334**	**418**	**323**	**323**	**526**
Percent of appropriated funding granted to States for data collection	*10%*	*9%*	*11%*	*10%*	*11%*	*11%*	*8%*	*11%*	*7%*	*11%*	*12%*
State contributions for leveraged data collection	**5,824**	**3,783**	**4,594**	**5,039**	**6,192**	**5,567**	**3,962**	**3,919**	**4,324**	**5,506**	**5,205**
Number of States contributing funds	**41**	**41**	**44**	**45**	**40**	**41**	**38**	**36**	**37**	**34**	**36**
Average contribution from States	**142**	**92**	**104**	**112**	**155**	**136**	**104**	**109**	**117**	**162**	**145**

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

Figure 3. FIA-appropriated funding level, FYs 2004–2017.



	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Gap	21.02	16.79	14.03	14.07	13.03	12.14	5.85	6.22	8.49	12.10	10.87	20.00	15.00	13.00
Federal Approp.	56.652	60.881	63.641	63.605	64.641	65.536	71.817	71.452	69.186	65.567	66.805	70.000	75.000	77.000

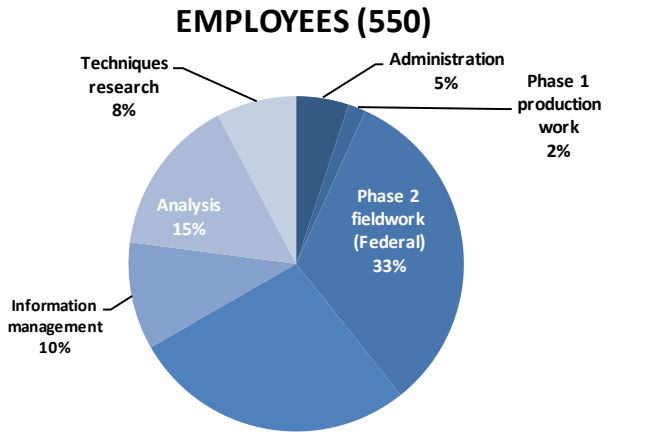
FIA = Forest Inventory and Analysis; FY = fiscal year.
Note: Estimated total funding to fully achieve the 2007 strategic plan was $77.7 million. The 2014 Farm Bill required a new strategic plan and added items requiring $90 million annually to fully achieve plan options A through C. This gap in funding is noted in the red segment on the 2017 bar.

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 2017 ranged from 9 to 15 percent across the country (appendix table B-2), reflecting differences in both sources of funding and what is included in research station indirect expense assessments. The National FIA Program Office has a 71-percent rate of indirect cost because that budget item includes the USDA overhead and programwide charges to the Albuquerque Service Center ($6,550,000) and expenses related to the Information Resources Direction Board (IRDB) ($2,500,000) in FY 2017. Overall, the program's indirect expenses were 20 percent of the total expenses. Inclusion of Service Center charges would take total program indirect to roughly 28 percent of appropriated funds. Figure 3 shows the total appropriated funding for FIA from FY 2001 through FY 2017 and the FY 2018 target. Appendix table B-12 shows the trend data in FIA performance measures for FY 2010 through FY 2017.

In FY 2017, FIA Federal program staffing consisted of 341 Federal person-years of effort (appendix table B-3a), slightly lower than FY 2016. Cooperators, especially State forestry organizations, using grants and agreements, accomplish much of the work done by FIA, and they added 209 employees for a total workforce of 550. Cooperator employees included 151 State or cooperator field employees, 15 information management specialists, 27 analysts, 14 researchers, and 1 administrative specialist. Cooperator employees constituted 38 percent of the total FIA workforce in FY 2017. The percentage of the total FIA workforce has not changed from 2016, while FIA continues to seek cost-effective partnerships.

Of all Federal and cooperator FIA employees, approximately 61 percent were involved in data collection and field support, 25 percent in analysis and information management, 7 percent in techniques research, 4 percent in program management and administration, and 2 percent in P1 production work (fig. 4).

Figure 4. FIA program employees by job group, FY 2017.



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

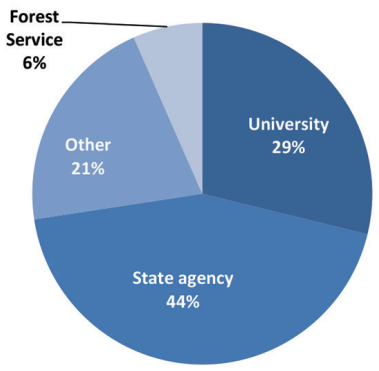
FIA Grants and Partners' Contributions

The complete FIA program envisioned by Congress was to be a Federal-State partnership, in which both Federal and State partners contribute resources to accomplish the work. Congressional guidance indicates that the base Federal commitment is an inventory program that collects data from 10 percent of the sample locations in the Western United States (10-year cycle) and 15 percent of the sample locations in the Eastern United 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 is not available within FIA; in other cases, they share the workload. Appendix table B-5 lists 123 grants and agreements for FY 2017, comprising $20,704,594. 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. Financially, these grants and agreements were with State agencies (44 percent) and university partners (29 percent) (fig. 5).

Additional cooperators included other Federal and Forest Service offices (6 percent) and non-Federal partners (21 percent) supporting collaboration in data collection, information management, and research in techniques development. 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.

Figure 5. Grants and agreements by recipient group, FY 2017.



FY = fiscal year.

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 (Option D of Strategic Plan). 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.

Appendix table B-4 lists 100 partners that have contributed resources to the FIA program in FY 2017, either to achieve the 20-percent level of cost-sharing envisioned

Table 3. FIA grants and partners' contributions, FY 2008 through FY 2017.

Group	Total FIA grants	Average annual grants	Percent of grants	Total partner contributions	Average annual contributions	Percent of contributions
	Dollars			*Dollars*		
States/islands	70,335,570	7,003,557	48%	49,199,101	4,919,910	68%
Universities	41,037,259	4,103,725	28%	7,022,487	702,248	6%
Forest Service	11,049,939	1,104,993	8%	23,369,011	2,336,901	21%
Other Federal	1,728,613	174,861	1%	5,140,217	514,021	4%
Other partners	20,839,132	2,083,913	14%	857,897	85,789	1%
Total	**145,010,513**	**14,501,051**	**100%**	**85,588,713**	**8,558,871**	**100%**

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

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 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 $3.7 million toward the full 20-percent of target plots measured annually and another $7.2 million in contributions that add value to the FIA program, for a total of $10.9 million in partners' contributions. These contributions amount to $339,990 more than partners contributed in FY 2016. Experience has shown that as Federal funds increase, partners' contributions tend to follow. The source of partners' contributions depends 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 nearly $145 million to efficiently carry out annualized inventory, and partners have contributed nearly $86 million to leverage Federal dollars to reduce inventory cycles and provide for other annual inventory enhancements. Table 3 summarizes FIA grants and partners' contributions by organization.

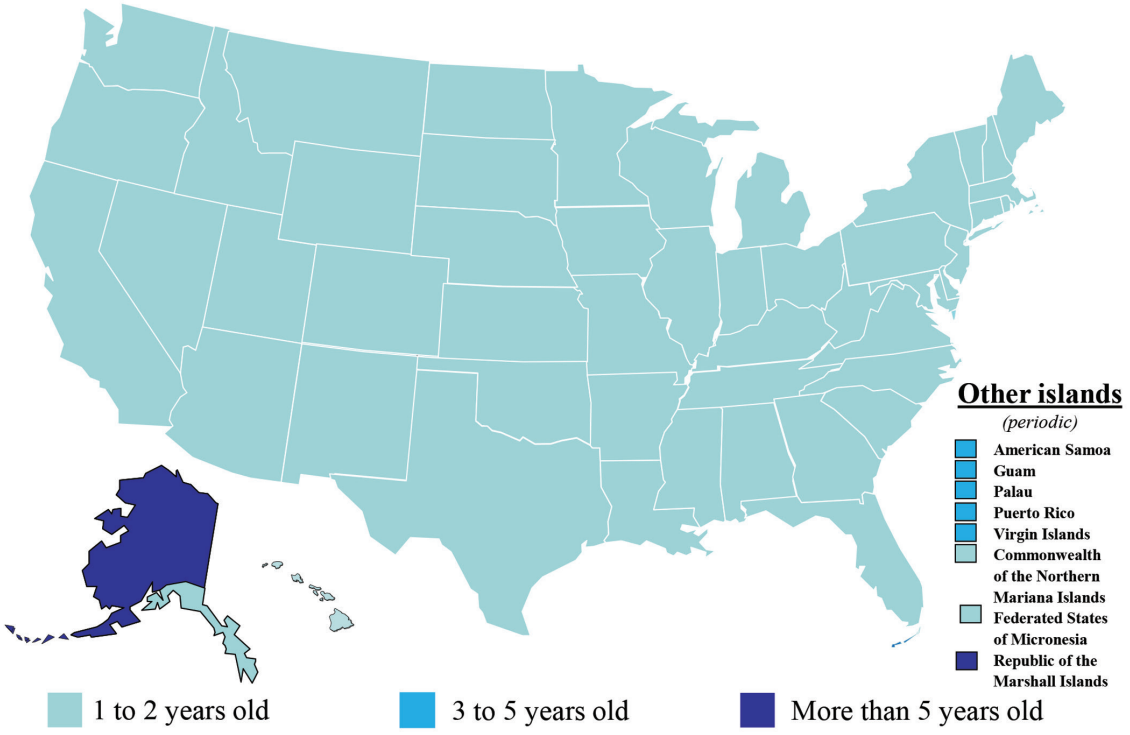
FIA Data Availability

In 2017, FIA completed migrating its data and data-processing procedures to the new Forest Service corporate servers in Kansas City, MO. The overall goal of this migration was to move the Forest Service to a more reliable, secure, and modern infrastructure with improved platform tools, better response times, better documentation, and, of course, lower total life-cycle cost. Many significant challenges remain in the new corporate-server environment, but the major hurdles are behind us. FIA has returned to normal server operation levels that are commensurate with FIA's high customer service standards (appendix table B-7).

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.

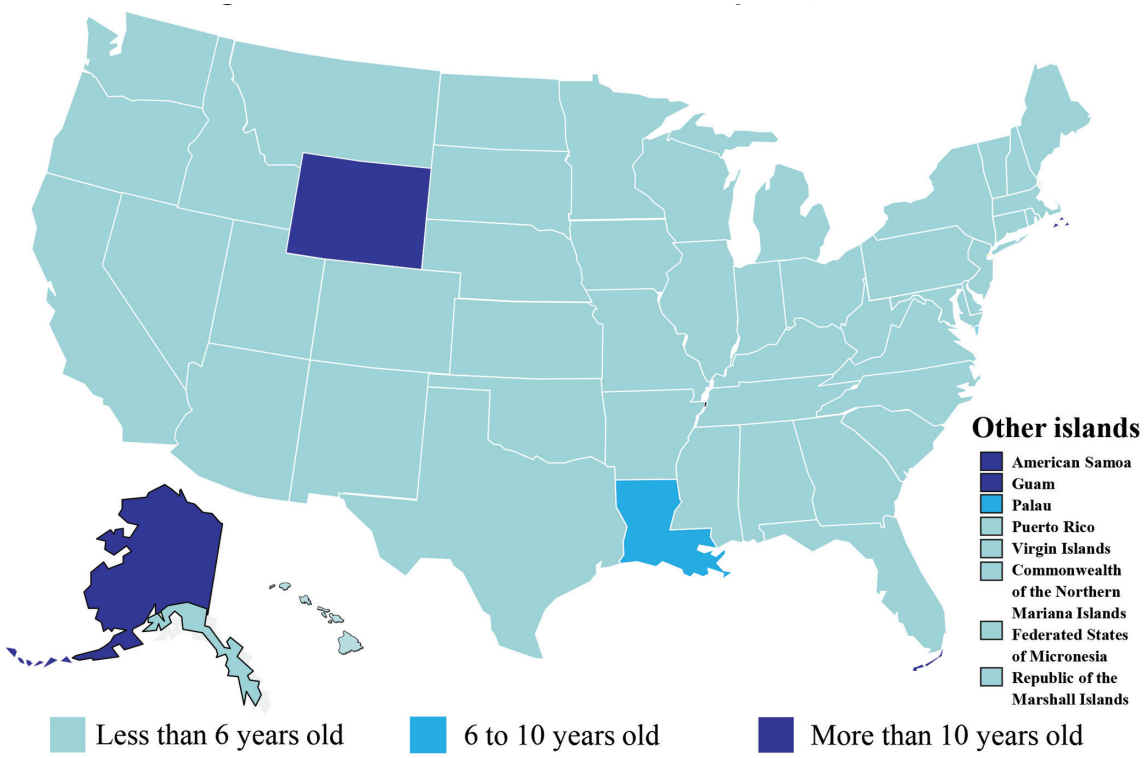
As we move through the transition to full program implementation, one key performance measure is how well we are satisfying program objectives. Figure 6 shows, for each State, the age of FIA data accessible in our public database as of September 30, 2017—the end of FY 2017.

Figure 6. Availability of online FIA da



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

Figure 7. Publication status of State reports, FY 2017.



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

Virtually all States now have data that are less than 2 years old available in the database. Interior Alaska and Hawaii remain outliers, but the current Hawaii inventory is wrapping up and data will soon be available for Hawaii and the Tanana Valley in interior Alaska. Some island data may be older because the islands' periodic inventory cycles are predominantly 10 years. Continued improvements in data processing and NIMS are now paying dividends by enabling us to establish a more routine loading schedule.

Figure 7 shows the age of the most recently published statewide FIA report for each State. States with publications based on data that are less than 6 years old—the program objective—are shaded light blue. States with publications 6 to 10 years old are shaded medium blue, and States where the most recent publication reports are based on data more than 10 years old are shaded dark blue. Only two States now have State reports more than 6 years old, excluding interior Alaska (fig. 7). FIA made significant strides in catching up with the backlog of 5-year reports in recent years and should soon complete the process of full compliance with its legislative mandate. As noted earlier, some islands will have reports more than 6 years old because of longer inventory cycles. The goal, however, is not to exceed 10 years in these areas.

Quality Assurance

FIA is committed to producing and delivering complete, accurate, and unbiased information with known precision, representativeness, comparability, and accuracy. The FIA Quality Assurance (QA) program supports this goal using a framework that promotes 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 collection of core program 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. The National Quality Assurance Coordinator position remained vacant in FY 2017. Normally, this important position works with the National FIA Program Office and the regional and national indicator advisors 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 following:

- The FIA *National Prefield Guide* 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* ensure consistent core program data collection.
- The field *QA Check Procedures Guide* promotes field QA consistency from region to region.
- The *Forest Inventory and Analysis Database: Database Description and User Guide* provides detailed information to users about published FIA data.
- 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.*
- The analytical *QA Guide* outlines steps for checking compiled data for accuracy and completeness before releasing them to the public.
- *A National FIA QA Plan* describes the overall QA process.

New and ongoing QA tasks in FY 2017 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.
- 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.
- Published a study on how lack of adequate quality assurance/quality control (QA/QC) data in the FIA inventory is hindering the assessment of potential forest degradation.[2]

[2] Brandeis, T.; Zarnoch, S.; Oswalt, C.; Stringer, J. 2017. The lack of QA/QC control data hinders the assessment of potential forest degradation in a national forest inventory. *Forest Ecology and Management.* 396 (2017): 176–183.

Regional Program Accomplishments for FY 2017

This section provides information on FIA results, accomplishments, and outcomes throughout the country by FIA unit. More detailed information is available from the respective FIA unit, as shown below. (Contact information for each FIA unit also appears in appendix A.)

Northern Research Station FIA Program

Finding: The USDA Forest Service's Forest Inventory and Analysis Program is coming to a city near you

Accomplishment: Completed the first urban inventory report for the city of Austin, TX.

Outcome: The Forest Service's Forest Inventory and Analysis Program (FIA) has packed its suitcase and is taking a trip to the city. For many years, FIA has only measured information on trees in areas that meet its definition of "forest"—generally, groups of naturally growing trees in areas that meet specific size requirements. Now, however, FIA has established a national urban forest inventory program and has begun monitoring in urban areas around the Nation, focusing on the most populous cities. Using its suitcase full of inventory methods, database and reporting tools, and statistical techniques, including i-Tree software tools which quantify ecosystem services, FIA is now monitoring the urban tree resource. By doing this, FIA fulfills its goal of making more comprehensive reports on the status of and trends in the Nation's forests and trees.

FIA, working with State and local partners, is collecting data and refining its data processing and reporting methods continuously. The ultimate goal of this effort is to have a seamless reporting system that uses the existing FIA protocols to provide new and valuable information on trees in these previously unmeasured areas.

Contact: Tonya Lister, tlister@fs.fed.us.

Finding: Forest Inventory and Analysis establishes partnerships to produce high-resolution land cover maps of the northern plains

Accomplishment: Forest Service personnel from Northern Research Station (NRS)-FIA and National Agroforestry Center (NAC) have developed operational mapping methods and are transferring the technology via training, documentation, and custom Geographic Information Systems (GIS) toolkits to the partner institutions.

Figure 8. Urban forest species composition as a percentage of all trees, Austin, TX. This data and more are included in FIA's first published urban report—Austin's Urban Forest, 2014.

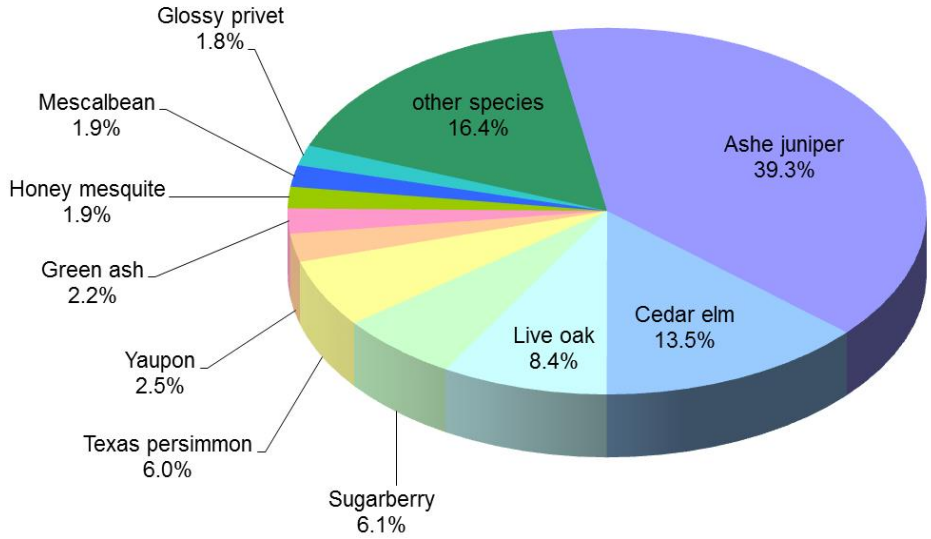
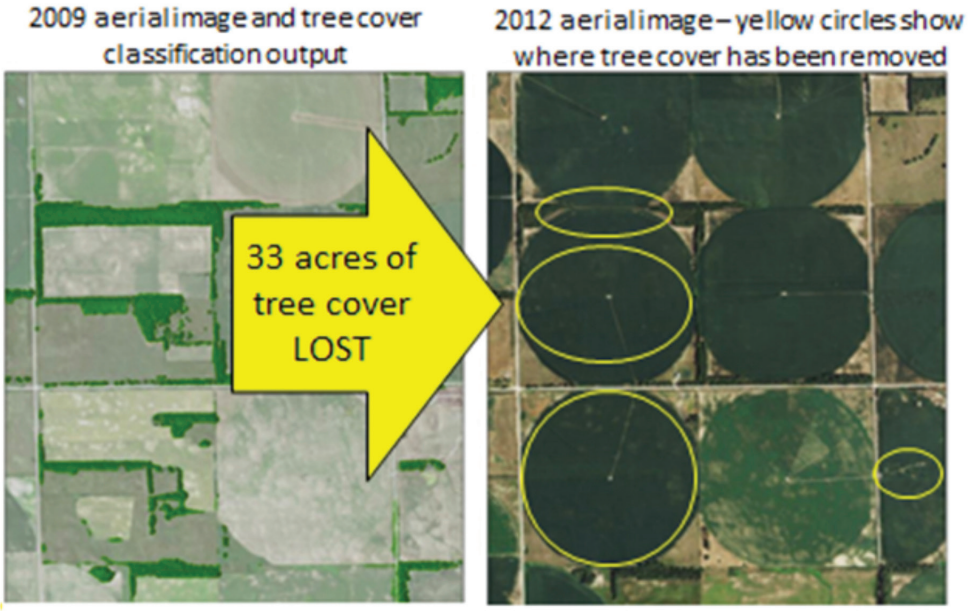


Figure 9. High-resolution maps showing windbreaks (left) facilitate monitoring in the dynamic agricultural landscapes of the Central United States. In this area, 33 acres of windbreaks have been removed between 2009 and 2012.



Outcome: The Prairie States Forestry program oversaw the planting of more than 200 million trees from 1935 to 1942 in a corridor stretching from Texas to North Dakota. Windbreaks are now a common feature on the landscape, serving critical functions such as carbon sequestration and protection from wind erosion. The windbreaks and riparian corridors common in agricultural landscapes are not considered to be forest land due to their narrow configurations. In response to the USDA Strategic Agroforestry Framework, the FIA program at the NRS-FIA and the NAC have been developing techniques for high-resolution land cover mapping to fill a monitoring role for these tree resources. In 2016, official agreements were established with the University of Nebraska-Lincoln's Center for Advanced Land Management Information Technologies and Kansas State University – Kansas Forest Service to work jointly on land cover mapping. A series of county-level datasets for Nebraska and Kansas was released in late 2016.

Research Data Archive, RDS, Paull, Darci A.; Whitson, Jakob W.; Marcotte, Abbey L.; Liknes, Greg C.; Meneguzzo, Dacia M.; Kellerman, Todd A. 2017. High-resolution land cover of Kansas (2015). Fort Collins, CO: Forest Service Research Data Archive. Updated 27 November 2017. https://doi.org/10.2737/RDS-2017-0025 https://www.fs.usda.gov/rds/archive/Product/RDS-2017-0025/.

Contact: Greg Liknes, gliknes@fs.fed.us; Dacia Meneguzzo, dmeneguzzo@fs.fed.us.

Finding: FIA data help to understand landscape drivers of Tamarack mortality during an outbreak of eastern larch beetle

Figure 10. Gallery pattern of eastern larch beetle under the bark of an infested tamarack. Photo by Steven Katovich, USDA Forest Service, Bugwood.org.

USDA Forest Service photograph.

Accomplishment: Knowing what type of tree or what growing conditions make tamarack trees more susceptible to mortality from eastern larch beetle (ELB) will help to inform land management strategies necessary to reduce the impacts of this insect.

Outcome: Tamarack trees have long been associated with Minnesota's Great North Woods. Though no longer as prevalent across the landscape as before European settlement, tamarack in Minnesota has seen a slow but steady rise in abundance starting in the mid-20th century. Now, an eruption in the population of native eastern larch beetles is causing tamarack mortality to climb. Unlike historic outbreaks, the current ELB outbreak has been long-lasting and was not preceded by disturbance events, including defoliation or flooding. Comparing the growing conditions and tree characteristics of live and dead tamarack trees, Forest Service scientists and their research collaborators found that in northeastern Minnesota, the largest diameter trees were those more often killed by ELB. In northwestern Minnesota, tamarack trees growing close to other conifers (as opposed to hardwoods) were more likely to be killed by ELB. Comparing tamarack trees across a vast area provides an opportunity to better understand factors that make trees more susceptible to bark beetle mortality on a landscape scale.

Crocker, S.J.; Liknes, G.C.; McKee, F.R. [et al.]. 2016. Stand-level factors associated with resurging mortality from eastern larch beetle (*Dendroctonus simplex* LeConte). Forest Ecology and Management. 375: 27–34.

Partners: Fraser McKee, Ministry of Agriculture and Forestry, Government of Alberta; Jana Albers, Minnesota Department. of Natural Resources; Brian Aukema, University of Minnesota.

Contact: Susan Crocker, scrocker@fs.fed.us; Greg Liknes, gliknes@fs.fed.us.

Figure 11. Aerial view of tamarack mortality caused by eastern larch beetle.

USDA Forest Service photograph.

Pacific Northwest Research Station FIA Program

Finding: Variation in Douglas-fir biomass dynamics within and between vegetation zones implies multi-scale climatic controls on forest structural trajectories for Douglas-fir and highlights the potential for continued atmospheric carbon sequestration in warm and wet forests of the Pacific Northwest for both young and old forests, given that future climatic conditions support similar forest dynamics.

Accomplishment: To assess potential sources of variation in structural trajectories, we examined proportional biomass change for a regionally dominant tree species, Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco), across vegetation zones representing broad gradients in precipitation and temperature with 3,510 forest inventory plots in Oregon and Washington. We found that *P. menziesii* biomass change decreased with *P. menziesii* biomass stocks and increased with *P. menziesii* density, remaining positive in older stands only in the wet and warm vegetation zone. Within two of the vegetation zones, biomass change was greatest in warm and wet environments. In dry vegetation zones, positive *P. menziesii* biomass change responses to initial canopy cover and canopy cover change (i.e., increases with cover loss and decreases with cover gain) indicated shifts in forest structure.

Outcome: While ecological succession shapes contemporary forest structure and dynamics, other factors like forest structure (dense versus sparse canopies) and climate may alter structural trajectories.

> Bell, D.M.; Gray, A.N. 2016. Assessing intra- and inter-regional climate effects on Douglas-fir biomass dynamics in Oregon and Washington, USA. Forest Ecology and Management. 379: 281-287.

Contact: David Bell, dmbell@fs.fed.us; Andrew Gray, agray01@fs.fed.us

Finding: Regional carbon cycle responses were modeled over the four-State Northwest United States region for the interval from 1986 to 2010.

Accomplishment: We applied the Biome-BGC model over the four-State (Oregon, Washington, Idaho, and Western Montana) Northwest region of the United States for the interval from 1986 to 2010. Landsat data were used to characterize disturbances, and forest inventory data were used to parameterize the model. The overall disturbance rate on forest land across the region was 0.8 percent per year, with 49 percent as harvests, 28 percent as fire, and 23 percent as pest/pathogen. Net ecosystem production (NEP) for the 2006–2010 interval on forestland was predominantly positive (a carbon sink) throughout the region, with maximum values in the Coast Range, intermediate values in the Cascade Mountains, and relatively low values in the Inland Rocky Mountain ecoregions. Localized negative NEPs were mostly associated with recent disturbances. There was large interannual variation in regional NEP, with notably low values across the region in 2003, which was also the warmest year in the interval. The recent (2006–2010) net ecosystem carbon balance (NECB) was positive for the region (14.4 teragrams of carbon per year). Despite a lower area-weighted mean NECB, public forestland contributed a larger proportion to the total NECB because of its larger area. Aggregated forest inventory data and inversion modeling are beginning to provide opportunities for evaluating model-simulated regional carbon stocks and fluxes.

Outcome: Variation in climate, disturbance regime, and forest management strongly influence terrestrial carbon sources and sinks. Spatially distributed, process-based, carbon cycle simulation models provide a means to integrate information on these various influences to estimate carbon pools and flux over large domains.

> Turner, D.P.; Ritts, W.D.; Kennedy, R.E. [et al.]. 2016. Regional carbon cycle responses to 25 years of variation in climate and disturbance in the U.S. Pacific Northwest. Regional Environmental Change. 16: 2345-2355.

Partners: Oregon State University and USDA Forest Service, Rocky Mountain Research Station.

Contact: Andrew Gray, agray01@fs.fed.us.

Finding: In most unmanaged forests, yellow-cedar has recently increased, as measured by live tree basal area, and the average mortality rate has been relatively low.

Accomplishment: Climate change is expected to impact forests worldwide, and yellow-cedar (*Callitropsis nootkatensis* (D. Don) Oerst. ex D.P. Little) decline has been used as an example of how changing climate can impact a tree species. However, most previous research has not placed yellow-cedar decline within the context of yellow-cedar overall. We used a 2004–2013 regional inventory of the temperate rainforest of Alaska (671 plots with yellow-cedar) to estimate current attributes and a subset of 564 remeasured plots (established 1995–1998) to estimate recent change. Results show that in unmanaged forests, yellow-

cedar live tree basal area recently (1995–1998 to 2004–2013) increased, with a 95-percent confidence interval of 0.3 percent to 3.3 percent increase per decade. Yellow-cedar has a relatively low mortality rate, 0.41 percent of trees per year. An analysis of live-tree-to-snag ratios was consistent with elevated mortality of yellow-cedar prior to 1995 but also indicated that little range contraction had occurred.

Outcome: The large numbers and wide geographic range of yellow-cedar trees in Alaska and the recent (1995–2013) stability in the monitored population serve as important contextual information for yellow-cedar decline. This research also illustrates that understanding the spatial and temporal complexities of how tree species respond to climate change will be improved if focused studies are accompanied by regional monitoring.

Barrett, T.M.; Pattison, R.R. 2016. No evidence of recent (1995–2013) decrease of yellow-cedar in Alaska. Canadian Journal of Forest Research. 47: 97-105.

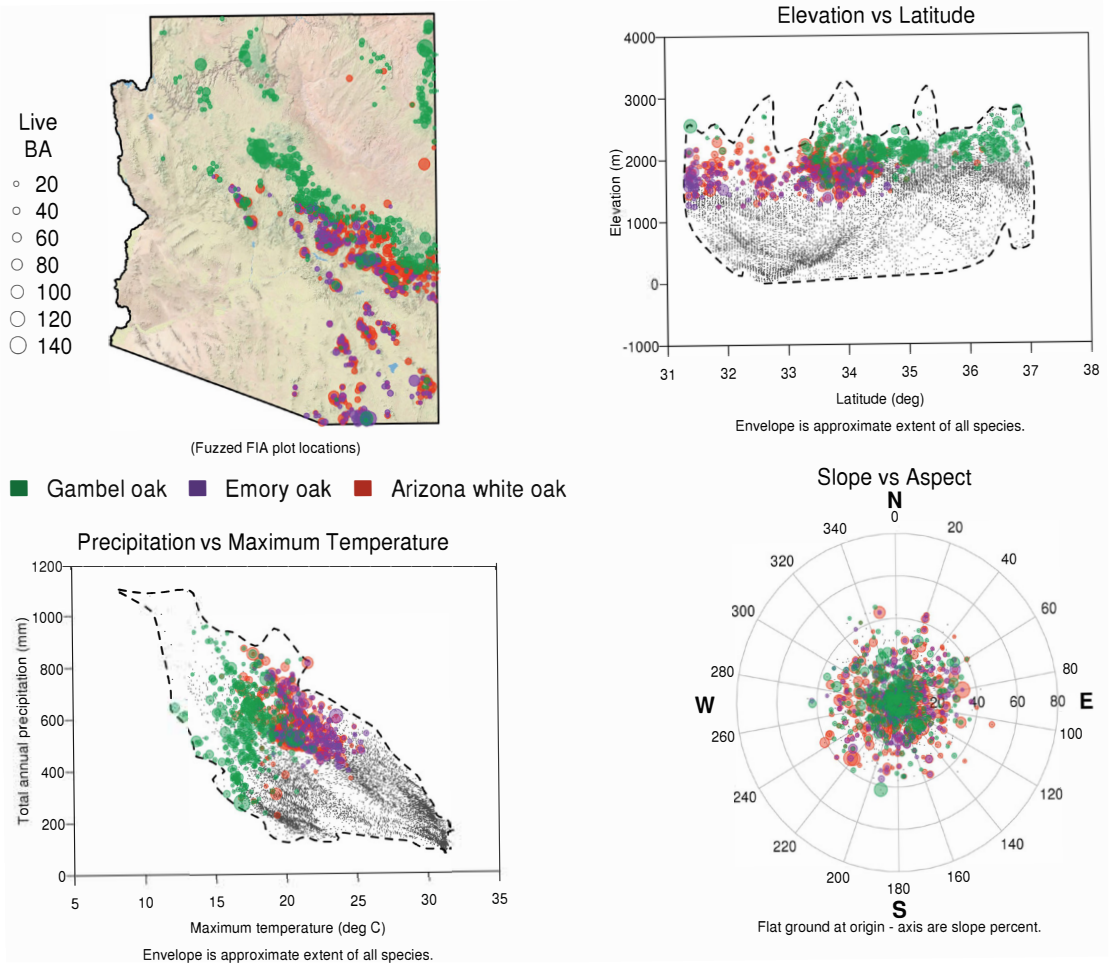
Contact: Tara Barrett, tbarrett@fs.fed.us.

Rocky Mountain Research Station, Interior West FIA Program

Finding: TreeExplorer is a *Shiny* web application that enables interactive exploration of tree species distributions from FIA data.

Accomplishment: *Shiny* is an R statistical program package that allows the creation of interactive web applications. These web apps provide new opportunities for hands-on, interactive exploration of FIA data. Any map, analysis, or data visualization that is possible in R can be made interactive. Using *Shiny*, developers in the Interior West FIA unit have created a web app that allows users to explore tree species distributions throughout the region. Users can pick one or more species of interest, and immediately see a map showing the distribution and associated basal area across a given State. They can also see graphs of species distribution and basal area as a function of topographic and climatic variables such as slope, aspect, temperature, and precipitation. This makes it easy to explore potential driving forces behind tree species distributions.

Figure 12. Example of exploring oak species distributions in Arizona.



Live BA = live basal area per acre; deg = degrees; deg C = degrees centigrade; m = meters; mm = millimeters.

Outcome: This use of this tool requires no training, and the figure below illustrates a simple example. Suppose someone is interested in oak distributions in Arizona. Within 5 minutes, they can find out that while there are seven oak species in the State, only three are common: Arizona White oak, Gambel oak, and Emory oak. From the map in the upper left, they can see that Arizona white oak and Emory oak have very similar distributions, while Gambel oak is completely different. The three remaining graphs illustrate that while there is little difference in precipitation received in areas occupied by these three species, Gambel oak is found on cooler, higher elevation plots compared to the other species. The maps and graphs generated by this app can be easily downloaded and saved within an Microsoft Word document. Future plans include expanding the app to accessing FIA data nationwide, as well as adding additional forest inventory variables.

Contact: A development version of TreeExplorer is currently running on a Forest Service server. Users within the Forest Service firewall can contact Elizabeth Freeman at eafreeman@fs.fed.us for more details.

Finding: In support of the Landscape Change Monitoring System (LCMS), which will soon produce continually updated 30-meter maps of forest change across the country, FIA led a multi-partner team that discovered how to make more accurate maps by combining the strengths of several different mapping algorithms. Evolving technology enables many different mapping algorithms to be run in parallel to create an ensemble of maps. The team showed that: (1) the strengths, weaknesses, and results of ensemble members vary to a large degree (fig. 13); and (2) across complex mapping problems and landscapes, the best results are obtained when a machine-learning process identifies for each local area the algorithm or group of algorithms that gives the best answer.

Accomplishment: The LCMS Science Team applied many of the leading forest change detection algorithms to consistent time series of Landsat satellite imagery from sample areas around the country. Accuracies of each algorithm were compared and measured against the accuracy of an ensemble product created with a machine-learning model that combined all of the maps. Accuracy in the ensemble maps was approximately 50 percent greater than the accuracy of any individual algorithm.

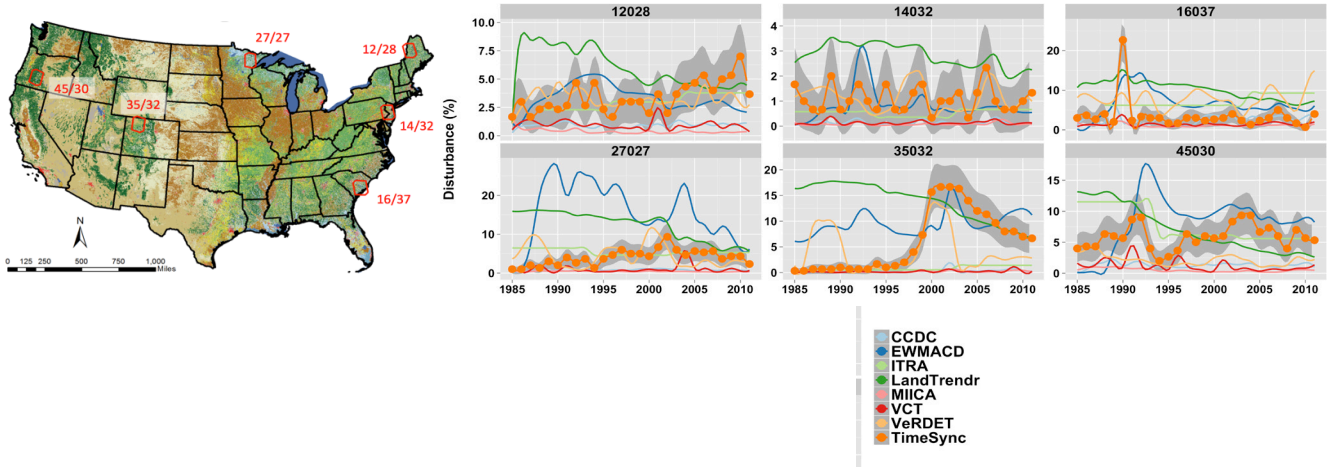
Outcome: With an optimal mapping strategy identified, operational mapping of forest disturbance (fire, harvest, insects, etc.) may now begin. LCMS will provide 30-meter maps of forest disturbance going back to 1985 and for each year going forward. The spatial insights provided by these maps will support habitat studies, fuel assessments, and forest health assessments across the country.

Cohen, W.; Healey, S.; Yang, Z. et al. 2017. How similar are forest disturbance maps derived from different Landsat time series algorithms? Forests. 8: 98.

Cohen, W.B.; Yang, Z.; Healey, S.P. et al. 2018. A LandTrendr multispectral ensemble for forest disturbance detection. Remote Sensing of Environment. 205: 131–140.

Healey, S.P.; Cohen, W.B.; Yang, Z. et al. 2018. Mapping forest change using stacked generalization: An ensemble approach. Remote Sensing of Environment. 204: 717–728.

Figure 13. Different algorithms (shown with different colored lines and named in the legend) produced very different forest cover loss estimates for different parts of the country in the Landscape Change Monitoring System comparative study.



Partners: U.S. Geological Survey Earth Resources Observation and Science Data Center; National Atmospheric and Space Administration (NASA); Boston University; State University of New York School for Environmental Studies; Virginia Polytechnic Institute and State University; Oregon State University; Utah State University; University of Maryland; Google Corporation.

Contact: Sean Healey, seanhealey@fs.fed.us.

Southern Research Station FIA Program

Finding: Native and introduced insects and diseases have long plagued forests of the United States. In recent decades, mountain pine beetle (*Dendroctonus ponderosae* Hopkins), hemlock woolly adelgid (*Adelges tsugae* Annand), emerald ash borer (*Agrilus planipennis* Fairmaire), and beech bark disease (*Neonectria* ssp.) have been especially destructive. Evidence of these and other stressors was apparent in the crown dieback assessments made by the FIA Program during the 2011–2015 inventory years.

Figure 14. Multiple sprouts along the tree trunk, crown dieback (inset A), and D-shaped holes in the bark (inset B) on this urban-dwelling ash (*Fraxinus* spp.) tree in Knoxville, TN, are typical signs of an emerald ash borer (*Agrilus planipennis* Fairmaire) infestation.

USDA Forest Service photograph.

Accomplishment: Individual-tree crown dieback is assessed by the FIA Program to monitor forest condition, particularly in areas known to be affected by insects, diseases, and other stressors (e.g., drought). Crown dieback levels observed during 2011–2015 were within expected norms for most species in the United States. Species with elevated levels of crown dieback in the Eastern States included ash (*Fraxinus* spp.), American beech (*Fagus grandifolia* Ehrh.), and eastern hemlock *(Tsuga canadensis* (L.) Carriere). Among these three species, crown dieback was greatest in counties with known stressors (emerald ash borer, beech bark disease, and hemlock woolly adelgid) and was highest for ash and eastern hemlock in areas where the stressors have persisted the longest. For beech, crown dieback observations mirrored what might be expected in the three stages of beech bark disease (advance front, killing front, and aftermath). A retrospective analysis of crown conditions in the Rocky Mountain region indicated high mortality of trees that were presumed to be healthy at the previous assessment (made during 2001–2005) due to the absence of crown dieback. This was especially noticeable for lodgepole pine *(Pinus contorta* Douglas ex Loudon var. *latifolia* Engelm. ex S. Watson), quaking aspen (*Populus tremuloides* Michx.), and subalpine fir (*Abies lasiocarpa* (Hook.) Nutt.), and likely reflects the effect of stressors (e.g., mountain pine beetle), which heightened during the time period between assessments.

Outcome: Results will be included as a chapter in *Forest Health Monitoring: National Status, Trends, and Analysis* 2017.

> Potter, Kevin M.; Conkling, Barbara L., eds. 2018. Forest health monitoring: national status, trends, and analysis 2017. Gen. Tech. Rep. SRS-233. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 190 p. https://www.srs.fs.usda.gov/pubs/56285.

Contact: KaDonna Randolph, krandolph@fs.fed.us

Finding: An evaluation of the extent and structural components of longleaf pine (*Pinus palustris* Mill.) primary regeneration in forests across the Southern United States may indicate inadequate advance regeneration.

Accomplishment: The extent of the longleaf pine (*Pinus palustris* Mill.) ecosystem has been dramatically reduced over the past 150 years throughout the Southeastern United States, from a high of 37 million hectares (ha) to a low of 1.5 to 1.7 million ha, currently. Cutting, species replacement, and ineffective fire management have caused most of this reduction. Several organizations have studied various means to restore and increase the area of this important southern

Figure 15. Open montane longleaf pine *(Pinus palustris* Mill.) stand with longleaf seedlings and saplings coming out of the grass stage on the Oakmulgee Ranger District in Alabama.

USDA Forest Service photograph.

pine ecosystem. One important component of this effort is to assess the amount of forest land with longleaf pine primary regeneration (seedlings less than 2.57 centimeters [cm] in diameter but 30 cm or taller). FIA data were used to determine the extent and condition of longleaf pine primary regeneration. Using the premise that all overstory stand components originated through the seedling stage, an evaluation of the seedling component of longleaf pine seedlings is important for evaluating and managing for the future sustainability of the ecosystem. The assessment determined the amount of forest land with longleaf pine seedlings; the structural component was defined by seedling density, dominance, species richness (S), and evenness metrics. For the latter, the McIntosh Evenness Index (MEI) was used.

Across the Coastal South, from North Carolina to Texas, 3,458,396 (±181,376 confidence interval [C.I.]) ha of forest land contained at least 14 longleaf pine trees per ha (TPH) that measured 2.54 cm diameter at breast height (dbh) or greater (one tree sampled per sample unit [SU]). In these longleaf pine forests there were 897,757 ha (±118,730 C.I.; n = 483) with longleaf pine seedlings present; 57 percent on private forest land, 41 percent on public land, and 3 percent on forest industry land. Most of these seedling occurrences were in forest stands with trees measuring 2.54 cm dbh or greater present. These stands had longleaf pine seedlings averaging 865 TPH, seedling (S) = 4.3 SU-1, and MEI = 0.67. Some newly established or regenerated forests (less than 8 years old) with no overstory component were evident, approximately 216,751 ha (174,572 ha in plantations and 42,179 ha in natural stands). Here, density of longleaf seedlings averaged 904 TPH, seedling (S) = 3.3 SU-1, and MEI = 0.59. Here, the proportion of seedlings in longleaf averaged 45 percent. Overall, the high (S) and MEI along with low TPH may indicate shortcomings in the primary regeneration of longleaf pine. The area in new longleaf stands is encouraging but the longleaf seedling metrics may indicate inadequate stocking levels in many stands.

Outcome: This study was presented at the 102nd Annual Meeting of the Ecological Society of America; Portland, OR; August 6-11, 2017.

Partners: James M. Guldin

Contact: James F. Rosson, Jr., jrosson@fs.fed.us.

Finding: Disturbance plays an important role in shaping the ability of forests to sequester carbon and provide critical ecosystem services, such as clean air and water. Satellite remote sensing offers a flexible and cost-effective way to monitor disturbance over large areas, however, most disturbance mapping algorithms only resolve where and when a potential change has occurred. Using information

derived from Landsat time series, researchers were able to accurately map five different types of forest disturbance: conversion (or loss of forest to other land uses), fire, harvest, insects and disease (referred to as stress), and wind.

Accomplishment: Recent advances in forest health monitoring have focused on the use of satellite remote sensing techniques to map the year, extent, and location of forest disturbance. Although many newly developed algorithms can detect disturbance in an automated manner, many of the maps produced only indicate where and when a potential change has occurred. One critical piece of information that is often lacking is the causal agent responsible for the disturbance (e.g., fire, harvest, insects, etc.).

A recent Forest Service study found that change metrics derived from Landsat spectral trajectories can be used to accurately model different types of forest disturbance. Using a 2-step modeling approach, researchers were able to map annual changes brought on by fire, harvesting, insects and disease (referred to as stress), wind, and conversion (or loss of forest to other land uses) in 10 diverse study locations across the country. Separating forest management (i.e., harvests) from forest land use conversion is an important advance, considering both disturbances tend to look similar in spectral space, but often result in vastly different carbon consequences (e.g., permanent versus short-term loss of tree canopy cover). In addition to testing the agent mapping approach, researchers also offer guidance on several issues (e.g., reference data collection, predictor variable importance, modeling criteria, etc.) that may potentially impact future development of an operational U.S. national forest disturbance mapping product.

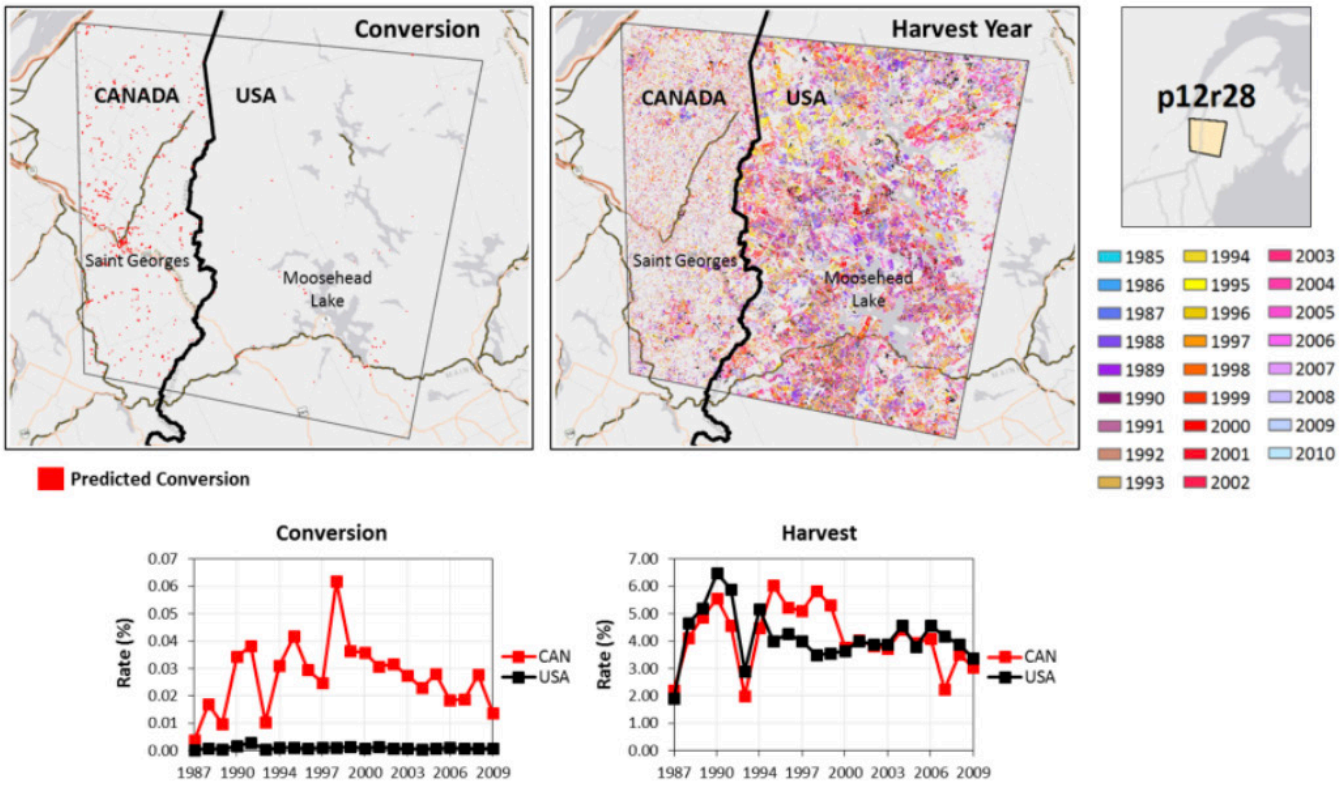
Outcome: The results of this work have been published in Remote Sensing and the Environment.

> Schroeder, T. A.; Schleeweis, K.G.; Moisen, G.G. [et al.]. 2017. Testing Landsat-based approach for mapping disturbance causality in U.S. forests. Remote Sensing of Environment. 195: 230–245. https://www.fs.usda.gov/treesearch/pubs/54667.

Partners: Karen G. Schleeweis, Gretchen G. Moisen, Chris Toney, Elizabeth A. Freeman, Interior West FIA; Warren B. Cohen, Pacific Northwest Research Station; Zhiqiang Yang, Oregon State University; Chengquan Huang, University of Maryland.

Contact: Todd A. Schroeder, taschroeder@fs.fed.us.

Figure 16. Model predictions of forest harvesting and conversion along the United States/Canadian border in northern Maine show most of the forest lost to development occurred in Canada, and although annual rates of harvesting (normalized for the total amount of forest area in each country) are roughly similar, the forest cut blocks on the U.S. side are noticeably larger.



National FIA Program

National Office Accomplishments: The National FIA Program Office helps guide and coordinate the FIA field units in implementing the enhanced FIA program, and it represents FIA for national efforts and internationally. 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. These accomplishments include:

- Provided budget coordination, briefings, and guidance for FIA field units.
- Facilitated one FIA management team meeting and dozens of briefings for internal and external partners, customers, collaborators, and supporters.
- Colloborated with the Society of American Foresters and helped organize the 10th national users group meeting for FIA customers, held in Madison, WI, in April 2017.
- Facilitated the Global Forest Resource Assessment Advisory Group, which is focused on the 2020 Global Forest Resource Assessment.
- Served as Forest Service lead for the Federal Geographic Data Committee Land Use and Land Cover Theme.
- Worked with Forest Service's International Programs to provide inventory and monitoring technical expertise as needed.
- Published the *Forest Inventory and Analysis Fiscal Year 2016 Business Report.*

Contact: Greg Reams, greams@fs.fed.us.

FIA Data Requests and Access

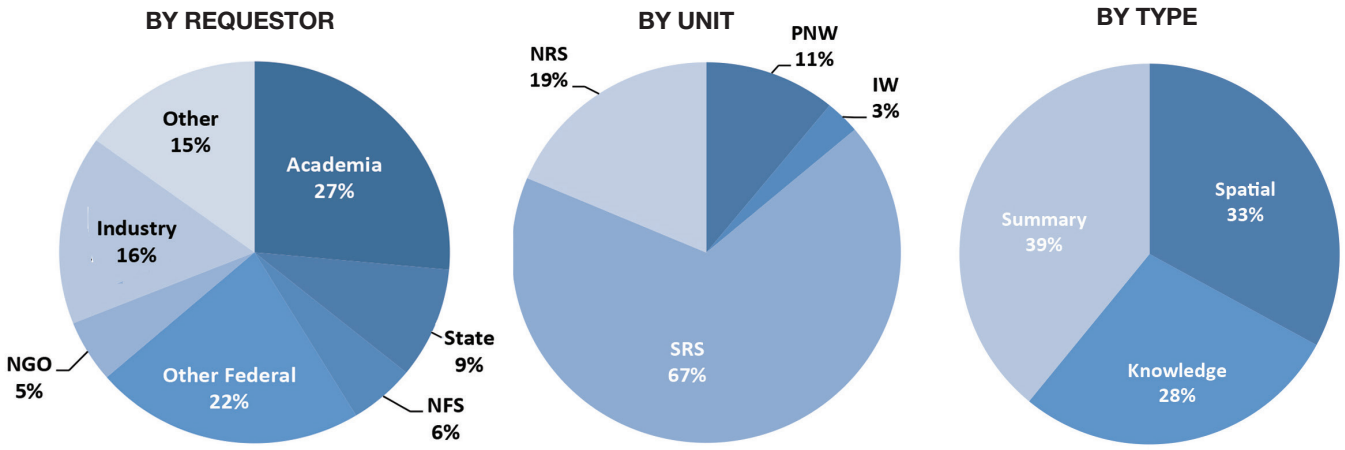
The FIA Spatial Data Services (SDS) Team provides spatial data services to clients and operates as a virtual Spatial Data Services Center (SDSC) with staff located throughout the country. SDSC staff consists of:

- Tom Thompson, Team Lead, Pacific Northwest Research Station;
- Rich McCullough, Liz Burrill, Northern Research Station, National and Multi-Regional Projects;
- Sam Lambert, Carol Perry, Southern Research Station;
- Chris Toney, Interior West, Rocky Mountain Research Station;
- John Chase, Pacific Northwest Research Station.

Partners

Memoranda of Understanding (MOU) agreements continue to be put in place for those clients where access to the confidential data is critical for the project and it clearly benefits FIA. Most data requests do not require an MOU and are handled by SDS personnel working with the client to provide the information needed. New agreements were put in place this year with the University of Vermont, the University of Minnesota, University of Arkansas, Tennessee State, Colorado State, and the Cary Institute of Ecosystem Studies. Work continues with a variety of partners including: NASA, Oregon State University, the University of Maryland, the University of New Hampshire, other universities, and groups within the Forest Service.

Figure 17. Requests made to the FIA Spatial Data Services Center in 2017.



FIA = Forest Inventory and Analysis; IW = Interior West; NFS = National Forest System; NGO = non-governmental organization; NRS = Northern Research Station; PNW = Pacific Northwest Research Station; SRS = Southern Research Station.

FY 2017 Spatial Data Requests

In FY 2017, 539 requests were active (fig. 17). National or multiregional data requests accounted for 36 percent of the total number of requests. Of the received requests, 97 percent were completed by the end of the fiscal year and 3 percent remain in progress.

Requests are almost evenly divided between knowledge, summary, and spatial types (fig. 17).

Academia continues to be SDSC's largest client, with 30 percent of all new requests (fig. 17). Federal agencies accounted for 25 percent of requests.

FY 2017 Web Tools

The FIA program has been serving data to the public since 1996 through a variety of web tools. The first database retrieval program FIA released in 1996 was the FIA Data Base Retrieval System (DBRS). The DBRS allowed the public to query regional FIA data sets in eastwide/westwide format. In 2002, the Forest Inventory Mapmaker program was introduced, allowing the public to generate estimates from national FIA data in the newly created Forest Inventory and Analysis DataBase (FIADB). The current generation of data retrieval programs produces estimates and their associated sampling errors. Forest Inventory Data Online (FIDO) was introduced in 2008 and the EVALIDator web application was introduced in 2009. In FY 2015, the ability to create multiple reports using a batch function was introduced to EVALIDator. This feature allows users to quickly and easily create multiple reports for an existing dataset. A new tool was added in 2015, the Design and Analysis Toolkit for Inventory and Monitoring (DATIM). The DATIM tool has been developed as a partnership between the National Forest System and FIA. DATIM 6.0 was released in January 2017 with public access and had 1,092 hits this fiscal year. The EVALIDator Application Programming Interface (API) was released in FY 2016. The API allows users to enter Hyper Text Markup Language (HTML) to query the database. There were 38,313 hits to this tool in FY 2017.

In FY 2017, the total number of FIDO retrievals was 11,898. Analysis of internet addresses showed that although the source of 35 percent were undetermined, academia accounted for 17 percent of the users; corporate use, 19 percent; government use (State and Federal combined), 25 percent; non-governmental organizations (NGOs) accounted for 1 percent; and 4 percent were from outside the United States. For EVALIDator in FY 2017, the largest user group was government (State and Federal), with 48 percent; 28 percent of users could not be determined; academia accounted for 10 percent; and corporate for 12 percent. The total number of EVALIDator retrievals was 38,597.

Both FIDO and EVALIDator are being actively "crawled" by various web search engines—with a significant number of page hits resulting from this activity that are not included in the totals above.

The Timber Products Output (TPO) program collects and reports data related to timber harvest for industrial products, logging residues, and mill residues. The TPO program also provides valuable information on timber harvesting activities, growth and drain relationships, residential fuelwood use, timber-processing firms, and the economic impacts of timber harvesting and wood products manufacturing. There were approximately 37,000 queries for TPO data in FY 2017.

In 2009, a web application was developed that allowed querying of the National Woodland Owner Survey (NWOS) database. In FY 2017, 2,517 retrievals were completed. The FIA DataMart was revised in 2009 to include the ability to download FIADB data by State as Microsoft Access database files. The Access databases contain a reporting tool (the EVALIDator-PC) that allows the user to generate reports. These reports are not included in table 2 but undoubtedly number in the thousands or tens of thousands.

In FY 2010, users downloaded 18,026 Zip files that contained data from one or more FIADB tables. In FY 2017, users downloaded files 53,315 times.

In 2003, the FIA Mapmaker program added a module that allowed the user to download FIA data in Forest Vegetation Simulator (FVS) format. This feature was lost with the retirement of the Mapmaker program in 2009. The FVS format is now available through a tool developed by the Forest Management Service Center. The FIA2FVS program is used to extract data fields from the FIADB into a FVS-ready database. The FIA2FVS program can be downloaded from http://www.fs.fed.us/fmsc/fvs/software/data.shtml.

Table 4. Number of database retrievals using FIA web applications by fiscal year.

Fiscal Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Number of Retrievals	26,548	56,475	24,335	26,615	59,609	90,974	101,643	132,413	94,027	103,211	186,175	170,407	250,559	182,732

FIA = Forest Inventory and Analysis; FY = fiscal year; NFS = National Forest System; NGO = non-governmental organization.

The National Reporting and Data Distribution (NRDD) team has been providing webinars and in-person trainings on our web tools. In FY 2010, the team provided one webinar and three trainings. In FY 2011, the NRDD team held six webinars and collaborated with Purdue University on another set of webinars covering the use of FIA data and our tools. The NRDD team also provided in-person training at three meetings in FY 2011. In FY 2012, the NRDD team again provided webinars and training. In addition, the NRDD team hosted a booth, providing information and publications to the public. In recent years, budget reductions have prevented the NRDD team from in-person outreach and trainings, but virtual outreach in the form of webinars and online presentations continues. In FY 2017, the NRDD team was able to provide seven DATIM webinars and/or presentations, along with three more general FIADB and tools presentations and webinars.

Consultations by FIA Staff

Consulting with FIA customers is a growing part of our business. Just as we have increased the amount of information (both data and analyses) made available on the web, our FIA staff are increasingly in demand by customers seeking either to understand more about the FIA program and our results, or seeking to address a specific question not obviously addressed through other means. Questions pertaining to a single administrative unit (e.g., to a single State or national forest) often are referred to partners within that administrative unit (e.g., State foresters and national forest analytical staff) who can often provide better context and who prefer to maintain their contacts with their customers. When questions span multiple administrative units, FIA staff will try to help the customer find 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. Appendix table B-6 shows the number of significant consultations that FIA staff provided in FY 2017, by unit and by type of customer. 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 our normal course of business in collecting, analyzing, and reporting on FIA information.

Combined, FIA staff addressed 1,341 significant consultations, which required 8,781 staff hours to complete (table 5)—equivalent to more than 4 full-time staff years. Of the consultations, 515 were conducted with other government agencies, such as State agencies and other Federal agencies, accounting for 59 percent of the time. The staff also had internal discussions within the Forest Service. Other major client groups included academic clients (approximately 20 percent of the consultations and 12 percent of the time), industry (20 percent of the consultations and 10 percent of the time), and NGOs (9 percent of the consultations and 7 percent of the time). The data also show some regional variations. For example, State government organizations are consistently the major clients throughout the country. FIA data indicate that industry and academic customers are the second most prominent clients (appendix B-6).

Table 5. Number and hours of significant consultations by FIA staff, by customer group, FY 2017.

Customer group	Number	Percent	Hours	Percent
Academic	269	20%	1,090	12%
Government	515	38%	5,187	59%
Industry	272	20%	873	10%
NGO	118	9%	649	7%
NIPF	13	1%	30	0%
Media	23	2%	738	1%
Other	131	10%	214	10%
Total	1,341	100%	8,781	100%

FIA = Forest Inventory and Analysis; FY = fiscal year; NGO = non-governmental organization; NIPF = nonindustrial private forest.

National Inventory and Monitoring Applications Center

The National Inventory and Monitoring Applications Center (NIMAC) was formed in 2006 during the merger of the North Central and Northeastern Research Stations. Although NIMAC is part of the Northern Research Station FIA program, it is responsible for providing national technical assistance on planning, conducting, processing, and analyzing forest inventories to FIA's broad range of customers, which include the National Forest System (NFS), other Federal agencies, State governments, and other countries.

National Forest Collaboration

In 2002, the Deputy Chief for R&D and the Deputy Chief for the NFS signed an internal MOU providing for permanent inclusion of all national forest lands within the FIA program. This inclusion was a significant step forward for FIA customers, guaranteeing the availability of consistent FIA information across the entire United States. Under the terms of the agreement, NFS provides permanent funding to help cover the cost of the FIA program on their lands, and in return, the FIA program agrees to implement the program in a manner consistent with other forested lands within the same State and to load FIA data into the NFS Field Sampled Vegetation (FSVeg) database for use in forest planning and other landscape and regional assessments. FIA also provides advice for and assistance in developing forest and regional sampling protocols linked to FIA, and collaborates with national forests that want to contribute resources for additional sampling.

NFS and FIA continue to fund NIMAC to develop the Design and Analysis Toolkit for Inventory and Monitoring (DATIM). The design tool helps identify inventory information needs, sampling designs (including intensification of FIA samples), and the development of monitoring plans as part of NFS forest plans as required by the new Planning Rule. The analytical tools enable NFS to quickly analyze an enhanced form of existing FIA data that better serves its needs by adding NFS attributes computed using the Forest Vegetation Simulator (FVS). These analyses can be localized using GIS, and map attributes can be used in the analysis. DATIM received additional funding to develop online training modules for each of its tools. We released version 7 in 2017 and are developing version 8. These versions are available to all FIA customers.

With support from NIMAC, the Southern Region used the design tool to determine intensification plans for about one-half of the national forests in the region. The Southern Station FIA has supported the region with these intensifications through agreements with State partners. Funding constraints have limited further intensification at this time. Similarly, the 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.

In 2013, the Pacific Northwest FIA Information Management and Reporting staffs worked with the Pacific Northwest Region to conduct extensive quality assurance and load regional intensification data into FSVeg. The Pacific Southwest Region has expressed strong interest and support for the project. The Pacific Northwest and Pacific Southwest Regions continue to work with Pacific Northwest FIA to collaborate in crew training, contract administration, data collection, and data processing. The Northern Region and Intermountain Regions have collaborated with Interior West FIA, and the Alaska Region has collaborated with Pacific Northwest FIA, to further expand current FIA protocols to include collecting information on all land types, not just the forested portion. Both regions are using an intensification system that integrates with the Interior West FIA base data, yet enables the regions to use NFS applications to collect intensified data and store them in FSVeg.

FIA is collaborating on an agency-wide effort to improve inventory, monitoring, and assessment, such as developing National Management Questions, which will be used to drive information needs. As part of the USDA all-lands approach and the new Planning Rule, FIA data will be more heavily used by NFS and other partners. For example, each national forest must now complete a Climate Scorecard—a significant portion of which can be addressed using FIA data. In collaboration with NASA and the Forest Service R&D Climate Change program, FIA has provided the scorecard results for all forests.

Based on feedback from the nine NFS regions, FIA is meeting many of the needs of NFS partners. The development of streamlined vegetation and down woody

material (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.

FIA will continue to work on these issues in FY 2018. Increasing demands from NFS customers for additional forest planning data and increasing emphasis on individual forest and regional forest monitoring plans will likely require changes in current financial arrangements with NFS. Stronger funding support at the national level, including additional NFS funding for requirements beyond the core FIA program, would be needed.

The NFS inventory specialists continue to have the following priorities for the FIA program:

- Implement the annual system in all States.
- Collect data on all lands, including reserved lands and rangelands.
- Collect a full suite of vegetation and associated information.
- Transfer data from the National Information Management System into FSVeg within 1 year from the end of the data collection season.
- Follow standard protocols across all NFS lands.
- Allow for a la carte protocols with local and regional funding support.
- Allow for increasing the intensity of the core grid as needed.
- Provide an inventory compilation and analysis package that meets NFS business needs.
- Continue to participate in the process to help define the updated FIA Strategic Plan.

Other FIA Program Features

Urban Forest Inventory

The 2014 Farm Bill included direction for FIA to begin implementation of nationwide inventory and monitoring of urban forests.

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 seen on the map in figure 18.

Why monitor urban trees? Urban trees and natural spaces are critical to human health and well-being. A neighborhood's 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

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

State	Metro Area / Urban Area*	Plot count
CO	Denver, Colorado Springs, urban areas	40
CA	San Diego	200
DE	Baltimore, urban areas	2
IA	Des Moines, urban areas	47
IL	Chicago, St. Louis, urban areas	79
IN	Chicago urban areas	5
KS	Wichita, Kansas City, urban areas	45
MA	urban areas	3
MD	Baltimore, urban areas	59
ME	Portland, urban areas	42
MI	Detroit	52
MN	Minneapolis, urban areas	132
MO	Kansas City, Springfield, St Louis	295
ND	Fargo, urban areas	29
NE	Lincoln	26
NJ	Philadelphia, urban areas	17
NY	Rochester	38
OH	Cleveland	47
PA	Pittsburgh	90
RI	Providence, urban areas	38
TX	Austin, Houston, San Antonio	320
VT	Burlington, urban areas	36
WI	Madison, Milwaukee	178
Total		1,820

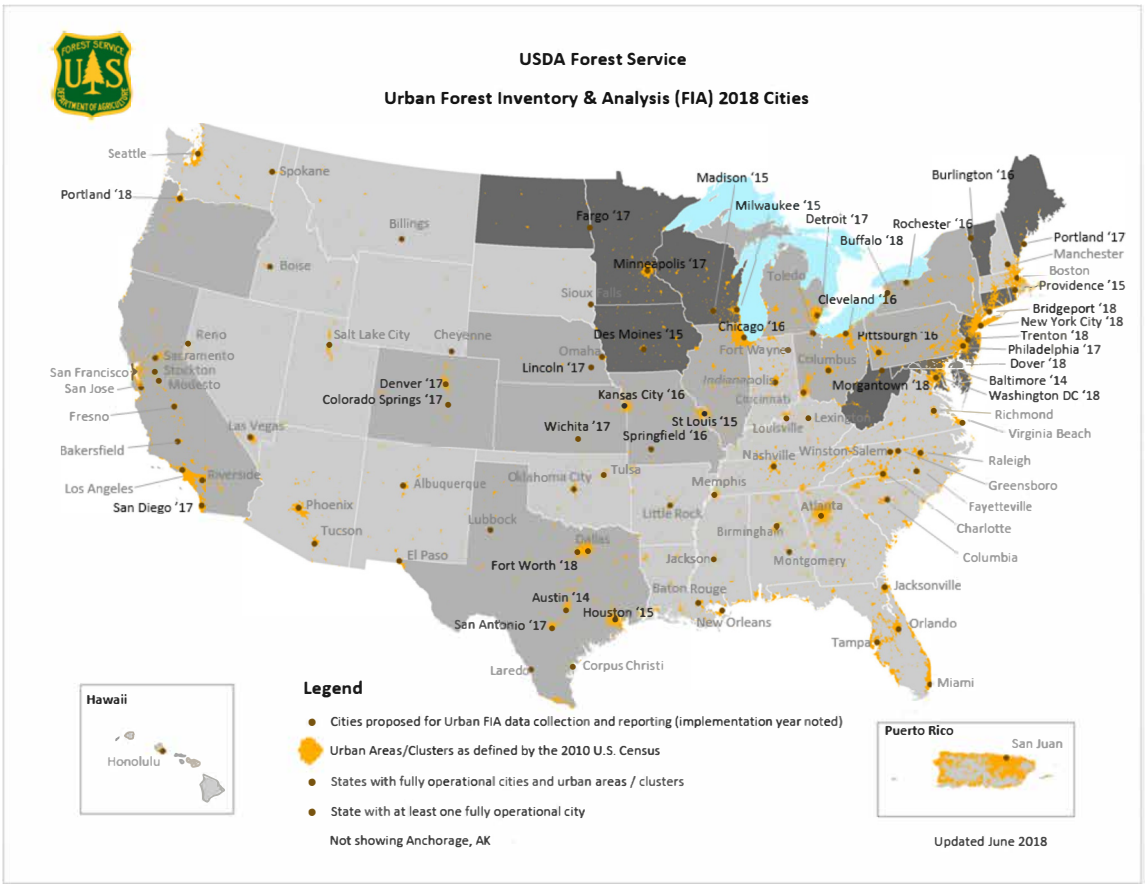
* Some Metro Areas/Urban Areas overlap State boundaries and are included more than once.

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 wall-to-wall inventory and monitoring system.

What is the Urban FIA plan? The plan is to fill this information void by extending the FIA sampling frame to urban areas. FIA started with two cities in 2014, Baltimore, MD, and Austin, TX. FIA is adding additional metropolitan areas as funding allows, with the goal of including all urban forests in the Nation. Once a city or Urban Area within a State is initiated, it will continue to be measured in the future, just as traditional FIA plots are, thus creating a continuous inventory of the Nation's urban forests. The following summarizes the progress of FIA plots in urban areas:

- In 2014, Baltimore, MD, and Austin, TX, were selected as the first Urban FIA (UFIA) cities because of the Forest Service's established relationships with the City of Baltimore and the State of Texas. The expressed enthusiasm and willingness on the part of these long-standing partners to collaborate and ensure the effort's success made them a logical starting point.
- In 2015, data collection was expanded to include Milwaukee and Madison, WI; Houston, TX; Des Moines, IA; Providence, RI; St. Louis, MO; and statewide Rhode Island.
- In 2016, data collection was expanded into Burlington, VT; Rochester, NY; Pittsburgh, PA; Cleveland, OH; Chicago, IL; Kansas City and Springfield, MO; and statewide implementation in Vermont and Wisconsin.
- In 2017, all four FIA units had active UFIA projects in operation with the expansion into San Diego, CA; Denver and Colorado Springs, CO; Lincoln, NE; Philadelphia, PA; Detroit, MI; Wichita, KS; Fargo, ND; Portland, ME; San Antonio, TX; Minneapolis, MN; and statewide implementation in North Dakota, Maine, Minnesota, and Iowa. Sample areas and plot totals for 2017 are summarized in table 6.
- In 2018, data collection will start in New York City and Buffalo, NY; Dover, DE; Trenton, NJ; Washington, DC; Portland, OR; Fort Worth, TX; Bridgeport, CT; Morgantown, WV; and statewide implementation in Delaware, New Jersey, Connecticut, West Virginia, and Maryland. Conversations with additional cities across the Nation continue.

Figure 18. Urban forest inventory implementation status.



Forest Products, Utilization, and National Woodland Owner Survey Studies

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. The number of surveys is listed in appendix table B-8, followed by 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, all primary wood-using mills in a State are canvassed. 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), Oswalt et al. (2014), and Morgan et al. (2005). Additional information and online data from all these surveys are available at http://www.fia.fs.fed.us.

Fuelwood surveys. Studies of fuelwood production from roundwood are necessary to provide information to forest managers and users about the fuelwood harvest and its effect on the resource. The amount and source of fuelwood harvested from forest land, urban areas, fence rows, windbreaks, or other sources are estimated from these studies.

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. Therefore the FIA program implements the National Woodland Owner Survey (NWOS) as a social complement to our biophysical forest inventory. The goals of the NWOS are to provide information on: 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.

In FY 2017, the efforts associated with the NWOS included:

- Receiving responses from 5,254 private landowners who participated in the 2017 NWOS
- Publishing results from the 2011–2013 NWOS on family forest ownerships with 1–9 acres (ac) (to complement the previously published results on family forest ownerships with 10+ ac)
- Completing the final pilot testing of the urban NWOS, in Wisconsin
- Developing a technique for systematically identifying large corporate forest ownerships
- Continuing to develop and populate the NWOS database
- Publishing a number of scientific publications based on the NWOS

In FY 2018, the NWOS efforts will include:

- Contacting more than 20,000 private forest ownerships to complete the 2017–2018 cycle
- Beginning the urban NWOS in a production mode, starting with Baltimore
- Pre-testing and implementing the large corporate NWOS
- Continuing to develop and populate the NWOS database
- Revisiting NWOS estimation procedures
- Beginning work on core reports from the 2017–2018 NWOS
- Beginning work on data access tools from the 2017–2018 NWOS
- Continuing to produce scientific publications

More detailed information on NWOS may be found in Butler et al. (2016a), Butler et al. (2016b), Butler et al. (2016c), and Butler and Snyder (2017). For updates and more information about NWOS, visit http://www.fia.fs.fed.us/nwos.

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Butler, B.J.; Hewes, J.H.; Dickinson, B.J. [et al.] 2016b. Family forest ownerships of the United States, 2013: findings from the USDA Forest Service's National Woodland Owner Survey. Journal of Forestry. 114(6): 638–647. http://dx.doi.org/10.5849/jof.15-099.

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i-Tree

In 2017, i-Tree usage increased by over 60,000 new users, reaching nearly 250,000 users in 131 countries. Last year i-Tree released:

- i-Tree Database to aid international users and facilitate international projects
- New i-Tree apps (tree planting benefits calculator, a wood products calculator)
- Many new map layers in i-Tree Landscape (e.g., climate change, ultraviolet radiation, U.S. Environmental Protection Agency air quality nonattainment areas, basal area, forest types, insects and diseases, hardiness zones, surface temperatures)
- i-Tree Hydro upgrades to facilitate easier use across the world

Planned new releases for 2018 include:

- International versions of i-Tree Eco for Mexico (in Spanish) and Europe. Other international versions currently include Canada, Australia, and the United Kingdom
- i-Tree website translation to Spanish
- Project Learning Tree "Teaching with i-Tree" materials
- Understanding i-Tree report—designed to summarize all methods in one report
- i-Tree Design and Canopy improvements
- i-Tree County—new web tool to easily assess forest benefits and values across the United States based on selecting your local county

Figure 19. i-Tree users.

- i-Tree Mapper—ability to map and download i-Tree Eco plot data
- i-Tree Wood—tool to list and exchange information on harvested urban trees to facilitate wood utilization/ reclamation
- Mobile data collector mapping functions
- Many new i-Tree Landscape maps and areas of analysis

Ecosystem Health Indicator Surveys

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 2006).

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 12.7cm. diameter at breast height, including uncompacted live crown ratio, crown diameter (for some years), crown density, foliage transparency, crown dieback, crown light exposure, and canopy position. The crown indicator is described in Schomaker et al. (2007).

Lichen communities. Longterm observation of epiphytic (i.e., treedwelling) 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 hectare area). The lichen indicator is described in Will-Wolf (2011). This indicator is currently sampled in the Pacific Northwest Research Station (PNW) only.

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).

Vegetation diversity. 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. For this indicator, 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. (2010).

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 88 m in length. Fine woody debris between 2.5 and 7.5 cm is sampled on a series of transects totaling 12 m in length. Fine woody debris less than 2.5 cm is sampled on a series of transects totaling 7 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).

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.

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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.

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U.S. Department of Agriculture, Forest Service. 2013. Forest Inventory and Analysis national core field guide (phase 3), version 6.0. Washington, DC: U.S. Department of Agriculture, Forest Service, Forest Inventory and Analysis. http://www.fia.fs.fed.us/library/field- guides-methods-proc/.

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Will-Wolf, S.; Jovan, S. 2008. Lichens, ozone, and forest health—exploring cross-indicator analyses with FIA data. In: McWilliams, W.; Moisen, G.; Czaplewski, 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.

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Beyond Standing Trees: The Evolution of FIA Ecosystem Health Indicators

For more than a decade, FIA has collected data on ecosystem health indicators on a subset of Phase 2 plots (P2). FIA recently revised sampling techniques for these indicators in response to fluctuating budgets, the need for more efficient field operations, emerging user needs, and evolving forest health science.

Some of the new enhanced forest indicators (DWM, understory vegetation, and crown conditions) were implemented in FY 2013 in a "Phase 2 Plus Program/ Ecosystem Indicator Program" (included, but not separate, in appendix table B-9). 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, potentially increasing the statistical power of future forest health analysis.

These changes represent a continuation of efforts to address current budget realities and adapt for the future while continuing to meet customer needs. FIA will work closely with clients to ensure a successful transition from the previous indicator program to a fully integrated Enhanced Forest Indicator Program that continues to provide a comprehensive survey of forest biomass, carbon pools, and ecosystem health in addition to the "traditional" function of the FIA program.

Special Partnerships Spanning Cultures

There are an estimated 18 million acres of Tribal forest lands located on 305 reservations across 24 States, based on FIA data and reported in the 2013 report "Assessment of Indian Forests and Forest Management in the United States" (https://www.fs.fed.us/spf/tribalrelations/pubs_reports/index.shtml). For management, Tribes need a broad spectrum of information, from timber to fuel loading to wildlife habitat to surveys of forest stewardship objectives. Tribes realize these needs have environmental, social, and economic consequences related to forest sustainability and the unique place of forests in Tribal life.

FIA is committed to developing partnerships with Tribes and has assisted many Tribes in assessing resource status, historical conditions, resource availability, and regional context for tribal forests. Recent efforts have included:

- Ongoing partnership with the Alaskan Native Chiefs to implement forest inventory in interior Alaska.
- 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 paper birch within the territories ceded in the treaties of 1836, 1837, 1842, and 1854.
- Continue to create custom databases for the Quinault Indian Nation and Sealaska Corporation in Alaska and Tribal lands in Nevada.
- Continue to provide data to quantify woodland resources for the San Carlos Apache Tribe, allowing managers to make informed decisions about treecutting regulations.
- Ongoing partnership with the Eastern Band of Cherokee Reservation to assist with timber cruising and prescribed burns.
- Continue to examine traditional and nontraditional harvest methods for edible and medicinal forest products, and impacts on plant populations, in collaboration with Eastern Band of Cherokee, North Carolina Arboretum, and Virginia Tech University.
- NRS-FIA Tribal Liaison Rachel Riemann continued to collaborate between the College of Menominee Nation's Sustainable Development Institute and Region 9.

FIA will continue to explore partnerships with Tribes to better serve this community of users.

Program Safety

Every individual is entitled to safety in every way: physical, psychological, and social. As part of our ongoing effort to improve our workforce environment, the Forest Service is strengthening our commitment to protect our employees from harm. We report and learn from any behaviors or conditions that put people at risk. We stand up to intimidation, bullying, harassment, assault, and retaliation in all its forms. We build and practice skills that help us speak up and resolve conflicts in a constructive and positive manner.

FIA takes safety very seriously and considers it a top priority. Employees and partners in FIA travel hundreds of thousands of miles each year while conducting business, operating in very difficult terrain across all types of plant and forest communities. FIA remains focused on creating a workforce culture that seeks to protect FIA and our partner employees from daily exposure to hazards that threaten safety, health, and well-being. Safety is a commitment and a core value shared amongst the four FIA units. Across the four units, much of the FIA safety program is the same, based on the commitment and shared continuous mission to improve the procedures to minimize the risk individually and as an organization. Further, FIA leadership fosters employee empowerment to freely communicate ideas and suggestions to minimize the exposure to possible hazards, and physical, psychological, and social threats. In FY 2017, FIA units participated in the life-work dialogs where three primary topics were discussed: (1) building trust, (2) managing exposure, and (3) learning from each other.

Employees across the four units serve on location-level and on Station Safety Committees, in addition to the unit's Safety Committees. Safety notes, suggestions, and lessons learned discussed in meetings are made available to the respective program's employees, often posted on the web for wider distribution. Stand-up meetings to discuss, track, and report safety issues occur on FIA units on a daily

Table 7. FIA program Federal employee estimates for hours worked, miles driven, aircraft hours flown, and safety incidents reported in FY 2017.

	FIA Unit					
Category	**PNW**	**IW**	**SRS**	**NRS**	**NO**	**Total**
Base data						
Federal FTE equivalents[a]	84	83	81	90	4	341
Total estimated hours worked[b]	166,400	197,600	168,272	193,440	8,320	734,032
Total vehicle miles driven	232,349	583,290	720,639	244,224	0	1,780,502
Total flight hours logged	515	0	0	0	0	515
Recordable incidents by class						
Time lost illness/injury incidents	1	0	1	0	0	2
Motor vehicle accidents	0	0	1	0	0	1
Aircraft accidents	0	0	0	0	0	0
Safety incident frequency rate						
Time lost illness/injury rate per 100 FTEs	0	0	0	0	0	0
Motor vehicle accidents per million miles driven	0	0	0	0	0	0
Aircraft accidents per 100,000 flight hours	0	0	0	0	0	0

PNW = Pacific Northwest Research Station; IW = Interior West; SRS = Southern Research Station; NRS = Northern Research Station; NO = National Office.

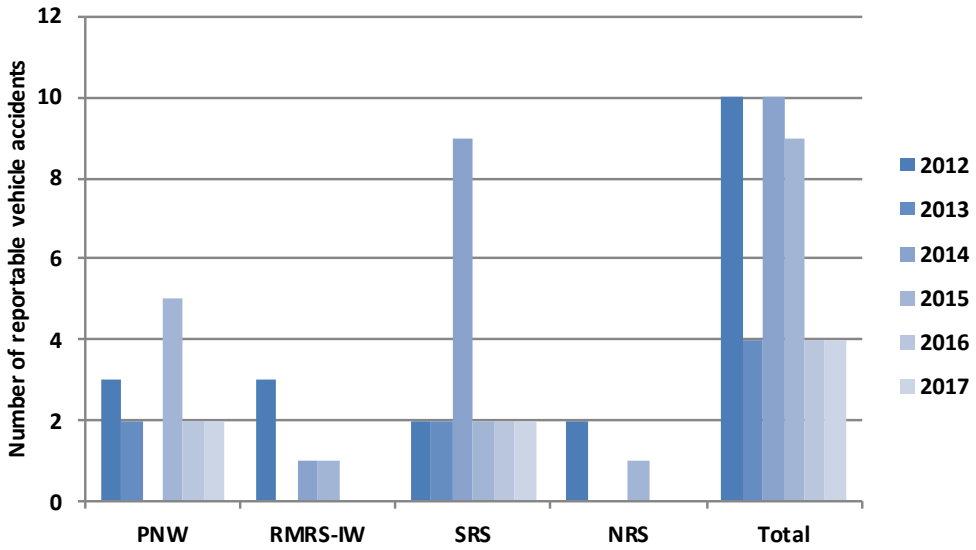
[a] Based on appendix table B-3 number of Federal employee estimated full time equivalents (FTE).

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

basis. Awarding safe work environments with programs such as Safety Bucks, Spot Awards, and Certificates of Appreciation are implemented across the four FIA units. We offer ergonomic stand-up desks, chairs with lumbar support, and have active Wellness programs available to office and field employees alike. Each unit has a working check-in/check-out program and continuously reviews procedures to enhance the program to include live hazard warnings/maps (fire, weather, etc.). FIA units continue to implement other safety features such as the Hearing Conservation Program.

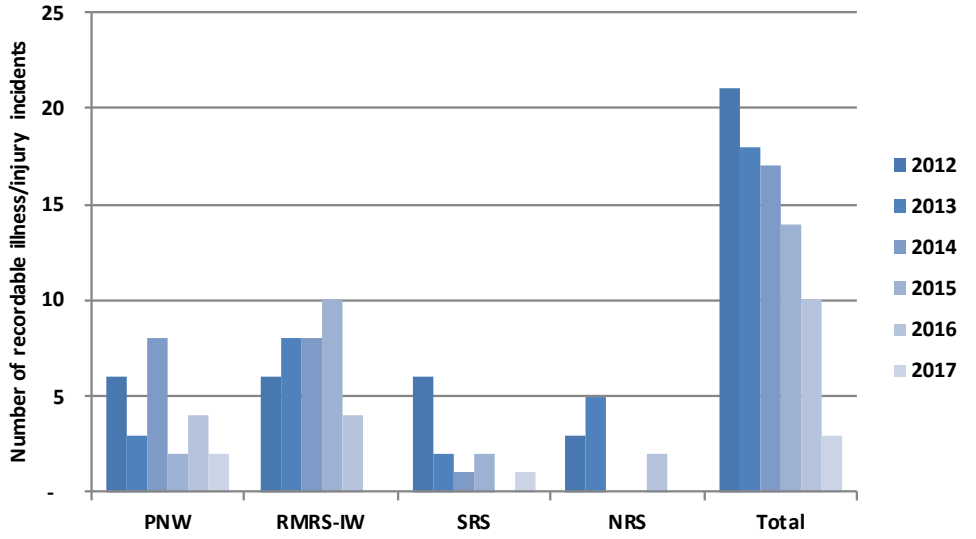
Table 7 summarizes the program's safety record for FY 2017. Figures 20 and 21 show program safety trends by incident type for FY 2012 through FY 2017, followed by select bullets for regional safety highlights for FIA units in FY 2017.

Figure 20. Number of motor vehicle accident incidents by Unit, 2012–2017.



FIA = Forest Inventory and Analysis; FY = fiscal year; NRS = Northern Research Station; PNW = Pacific Northwest Research Station; RMRS-IW = Rocky Mountain Research Station-Interior West; SRS = Southern Research Station.
Notes: 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 21. Number of OSHA (Occupational Safety and Health Administration) recordable cases by Unit, 2012–2017.



FIA = Forest Inventory and Analysis; FY = fiscal year; NRS = Northern Research Station; PNW = Pacific Northwest Research Station; RMRS-IW = Rocky Mountain Research Station-Interior West; SRS = Southern Research Station.
Notes: 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.

Each unit annually reviews Job Hazard Analyses (JHA) and updates when necessary.

Safety training is mandatory and conducted at each field unit. Safety training and equipment are provided for headquarters offices, field offices, and field crews, including driver training, first aid kits, cell phones, and satellite communications where cell coverage is lacking. All four units research new communication devices to ensure local needs for communication are met. This includes piloting the next generation of satellite phones and satellite emergency notification devices. New hard hats, safety glasses, and safety boots are provided regularly, helping to ensure that heads, eyes, and feet are safe. Additional training and equipment are provided for units and crews that utilize aircraft, are exposed to potentially dangerous wildlife, or work in extremely remote and difficult-to-access areas such as wilderness.

Regional Safety Highlights for FY 2017

Northern Research Station FIA Safety Highlights

- Field clothing treated with permethrin to prevent exposure to ticks.
- Aerosol defensive spray authorization approved for FY 2018.
- To reduce the carbon footprint and decrease hazard exposure, the unit looked toward vehicle efficiency, such as reducing the number of vehicles and miles driven.
- Use of the Garmin InReach Satellite Emergency Notification Device (SEND) has continued with great success. In FY 2017, we avoided unnecessary search-and-rescue events, due to the ability to effectively and efficiently use the device for two-way communication. A two-person crew in Northern Maine got two flat tires driving down shale roads. With no cell service, they used the SEND device to communicate with a field supervisor and then arrange for assistance from our Maine FIA cooperator. They were even able to communicate directly with the cooperator using the InReach. Within a couple hours, they were able to drive the vehicle out with their spare and a borrowed tire. An employee did activate the emergency SOS in the field last year when it wasn't a medical emergency. The field staff got a vehicle stuck in a remote area without cell coverage and activated the SOS as opposed to sending a message to the dispatcher and/or supervisor using the SEND device. The Garmin InReach SOS team communicated directly with the employee and arranged for a local State agency to assist. They successfully got him back on the road approximately 3 hours after initiating the SOS.

Pacific Northwest Research Station FIA Safety Highlights

- The data collection teams in California, Oregon, and Washington continue to support the "Safety Challenge of the Month" program. Challenges assigned so far include: poisonous plant ID, vehicle orientation, water-pump inspection and operation, backpack shake-out, and tire tread/pressure assessments.
- The Anchorage data collection team used an end-of-the-field-season debrief to discuss their overall safety program including: safety training needs (aviation, firearms, survival, medical training, and emergency response); safety equipment; boat and helicopter operations; and how we interact and communicate safety concerns as a team. We also discussed our integration with our contractors and partners, their safety programs, and how they are integrated to best utilize the principles of risk management, limit exposure, and respond to emergencies.
- The Portland Forestry Sciences Lab data collection leadership enacted a stand-down on all backpacking/car camping activities on September 5 due to extreme fire behavior throughout the region. Limiting exposure was prioritized over production during a period when access to the backcountry was critical to meeting plot completion targets.
- Anchorage Forestry Sciences Lab, data collection team continued to develop their aviation program by helping to facilitate aviation-related training sessions for the field crew, including aviation user training, helicopter crew member, helicopter manager, and water ditching and survival training. They also completed their first comprehensive Aviation Operations Plan and exceeded expectations during their Exclusive Use Helicopter Contract and operational inspection by the Regional Aviation Group from Region 6.

Interior West (IW) FIA Safety Highlights

- IW-FIA continued publishing the monthly safety newsletter "Careful Chronicle," featuring a message from the program manager, Sharing Our Stories (SOS)—employees' firsthand accounts of near misses and accidents—as well as monthly trivia and contests and other safety and health news.
- The trailer towing classifications used by the program were reviewed and resulted in the reclassification of livestock trailers. Due to the increased risk, livestock trailers now require an additional endorsement (training and experience) before employees may tow them.
- The program completed an assessment of its off-road vehicles and determined the program's single-person utility terrain vehicles have limited use in the diverse environments in which we operate.

- Employees again participated in small-group safety dialog sessions in the beginning of the season and completed follow-up sessions after the season, which will help shape program cultural change.
- Employees also assisted the program safety and health manager in the development of the program's Livestock Management Plan.
- The program's Aviation Safety Plan was extensively updated with the assistance of multiple regional aviation experts.
- In 2016, the program equipped every field-going employee with an InReach SE®, a new Satellite Emergency Notification Device (SEND) with greater technological capabilities than the previously used SPOT devices (GPS tracking devices), and refined and improved the protocols for use. The program has utilized every near miss and unexpected outcome as a learning opportunity and shared the information with the program and beyond. The objective is to ensure that every employee has the knowledge necessary to use the device in an emergency, but also to utilize the device to its fullest potential to reduce employee risk in the field. The InReach provides users with two-way communication through Short Message Service (SMS) or email messaging, and unlike most SENDs, the ability to check-in from remote areas using customized or automated SMS text messages. It also provides message recipients with up-to-date location information and allows for continuous tracking.
- The program offered new mapping applications for mobile devices to aid in more efficient navigation. The application allows users to download maps for offline use, import and export shapefiles, Forest Service maps, topographic maps, and other maps. It uses the mobile device's built-in GPS to track the user's location on any map and allows the user to import and export place marks, and measure distance. Next season, the program plans to host another hands-on training session on InReach and other technology.

Southern Research Station FIA Safety Highlights

- Working with the Station, we helped to bring online a new Hazardous Weather Mass Notification system. This system combines employee telephone numbers, email addresses, and text messaging to better and more quickly pass along local weather conditions that may affect office delays or closures.
- We are continuing to look for a new SEND unit with expanded capabilities. Currently we are using the first-generation SPOT unit and while this unit has been able to increase effectiveness of our communication efforts, we believe there are better systems available. This was one of our goals for FY 2016, however, we are aware of potential policy changes that could affect purchase of the appropriate equipment. We understand that this is an issue for both our employees and supervisors; however, to make sure we are in line with equipment and policy requirements, we need to be sure we are making the best use of our limited resources. We will continue to refine the use of our devices and keep exploring the purchase of new devices.
- During a field meeting in Lake Guntersville, AL, we conducted refresher training on boat operation and safety, off-road driver training, and use of winches to extricate our field vehicles from trapped areas. We also refreshed our training on defensive spray to ensure all new employees were aware of this capability and the best ways to use it.

Comparing FY 2016 Plans With FY 2017 Accomplishments and FY 2018 Plans

This section lists the FIA portfolios that generally correspond to the elements identified in the FIA Strategic Plan.

Timber Products Output (TPO): Business Plan Update

In the FY 2016 business report, we said that in FY 2017, we would—	In FY 2017, we—	In FY 2018, we will—
Publishing Timber Products Output Reports and Fact Sheets		
Publish TPO reports for California (2012) and Oregon (2013).	Published TPO reports for Oregon.	Publish fact sheets for Alabama, Arkansas, Georgia, Florida, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, and Virginia.
Complete draft Hawaii NTFP report.	Completed draft Hawaii NTFP report.	
Publish journal article "Predicting logging residue volumes in the Pacific Northwest" in *Forest Science*.	Published *Forest Science* article on predicting logging residue.	Publish southern pulpwood reports 2013–2016.
Draft material on Idaho, Montana, Oregon, and Washington logging utilization	Published logging utilization study for Oregon and Washington.	Publish TPO report (2015 southwide, Wyoming, Montana and Idaho). Complete change proposals and continue with national implementation.
	Published State fact sheets for Alabama, Arkansas, Georgia, Florida, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, and Virginia	Publish harvest utilization reports for North Carolina, East Texas, Georgia, Arkansas, New Mexico, and Montana.
		Publish annual TPO sample design in *Forest Science*.
Testing and Processing TPO System		
Continue testing of the processing system and automated table reporting applications.	Processed all southern data through compilation system.	Continue training and data loaded through national compilation system.
	Continued loading and testing of northern and western data.	

NTFP = nontimber forest products; TPO = timber products output.

National Woodland Owner Survey (NWOS): Business Plan Update

In the FY 2016 business report, we said that in FY 2017, we would—	In FY 2017, we—	In FY 2018, we will—
Implement NWOS Base/Family		
Implement NWOS Base/Family.	Implemented NWOS Base/Family across all 50 States.	Implement NWOS Base/Family across all 50 States.
Submit OMB package for 2019–2021 NWOS.	Submitted OMB package for 2019–2021 (NWOS, all modules).	Finalize approval for OMB package for 2019–2021.
Implement NWOS Urban		
Implement NWOS Urban.	Implemented NWOS Urban in Wisconsin.	Implement NWOS Urban in Baltimore. Incorporated production workflow in future GNN map production runs
	Finalized survey instrument.	
Implement NWOS Corporate		
Implement NWOS Corporate	NWOS Corporate implementation delayed.	Pre-test and implement NWOS Corporate across all 50 States.
Partnerships and integrating NWOS data		
Collaborate with partners to analyze NWOS data.	Collaborated with partners to analyze NWOS data including other Forest Service research work units, University of Massachusetts Amherst, University of Missouri, Michigan State University, University of Minnesota, Auburn University, SUNY College of Environmental Science and Forestry, and Purdue University.	
Continue to integrate NWOS data into NIMS.	Continued to integrate NWOS data into NIMS.	Continue to integrate NWOS data into NIMS.
Work to maintain access to the national parcel data and increase accessibility.	Renewed contract for national parcel data and secured outside funds for developing tool for accessing data.	
Future Projects		
		Begin planning for NWOS Tribal.
		Begin planning for NWOS Islands.
		Develop and revise NWOS estimation and nonresponse approaches.

NIMS = National Information Management System; NWOS = National Woodland Owner Survey; OMB = U.S. Office of Management and Budget; SUNY = State University of New York.

Carbon Accounting: Business Plan Update

In the FY 2016 business report, we said that in FY 2017, we would—	In FY 2017, we—	In FY 2018, we will—
Carbon Pilot Work		
Continue analyzing results from additional sites to further integrate field-collected and remotely sensed data.	Published work comparing different approaches for aboveground biomass estimation in northern Minnesota and expanded it to four CMS/LCMS sites across the Eastern United States.	Continue to explore estimation approaches for carbon pool estimation using LIDAR, Landsat, and other remotely sensed information for GHG reporting. Pilot will include six States in FY 2018.
Continue to explore estimation approaches for carbon pool estimation using LiDAR, Landsat, and other remotely sensed information for greenhouse reporting. Pilot will include six States.	Launched a pilot effort in six States, using multiple processing formats, to provide spatial and temporally resolved estimates (and associated uncertainties) of forest carbon stocks and stock changes.	Ready early results from the pilot effort specific to attribution in December 2018 for an early 2019 submission target.
As part of pilot work, explore possibility of more targeted ForCaMF assessments related to specific forest plan alternatives.		Continue the pilot effort through FY 2018 with early results on efficiencies and performance at the end of calendar year 2018.
Continue work on the pilot with research on attribution to disturbance, carbon dynamics associated with land use change, and integration of auxiliary data to support estimation and accounting.		
Continue to collect increment cores during the 2017 field season.		
Carbon Publications		
Produce several publications based on analysis of the remote sensing and field data collected in the Tanana pilot project.		
Use the Tanana results to inform the planning for Goddard's LiDAR, Hyperspectral, and thermal Imager (G-LiHT) sampling of the Susitna-Copper Inventory unit.	Drafted the understory manuscript, which is in internal review.	
Publish national paper. Early results from the pilot effort specific to attribution will be ready in December 2017 with an early 2018 submission target.	Began analysis of downed dead wood.	
Continue work on estimating total uncertainty in the forest land category and prepare an additional manuscript.		
International Carbon Reporting		
Test approaches for the estimation of forest area and carbon dynamics associated with land use conversion following IPCC Good Practice Guidance in New York, Maine, Vermont, and New Hampshire.	Tested the IPCC default 20-year conversion period in the current compilation system and adapted it to ensure consistency with IPCC good practice.	Work will continue to integrate all known sources of uncertainty into GHG estimation and reporting, with an emphasis on providing estimates across spatial and temporal scales.

In the FY 2016 business report, we said that in FY 2017, we would—	In FY 2017, we—	In FY 2018, we will—
Dead Wood Modeling		
Test litter and soil estimation methods on data from Interior Alaska pilot, and develop new methods for downed dead wood carbon estimation following the methods used for litter and soil carbon estimation.		The understory manuscript will be submitted in January 2018, and the dead wood modeling will be completed and submitted for publication in spring 2018.
Staff Planning		
		A post-doc and technician will continue to work on the conversion period in FY 2018 as part of the larger pilot effort in six States.
		A technician is to be hired in January 2018. Work will continue on this effort with early results expected December 2018.

ForCaMF = Forest Carbon Management Framework; GHG = greenhouse gas; IPCC = Intergovernmental Panel on Climate Change; LCMS = Landscape Change Monitoring System; LIDAR = light detection and ranging.

Digital Engagement: Business Plan Update

In the FY 2016 business report, we said that in FY 2017, we would—	In FY 2017, we—	In FY 2018, we will—
Forest Atlas of the United States (print and online)		
Have the print document reviewed by the Department and published.	Submitted the document and it is undergoing review.	Publish the print document.
Update the web application with all of the print features released in print.	Put 18 of 29 features online with 3 more in review. Production is being held pending review. Content is migrating to EDW and AGOL.	Complete the migration to EDW and AGOL.
Publish all associated data products in ArcGIS Online (AGOL).		Begin development on Version 2 of the web application by publishing three new features in it and AGOL.
Massive Raster Processing Environment		
Design, stand-up, and populate a development environment hosting secure massive raster processing dedicated for our purposes. This environment will be cloud-based and scalable.	Received and reviewed a prototyping plan. Four use cases were identified to demonstrate the platform's capacities: (1) Forest carbon modeling and mapping, (2) implementing several base learners for the LCMS, (3) small-area estimation, and (4) digital engagement through a sustainability tool.	Collaborate with ESRI to stand-up and populate a production environment hosting secure massive raster processing. The American Forest Foundation will leverage these development activities to produce decision-support tools related to green infrastructure and sustainability reporting.
Work with agency partners, with a contract to be extended to FY 2018.	Received Option Year 1 funding for FY 2018 activities.	Identify and procure Option Year 2 funding requirements.
Digital Analysis and Reporting Tools (e.g., story maps and dashboards)		
Publish at least two annual reports within each station using story map templates.	Published 20 annual reports in the story map format, including examples from every region.	Developed a process for web map generation that supports the development of annual story maps, thus increasing annual report production.

In the FY 2016 business report, we said that in FY 2017, we would—	In FY 2017, we—	In FY 2018, we will—
Digital Analysis and Reporting Tools (e.g., story maps and dashboards) continued		
Build out a live plot production dashboard for all 50 States in collaboration with regional IM groups.	Demonstrated the "Bill-Board" to positive reviews at the FIA Stakeholder Science Meeting. It is undergoing further testing.	Release the "Bill-Board" in early CY 2018 following confirmation from each region regarding the reported numbers. Batch processing at the individual State level will permit distribution to State partners.
Evaluate business intelligence dashboards (e.g., Tableau, Qlik, and PowerBI) for use in analysis and reporting	Found several BI tools interesting, but serious agency obstacles prevented establishing a development environment.	Purchase a Tableau desktop developer license and establish a development environment.
Publish, with NRS, two 5-year reports using story map templates.	Continued production work under contract on the Maryland 5-year report as a story map.	Enable other units to use these templates and automated web maps (above) as well. Targets depend on regional adoption.
Work with the lead for the Forest Resources of the U.S. report to develop a strategy for implementing story mapping technology into traditional workflows.	Held initial discussions with the lead for the Forest Resources of the U.S. report. We are waiting for other authors to submit their content to best assess which items lend themselves to digital reporting tools.	Create a story map to accompany the upcoming RPA Forest Resources Report.
Publish at least two science products within each station using story map templates. The team will also define and develop additional story maps relevant to national themes and pushes outlined in the Farm Bill.	NRS published a companion story map for a recent General Technical Report: "Mapping Occurrence of Tree Damage in the Forests of the Northern United States."	Finalize a plan for building the QA/QC dashboard based upon the plot production dashboard.
Develop a plan for building the QA/QC dashboard based on the plot production dashboard.	Began conversations on a QA/QC dashboard, but made little tangible progress to report at this time.	Work with NFS and SPF to develop applications addressing their needs.
Demonstrate tools at conferences and other venues to gather feedback.	Made presentations at the WO, at the ESRI User Conference, and the FIA Stakeholder Science Meeting.	Collaborate with Community Engagement to clarify needs for additional data and applications.
Safety Application for Check-in/Check-out		
Complete the prototype and share it with DAB.	PNW has produced a prototype application allowing field crews to monitor field plots in relation to existing wildland fires. Testing is underway.	Develop additional applications in consultation with regional safety teams.
Increase Access to FIA's Geospatial Content		
Publish at least five datasets in the Living Atlas and geoplatform.gov.	Made initial connections with CIO and ESRI collaborators to stand-up an open source data portal.	Publish at least five datasets in appropriate portals.
Investigate the publishing process for NatureServe and Databasin.	Began conversations but made little tangible progress to report at this time.	Geo-enable FIADB.
Investigate the process for geo-enabling FIADB, developing three uses cases to demonstrate the benefits of this approach.	Prioritized species from Wilson et al. (2013) but did not publish.	Publish at least 20 tree species ranges in AGOL.
Publish an additional 20 tree species, based on demand.		Develop and publish an interactive mill map web application.
		Develop an Interactive TPO Data Tool based upon Qlik. The prototype will focus on the South before including all regions.

In the FY 2016 business report, we said that in FY 2017, we would—	In FY 2017, we—	In FY 2018, we will—
Staff Planning		
Work as a dynamic, national team to complete all tasks.	Completed tasks with ad hoc team participation across all units.	Evaluate options to create a more formal team dedicated to this portfolio.
Applications for International Partners		
Work with ESRI and open source tools to develop inexpensive and/or free solutions to publishing digital stories.	Began conversations but made little tangible progress to report at this time.	Continue consultations with international partners and collaborate as appropriate.

AGOL = ArcGIS Online; CIO = Chief Information Officer; CY = calendar year; DAB = Data Acquisition Band; EDW = Enterprise Data Warehouse; ESRI = Environmental Systems Research Institute; FIA = Forest Inventory and Analysis; FIADB = Forest Inventory and Analysis Database; IM = Information Management; LCMS = Landscape Change Monitoring System; NFS = National Forest System; NRS = Northern Research Station; PNW = Pacific Northwest Research Station; QA/QC = quality assurance/quality control; RPA = Resource Planning Act; SPF = State and Private Forestry; TPO = Timber Products Output; WO = Washington Office.

Urban Inventory: Business Plan Update

In the FY 2016 business report, we said that in FY 2017, we would—	In FY 2017, we—	In FY 2018, we will—
Continued Urban Monitoring		
Conduct activities in Austin and Houston, TX; Baltimore, MD; Milwaukee and Madison, WI; Des Moines, IA; and St. Louis, MO; Providence, RI and added urban monitoring activities in: Springfield and Kansas City, MO; Chicago, IL; Cleveland, OH; Pittsburgh, PA; Rochester, NY; and Burlington, VT. Initiate statewide urban inventories in both Wisconsin and Vermont.	Conducted activities in Austin and Houston, TX; Baltimore, MD; Milwaukee and Madison, WI; Des Moines, IA; and St. Louis, MO; Providence, RI and added urban monitoring activities in: Springfield and Kansas City, MO; Chicago, IL; Cleveland, OH; Pittsburgh, PA; Rochester, NY; and Burlington, VT. Initiated statewide urban inventories in both Wisconsin and Vermont.	Continue activities in Austin and Houston, TX; Baltimore, MD; Milwaukee and Madison, WI; Des Moines, IA; and St. Louis, MO; Providence, RI; Springfield and Kansas City, MO; Chicago, IL; Cleveland, OH; Pittsburgh, PA; Rochester, NY; and Burlington, VT; and statewide urban inventories in Rhode Island, Vermont, Wisconsin, North Dakota, Maine, and Minnesota.
Additional Urban Locations		
		Add urban monitoring in New York City and Buffalo, NY; Trenton, NJ; Washington, DC; Portland, OR; Fort Worth, TX; Bridgeport, CT; Morgantown, WV; Dover, DE; and statewide inventories in Delaware, New Jersey, Connecticut, West Virginia, and Maryland.
Publish Urban Reports (print and online)		
Published Austin report and prepared Houston report for publication.	Published Austin report and prepared Houston report for publication.	Produce national reporting template.
Release My City's Tree app.	Released My City's Tree app.	Update Field Guide to version 8.1
Release Urban FIA DataMart.	Released Urban FIA DataMart.	

FIA = Forest Inventory and Analysis.

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

In the FY 2016 business report, we said that in FY 2017, we would—	In FY 2017, we—	In FY 2018, we will—
Technology Transfer Activities		
Provide support to international and other nontraditional FIA clients to deliver the broader FIA and Forest Service missions of engagement through technology sharing and research partnerships.	Conducted technology transfer activities, advised partner country staff, hosted visiting resource professionals, and developed data analysis tools and methods with cooperators in each of the regions.	With cooperators from each FIA region, support international partnerships by providing technical support to global monitoring activities through direct consultation, workshop participation, and transfer of software tools, guidebooks, and best practices.
Digital Publishing of Forest Inventory Data		
Process and make available completed panels of continuous forest inventory data via EVALIDator for Missouri and Wisconsin.	Processed and made available completed panels of CFI data via EVALIDator for Missouri and Wisconsin. Updated field guide/PDR program and intensified portions of the sample for Wisconsin.	Process and make available completed panels of continuous forest inventory data via EVALIDator for Missouri and Wisconsin. .
Release version 6 of DATIM in January 2017. Release version 7 of DATIM in July 2017.	Released version 6 of DATIM in January 2017 for FIA customers. Released version 7 in July 2017 to the public.	Intensify other portions of the Wisconsin sample
Finalize the PDR software and complete the database and analysis tool development for the U.S. Fish and Wildlife Service (FWS). Will implement sampling and plot design on additional refuges.	Forest inventory implementation planning is ongoing for other U.S. FWS refuges. Modifications to established PDR software completed. Database and analysis software development continues with increased scope of work.	Release publicly available version 8 of DATIM in January 2018. Release version 9 of DATIM in July 2018.
		Finalize the U.S. FWS database and analysis tool development. Continue to implement sampling and plot design on additional refuges.
Technology Partners		
Fully develop research and training partnerships with SilvaCarbon countries to address changing resource monitoring challenges related to sound forest management and biodiversity.	Worked with SilvaCarbon cooperators to deliver training materials in workshops and participate in research and development activities that meet SilvaCarbon goals.	Participate in a technical advisory role in the development of SilvaCarbon workplans, develop technical and training activities that help meet SilvaCarbon countries forest monitoring system objectives, and participate in research activities that improve forest and biodiversity monitoring in the United States and globally.

CFI = Continuous Forest Inventory; DATIM = Design and Analysis Tool for Inventory and Monitoring; FIA = Forest Inventory and Analysis; FWS = U.S. Fish and Wildlife Service; PDR = portable data recorder.

Land Use Land Change: Business Plan Update

In the FY 2016 business report, we said that in FY 2017, we would—	In FY 2017, we—	In FY 2018, we will—
Continued Image-based Change Estimation (ICE) Data Collection		
Complete Image-based Change Estimation (ICE) data collection in Hawaii, Utah, Vermont, New Hampshire, and New Jersey. Begin or continue ICE data collection in California, Nevada, Texas, Nebraska, Wisconsin, Ohio, New York, and Maryland	Completed ICE data collection in Nebraska, New York, Ohio, Wisconsin, Illinois, North Carolina, and Utah. Held portfolio meeting in Utah (February) to determine consensus strategy: a pilot study in Georgia will be used to inform leadership about potential directions for enhanced LULC	Complete and publish the Georgia comparison of alternative LULC monitoring strategies. Provide the management team with a data-driven matrix of FIA options for improved LULC options.
Update response design, manual and training material. Begin automated reporting format for completed States.	Collected ICE and TimeSync plots for all plots in Georgia study area.	Contribute to a Forest Service/USGS national sample-based assessment of historic LULC change.
Produce National Disturbance Maps (Digital)		
	Disturbance maps were also produced.	Roll out national forest disturbance maps produced by the Landscape Change Monitoring System.

ICE = Image-based Change Estimation, LULC = land use and land cover, USGS = U.S. Geological Survey.

Small Area Estimation: Business Plan Update

In the FY 2016 business report, we said that in FY 2017, we would—	In FY 2017, we—	In FY 2018, we will—
Identify Immediate Need and Develop Team		
Identify immediate needs for small area estimation through discussions with FIA analysts as well as NFS and industry partners.	Launch team and develop portfolio plan.	Continue team work and plan for future developments.
Develop plan for small area estimation session at 2017 FIA stakeholders meeting.	Held a small area estimation session at the 2017 FIA Stakeholders Meeting featuring developments in all units.	Contribute to a Forest Service/USGS national sample-based assessment of historic LULC change.
Identify and document most FIA-affiliated small area estimation projects currently underway.		
Build Estimation Tools		
	.	Publish an overview of small area estimation techniques in the base portion of Green Book 2.
		Build and publish an initial small area estimation tool for NFS applications.
		Track the publications and tools emerging from all of the groups affiliated with this portfolio.

FIA = Forest Inventory and Analysis; NFS = National Forest System.

Community Engagement: Business Plan Update

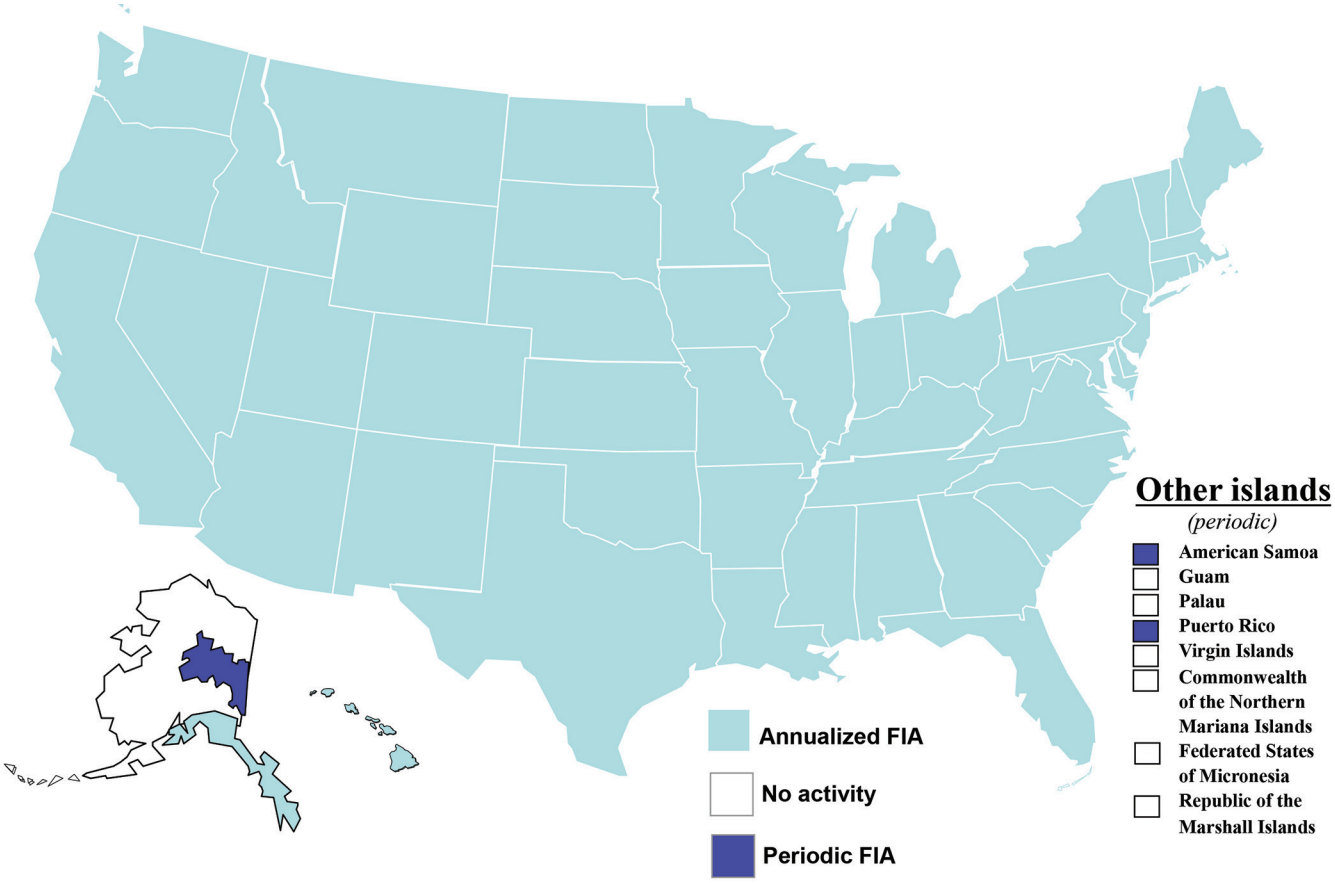
In the FY 2016 business report, we said that in FY 2017, we would—	In FY 2017, we—	In FY 2018, we will—
Engaging the Public		
	Established the FIA Community Engagement portfolio to proactively engage and communicate the multitude of FIA products available..	Continue to discover and organize existing engagement materials to make them more accessible for FIA staff and clients.
	Presented the CE portfolio to program leadership, and the portfolio was approved for implementation.	Track and report community engagement projects completed at each unit.
	Assembled a national community engagement (CE) team with representatives from each unit to facilitate communication, collaboration and efficiency, and sharing products between units.	Facilitate further community engagement projects and create budget proposal process to fund community engagement activities.
	Identified CE projects within the portfolio and helped facilitate.	Produce “What is FIA?” video.
Discover and Organize Existing Materials – Objective 1		
	Set up common folders as “white board” for members to place links, items, and ideas.	
	Establish business operations for the team.	
	Create portfolio documentation in shared location.	
Discover and Organize Existing Materials – Objective 2		
	Contact scientists/analysts/field staff from each unit and request examples of successful community engagement projects.	
	Reach out to Station teams to facilitate the communication and creation of new products for outreach purposes.	
Establish Engagement Database		
	Report on findings.	
	Develop inward facing communication site with clear description of materials available for community engagement.	

CE = community engagement; FIA = Forest Inventory and Analysis.

Fiscal Year 2018 FIA Program Direction

The FY 2018 budget, as in many recent years, has considerable uncertainties. The FY 2018 budget is set at $77.0 million, all from R&D appropriations. The FIA program will continue inventory operations in 49 States, coastal Alaska, and the Tanana Valley of interior Alaska (fig. 22). Other major activity planned for 2018 includes full compliance of State 5-year reports, completing publication of the recent iteration of the NWOS, continuing to modernize the program implementation of the Image-Based Change Estimation, or ICE, project for improving land cover and land use classification, expanding urban forest inventory, exploring digital technologies through story maps and publishing the FIAtlas. Accomplishment of these goals will depend on the continued strong support of our partners and their commitment to an efficient and productive FIA.

Figure 22. Planned FIA implementation status, FY 2018.



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

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 recession impacts on 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 began drafting a new strategic plan to update the plan that was published in 2007, 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 requires 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 to 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 forest inventory and analysis 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, and 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, NASA, National Oceanic and Atmospheric Administration, and 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..

FIA Backdrop. During its entire history of almost 90 years, FIA has been appropriated over $1 billion by Congress for inventory, monitoring, and assessment of U.S. forest lands. During that same period, 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

Goal	Performance measure	2012 level (%)	2013 level (%)	2014 level (%)	2015 level (%)	2016 level (%)	2017 level (%)	Target level (%)
Inputs								
Maintain sufficient funding to support the base Federal FIA program[a]	Percentage of total Federal funding necessary for annualized inventory received	89	85	85	89	82	82	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
Keep fieldwork current	Percentage of States actively engaged in the annualized inventory program	98	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
Outcomes								
Keep analysis current	Percentage of States with FIA State report less than 6 years old	92	88	90	94	96	96	100
Keep online data current	Percentage of States with FIA online data less than 2 years old	92	92	96	96	96	96	100
Customer satisfaction	Percentage of customers rating service as satisfactory or better	87	87	87	87	87	87	100
Partners' participation	Partners' financial contributions expressed as percentage of total program funds	11	13	10	10	12	12	20

FIA = Forest Inventory and Analysis; NRIS = Natural Resource Information System.
[a] Revised percentages based on new congressional target of $90,000,000 for new FIA Strategic Plan options A, B, and C and FY 2017 funding is 86 percent of the new target.

over $222 million in grants to partners, including States, dozens of universities, and NGOs, to collect data, conduct research, and perform analyses to improve program efficiency and support client information needs. Since 2000, FIA partners have contributed more than $147 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 eight 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 $10 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 2011 through 2016 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.

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 and 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. 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 clerical staff.

analysts. Staff who analyze data and write publications..

Phase 1 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. Programmers, data compilers, computer system support staff.

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

techniques research. Mainly research staff who conduct FIA-related research on methods and techniques.

travel. Broken into the following categories:

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

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

effective indirect expenses. These 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:

Effective indirect expenses = (total available funds) – (total direct FIA expenses + 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, previously referred to as Phase 3, measured for a more extended set of ecosystem attributes, including tree crown condition, lichen community diversity, soil data, and down woody debris.

FRIA (Forest Resource Inventory and Assessment). An account created by Congress within the State and Private Forestry portion of the Forest Service budget to provide funds to support forest inventory and analysis collaboration with States. This account was permanently zeroed out in FY 2013.

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 Forest Inventory and Analysis (FIA) unit. A management team for each FIA region 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. In the East, the current target is 15 percent and in the West, 10 percent annually, as set by Congress.

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.

Phase 3. *This term is no longer used; see ecosystem indicators.*

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

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

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

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

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

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

other. Publications that do not fit into any of the previous categories, such as abstracts, books, or other government publications.

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

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

proceedings papers. 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

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

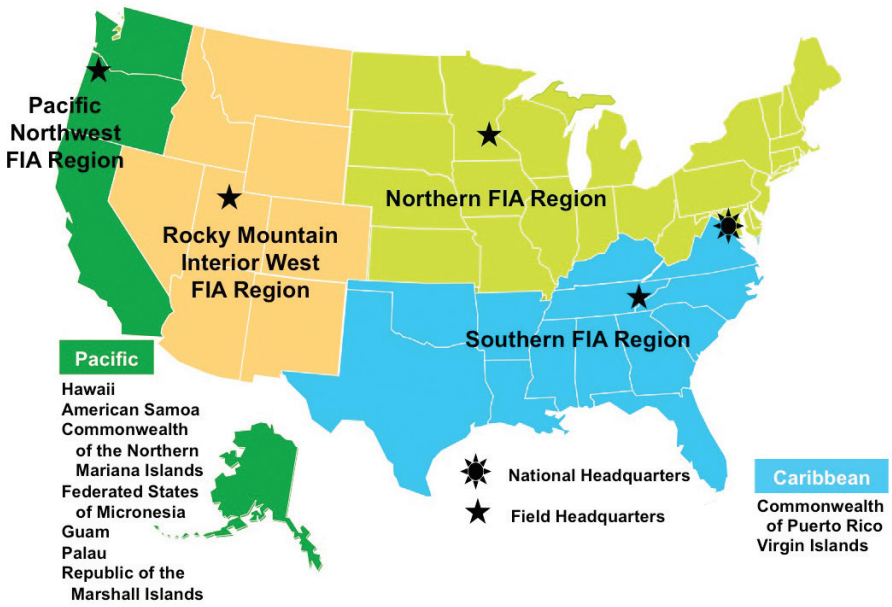
National FIA Program Office
National Program Leader, FIA
USDA Forest Service
201 14th Street, SW
Washington, DC 20250
703–605–4177

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

Pacific Northwest FIA Program
Program Manager, Resource Monitoring and Assessment
Program (FIA)
USDA Forest Service
Pacific Northwest Research Station
620 SW Main Street, Suite 502
Portland, OR 97205
503–808–2019

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

Figure A–1. FIA regions and headquarters.



FIA = Forest Inventory and Analysis.

Appendix B: Tables

Table B-1. Performance measures for the FY 2017 FIA program.

	Pacific Northwest	Interior West[a]	Southern	Northern	National Office	Total
Total available Federal funds, FY 2017	$16,995,000	$14,463,000	$17,999,000	$17,701,000	$9,927,000	$77,085,000
Total appropriated Federal funds, FY 2017	$16,995,000	$14,463,000	$17,914,000	$17,701,000	$9,927,000	$77,000,000
Appropriated as % of 2014 Farm Bill target	87%	86%	85%	87%	81%	86%
Contributions from partners:						
Supporting the 20% FIA program	$828,462	$108,253	$1,932,100	$878,087	$0	$3,746,902
Value-added contributions	$1,281,854	$630,200	$741,959	$4,505,403	$0	$7,159,416
Total contributions	$2,110,316	$738,453	$2,674,059	$5,383,490	$0	$10,906,318
Total all available funds, FY 2017	$19,105,316	$15,201,453	$20,673,059	$23,084,490	$9,927,000	$87,991,318
Forest plots sampled:						
Base Federal grid	**1,738**	**2,735**	**6,690**	**4,380**		**15,543**
Spatial intensification	-	-	-	1,518		1,518
Temporal intensification	886	-	1,397	359		2,642
Urban and Special Studies	85	27	283	126		521
Total forest plots sampled	2,709	2,762	8,370	6,383		20,224
Number of base forest quality assurance plots	316	304	1,154	425		2,199
Percent base forest quality assurance plots	7%	4%	16%	10%		11%
Total base grid plots and percent sampled[b]:						
Total base grid plots	41,463	91,341	89,205	101,342		323,351
Average percent of land with forest cover	37%	23%	46%	30%		36%
Estimated percent of base grid sampled	13%	12%	13%	15%		12%
Percentage of States with annual FIA activity[c]	100%	100%	100%	100%		100%
Number of publications:						
National forest reports	-	-	1	-	-	1
State/island resource reports	-	7	19	24	-	51
State timber product output reports	1	-	13	3	-	17
Regional reports	-	-	1	-	-	-
National reports	-	-	-	-	1	1
5-Year State reports	-	2	2	5	-	9
Subtotal--core reports	1	9	36	32	1	79
Peer-reviewed journal articles	16	10	32	34	-	92
Proceedings articles and published abstracts	-	-	3	5	-	8
Other station publications	4	1	3	-	-	8
Other publications	1	1	2	16	1	21
Total, all reports	22	21	76	87	2	208
Number of publications per Federal FTE	0.26	0.26	0.9	1	0.6	1
Consulting activities:						
Number of significant consultations	115	63	378	748	37	1,341
Total hours of significant consultations	2,176	2,053	1,438	2,864	250	8,781
Meetings:						
User-group meetings held	2	1	1	2	1	7
Management meetings held	0	0	0	1	1	2

[a] A unit of the Rocky Mountain Research Station.

[b] Includes only plots where trees were measured, excludes denied access and hazardous plots where no trees measured.

[c] 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 2017 FIA program Forest Service R&D funds.

	Pacific Northwest	Interior West	Southern	Northern	National Office	Total
Available funds:			*Dollars*			
Previous year end-of-year balance	50,365	181,146	173,082	227,809	0	632,402
Post-year adjustments[a]	(50,365)	(181,146)	(173,082)	(227,809)	0	(632,402)
Subtotal pre-year adjustments	0	0	0	0	0	0
FY appropriated funds						
Research (base)	16,490,000	14,163,000	18,184,000	17,701,000	9,927,000	76,465,000
Initial R&D funds added to base[b]	35,000	500,000	-	-	-	535,000
Secondary R&D funds added to base[b]	-	-	-	-	-	-
Inter-FIA Unit transfers	470,000	(200,000)	(270,000)	-	-	0
Subtotal appropriated funds	**16,995,000**	**14,463,000**	**17,914,000**	**17,701,000**	**9,927,000**	**77,000,000**
Special project funding[c]	0	0	85,000	0	0	85,000
TOTAL AVAILABLE FEDERAL FUNDS	**16,995,000**	**14,463,000**	**17,999,000**	**17,701,000**	**9,927,000**	**77,085,000**
Direct expenses:						
Salary--	**7,157,677**	**7,715,398**	**8,308,945**	**9,739,643**	**416,000**	**33,337,663**
Administration	652,363	820,871	650,709	523,485	416,000	3,063,428
Phase 1 production	3,441	0	270,589	402,498	0	676,528
Field support	972,808	978,548	1,110,230	735,358	0	3,796,944
Data collection	2,866,221	2,267,169	838,587	2,540,926	0	8,512,903
Quality assurance	393,611	553,920	1,586,289	326,176	0	2,859,996
Information management	971,115	1,335,942	828,142	1,621,266	0	4,756,465
Analysis	998,315	976,627	1,700,675	2,858,065	0	6,533,682
Techniques research	299,803	782,321	1,323,724	731,869	0	3,137,717
Travel--	**799,180**	**743,613**	**804,555**	**569,245**	**25,000**	**2,941,593**
Office travel	93,878	100,931	147,846	201,216	25,000	568,871
Field/quality assurance crew travel	705,302	642,682	656,709	368,029	0	2,372,722
Equipment--	**422,207**	**636,253**	**369,852**	**467,134**	**0**	**1,895,446**
Imagery	0	0	0	3,746	0	3,746
Vehicles	188,624	371,173	343,929	189,620	0	1,093,346
Field equipment	151,012	65,757	6,773	150,494	0	374,036
Information technology/communications	82,571	172,776	19,150	114,391	0	388,888
Other	0	26,547	0	8,883	0	35,430
Publications	**3,790**	**9,972**	**17,980**	**192,336**	**5,000**	**229,078**
Grants and agreements[d]	**5,372,437**	**2,445,252**	**6,365,753**	**4,061,915**	**2,459,000**	**20,704,357**
Field work/data	*4,201,126*	*1,707,437*	*5,387,052*	*1,908,547*		*13,204,162*
Information management	*286,025*	*232,767*	*83,000*	*661,502*	*2,334,000*	*3,597,294*
Research	*885,286*	*630,285*	*895,701*	*1,491,866*	*125,000*	*4,028,138*
Office space and utilities	**672,396**	**543,862**	**341,530**	**344,612**	**0**	**1,902,400**
Other direct expenses	**84,705**	**444,089**	**141,684**	**71,405**	**0**	**741,883**
Total direct expenses	**14,512,392**	**12,538,439**	**16,350,299**	**15,446,290**	**2,905,000**	**61,752,420**
Fire Transfer	**0**	**0**	**0**	**0**	**0**	**0**
Effective indirect expenses						
Total effective indirect[e]	**2,482,608**	**1,924,561**	**1,648,701**	**2,254,710**	**7,022,000**	**15,332,580**
Total effective indirect rate	15%	13%	9%	13%	71%	20%
End of year (EOY) balance	**9,358**	**21,916**	**17,800**	**70,710**	**0**	**119,784**
TOTAL FEDERAL EXPENSE	**16,995,000**	**14,463,000**	**17,999,000**	**17,701,000**	**9,927,000**	**77,085,000**

[a] Some bookkeeping is not completed until after the new FY begins, which may affect beginning balances. These adjustments including items such as carryover, return of fire transfer, return of unused prior year grants, Station adjustments, etc. are accounted for here.

[b] Mid-year additions to base funding from FIA Washington Office.

[c] Special Project funding from other Federal sources.

[d] Grants and Agreements include general allocation of grants to basic thematic categories.

[e] Program-wide charges for Albuquerque Service Center included in National Office indirect expense.

Table B-3a. Federal staffing (FTEs) for the FY 2017 FIA program.

	Pacific Northwest	Interior West	Southern	Northern	National Office[a]	Total
Administration	6.2	7.3	5.7	5.1	2.5	26.8
Phase 1 production work	0.1	0.0	4.4	4.3		8.8
Field support	11.6	9.8		7.1		28.5
Data collection	36.5	33.3	18.1	28.9		116.8
Quality assurance	5.2	6.2	18.7	3.6		33.7
Information management	8.8	11.5	7.4	14.1		41.8
Analysis	10.4	8.8	15.7	21.8		56.7
Techniques research	5.3	6.0	10.9	4.8	1.0	28.0
Total	**84.1**	**82.8**	**80.9**	**89.7**	**3.5**	**341.0**

FIA = Forest Inventory and Analysis; FTE = full-time equivalents; FY = fiscal year.
[a] Techniques person is in unit funded by National Office at Research Triangle Park, NC.

Table B-3b. Estimate of cooperator staffing funded by FIA grants and agreements (FTEs) for the FY 2017 FIA program.

	Pacific Northwest	Interior West	Southern	Northern	National Office[a]	Total
Administration	0.7	0.0	0.4	0.0		1.1
Phase 1 production work	0.0	0.0	0.0	0.5		0.5
Field support	0.3	0.7	0.9	2.3		4.2
Data collection	8.8	17.5	97.5	22.3		146.1
Quality assurance	0.0	0.0	0.0	0.3		0.3
Information management	0.5	1.2	1.0	6.6	6.0	15.3
Analysis	17.0	2.7	0.2	4.2	3.0	27.1
Techniques research	0.0	0.6	0.0	12.8	1.0	14.4
Total	**27.3**	**22.7**	**100.0**	**49.0**	**10.0**	**209.0**

FIA = Forest Inventory and Analysis; FTE = full-time equivalents; FY = fiscal year.
[a] Techniques person is in unit funded by National Office at Research Triangle Park, NC.

Table B-3c. Estimate of total federally funded staffing (FTEs) for the FY 2017 FIA program.

	Pacific Northwest	Interior West	Southern	Northern	National Office[a]	Total
Administration	6.9	7.3	6.1	5.1	2.5	27.9
Phase 1 production work	0.1	0.0	4.4	4.8		9.3
Field support	11.9	10.5	0.9	9.4		32.7
Data collection	45.3	50.8	115.6	51.2		262.9
Quality assurance crew	5.2	6.2	18.7	3.9		34.0
Information management	9.3	12.7	8.4	20.7	6.0	57.1
Analysis	27.4	11.5	15.9	26.0	3.0	83.8
Techniques research	5.3	6.6	10.9	17.6	2.0	42.4
Total	**111.4**	**105.5**	**180.9**	**138.7**	**13.5**	**550.0**

FIA = Forest Inventory and Analysis; FTE = full-time equivalents; FY = fiscal year.
[a] Techniques person is in unit funded by National Office at Research Triangle Park, NC.

Table B-4. Partners' contributions toward implementing FIA in FY 2017

Unit	Partner	Contributions toward the base program	Contributions that add value
		- - - - - - - - - Dollars - - - - - - - - -	
Interior West	Colorado State Forest Service		
	USDA Northern Research Station		20,000
	USDA Forest Service Region 1		67,149
	USDA Forest Service Region 2		37,000
	USDA Forest Service Region 4	2,858	155,000
	USDA PNW Research Station		102,683
	WO Forest Service (LANDFIRE)		75,000
	NASA, Brian Williams, Goddard Space Flight Center		139,023
	NASA, Eastern Africa		34,345
	University of Montana, Bureau of Business and Economics Research	105,395	
Interior West total		108,253	630,200
National Office		-	-
National Office total		-	-
Northern	Colorado State University		8,575
	Auburn University		1,250
	Kansas State University		12,782
	Michigan State University		18,750
	North Dakota State University		1,375
	Northern Arizona University		31,250
	State University of New York		23,011
	Texas A&M University		21,375
	University of Arkansas		15,876
	University of Maine		18,750
	University of Massachusetts		60,446
	University of Minnesota		112,150
	University of Missouri		12,500
	University of Nebraska-Lincoln		13,370
	University of New Hampshire		69,122
	University of Vermont		10,000
	Connecticut Dept of Conservation	2,000	
	Delaware Department of Agriculture	4,392	
	Illinois Division of Forest Resources	19,039	
	Indiana Department of Natural Resources	47,471	
	Iowa Department of Natural Resources	15,203	
	Kansas State Forest Service	16,938	
	Maine Forest Service	167,345	233,905
	Maryland Department of Natural Resources Forest Service	14,500	
	Massachusetts Department of Conservation and Recreation	7,700	
	Michigan Division of Forest Management	40,200	
	Minnesota Department of Natural Resources	141,160	344,641
	Missouri Department of Conservation	55,092	196,692
	New Hampshire Department of Resources & Economic Development	19,600	
	New Jersey Forest Service	21,248	113,130
	New York Department of Environmental Conservation	18,195	
	North Dakota Forest Service	4,590	
	Ohio Department of Natural Resources	13,687	
	Pennsylvania Depart of Cons & Natural Resources	43,000	13,082
	Rhode Island Department of Environmental Management	6,471	
	South Dakota Department of Forestry and Nat. Res. Mgmt.	14,505	
	Vermont Department of Forests, Parks & Recreation	6,000	4,000
	West Virginia Division of Forestry	22,271	
	Wisconsin Department of Natural Resources	54,600	561,983
	Nebraska Department of Forestry, Fish, and Wildlife	5,880	
	American Forests		7,500
	Conservation Biology Institute		7,500
	Davey Tree Expert Company		201,300
	American Forest Foundation		38,721
	City of Delta, BC		5,400

Table B-4. Partners' contributions toward implementing FIA in FY 2017 (continued).

Unit	Partner	Contributions toward the base program	Contributions that add value
	Environmental Protection Agency		298,762
	National Aeronautics and Space Administration		29,530
	USDA Forest Service Geospatial Technology and Applications Center		80,000
	USDA Forest Service National Forest Systems	500	910,175
	USDA Forest Service Reseach & Development		333,500
	USDA Forest Service Resource Planning Act		100,000
	USDA Forest Service State & Private Forestry	116,500	595,000
Northern total		**878,087**	**4,505,403**
Pacific Northwest	City of San Diego, Urban	87,000	
	Bureau of Land Management, BLM plot intensification		50,000
	NASA - Goddard Space Flight Center		55,952
	NASA - Goddard Space Flight Center	133,666	
	NASA - Marshall Space Flight Center		32,784
	Micronesia Conservation Trust		30,000
	Alaska Department of Natural Resources	524,318	
	California Department or Forestry and Fire Protection		157,464
	University of Alaska Anchorage, inventory sample processing	40,248	
	University of Guam	43,230	
	USDA Forest Service, Region 10, Coastal Alaska non-forest veg plots		140,000
	USDA Forest Service, State and Private Forestry, landscape restoration grant to Micronesia Challenge Regional Effort for Terrestrial Monitoring		159,922
	USDA Forest Service Region 5		475,000
	USDA Forest Service Region 6		163,632
	USDA Forest Service - Remote Sensing Applications Center		17,100
Pacific Northwest total		**828,462**	**1,281,854**
Southern	Alabama Forestry Commission	175,404	
	Arkansas Forestry Commission	149,069	
	Florida Department of Agriculture and Consumer - Intensification	23,116	69,350
	Florida Department of Agriculture and Consumer Services	141,108	
	Florida Department of Agriculture and Consumer Services Mangrove Project match	9,000	
	Florida Department of Agriculture and Consumer Services - Mangrove Project - WO Transfer	25,000	
	Georgia Forestry Commission	224,442	
	Georgia Forestry Commission - Intensification	27,650	82,950
	Kentucky Division of Forestry	115,054	
	Oklahoma Department of Agriculture and Forestry	117,556	
	South Carolina Forestry Commission	112,714	4,173
	South Carolina Forestry Commission - Intensification	24,283	72,850
	Tennessee Department of Agriculture - Intensification		70,750
	Texas A&M Forest Service - Implementation of Annual FIA	432,442	96,286
	Virginia Department of Forestry (over-match)		80,100
	Virginia Department of Forestry	131,236	
	Virginia Department of Forestry - Intensification	27,494	82,500
	International Institute of Tropical Forestry (IITF)	80,000	
	University of Tennessee (UT) - Information Mgt.		83,000
	VPI - Assess NFTP Inventory using Forest Inventory Data match	6,250	
	VPI - Improved Biomass and Carbon Database match	43,333	
	VPI -Fine Scale Estimate	60,699	
	VPI - RPA Land Use Modeling match	6,250	
	Region 8 Transfer - For rent & other direct		100,000
Southern total		**1,932,100**	**741,959**
Grand total		**3,746,902**	**7,159,416**

BLM = Bureau of Land Management; CNMI = Commonwealth of the Northern Mariana Islands; DATIM = Design and Analysis Toolkit for Inventory and Monitoring; FIA = Forest Inventory and Analysis; FY = fiscal year; GEDI = Global Ecosystem Dynamics Investigation; ICE = Image-based Change Estimation; IW = Interior West; LiDAR = Light Detection and Ranging; NASA = National Aeronautics and Space Administration; NFS = National Forest System; NLCD = National Land Cover Dataset; NO = National Office; NRS = Northern Research Station; NTFP = Nontimber Forest Products; NWOS = National Woodland Owner Survey; PAD = Protected Areas Database; PNW = Pacific Northwest Research Station; RMRS = Rocky Mountain Research Station; RPA = Resource Planning Act; RSAC = Remote Sensing Applications Center; SRS = Southern Research Station; USDA = U.S. Department of Agriculture; USDI = U.S. Department of the Interior; WO = Washington Office.

Table B-5. Grants and agreements entered into by FIA units, FY 2017.

Unit	Amount	Recipient	Purpose
	Dollars		
Interior West	61,160	Michael Kazio (Contract)	Implementation of Annual FIA
	26,350	Integrated Resource Inventories (Contract)	Implementation of Annual FIA
	220,935	Chestnut Ridge (Contract)	Implementation of Annual FIA
	10,566	Chestnut Ridge (Contract)	Implementation of Annual FIA
	21,426	Wesley Winslow (Contract)	Implementation of Annual FIA
	53,000	Integrated Resource Inventories (Contract)	Implementation of Annual FIA
	161,547	WITS Verizon (Contract)	FIA IT, National IM System Architecture
	12,500	RLT Contracting	Research Support (Stakeholder Meeting)
	1,049,000	Colorado State Forest Service	Implementation of Annual FIA
	80,000	Utah State University	Tree ring analysis
	251,634	University of Montana	Timber Products Output, Removals, Industry Analysis
	71,547	Utah State University	Land Use/Land Cover
	11,423	Swarthmore College	Estimation Strategies for FIA (FIESTA)
	185,000	RMRS, Forest and Woodland Ecosystems	Western soils analysis
	6,000	FS GTAC	FIA to FVS Translator
	52,720	FS CIO	National IM System Architecture
	50,000	RMRS, Forest and Woodland Ecosystems	Soils and regeneration study
	50,930	FS NRS/Univ Florida	Carbon accounting
	69,514	FS GTAC	ICE development and implementation
Interior West total	**2,445,252**		
National Office	100,000	University of Massachusetts	National Woodland Owner's Survey
	200,000	Southern Utah University	DATIM support
	1,500,000	University of Nevada-Las Vegas	FIA Database agreement
	200,000	Eastern Forest Environmental Threat Center	SRS Eastern Forest Environmental Threat Center
	125,000	GTAC (formerly RSAC)	Techniques Research Band Work Projects
	175,000	Geospatial Technology Applications Center(GTAC)	Forest Atlas
	159,000	Enivornmental Systems Research Institute (ESRI)	Engagement Portfolio
National Office total	**2,459,000**		
Northern	40,000	USDA National Agriculture Statistics Center	National Woodland Owner Survey
	7,998	Access Ability, Inc.	Prefield document imaging services
	90,745	Department of Energy, Oakridge	Oak ridge Institute for Science and Education research participation program
	20,000	Government Publishing Office	NWOS analytical support
	89,676	Chandler B. Johnson	Implementation of annual FIA Michigan
	87,729	Daniel Huberty	Kansas Plots
	46,294	Daniel Huberty	Nebraska Plots
	100,575	Glenn Summers	New York Plots
	65,500	Arborpro Inc	Mid-Atlantic Plots
	90,065	Daniel Huberty	Kansas/Nebraska ICE Ground Truth
	31,196	Joel Fyock	Mid-Atlantic Plots
	60,782	Joel Fyock	West Virginia Plots
	82,265	Mark Webb	Ohio Plots
	26,439	Tom Bergstrom	North Dakota Plots
	51,225	Mark Webb	West Virginia Plots
	30,000	Conservation Biology Institute Inc	Protected Database
	201,300	Davey Tree Expert Company	Enhancing ITREE Spatial Simulation
	28,725	Enivornmental Systems Research Institute (ESRI)	Annual services and additional learning credits
	344,641	Minnesota Department of Natural Resources	Implementation of annual FIA
	36,128	South Dakota Dept of Forestry & Nat Res. Mgmt	South Dakota plots
	83,096	Indiana Department of Natural Resources	Implementation of annual FIA
	514,938	Maine Forest Service	Implementation of annual FIA

Table B-5. Grants and agreements entered into by FIA units, FY 2017 (continued).

Unit	Amount	Recipient	Purpose
	24,990	New Jersey Forest Service	FIA Support for analytical science delivery
	10,000	NRS-Chicago	Urban Support
	20,000	NRS, Baltimore	Urban Wood FIA Support
	120,000	NRS, Grand Rapids	Soil Analyses
	20,000	Rocky Mountain Research Station	Urban Support
	40,000	NRS-Durham	Downed Woody National Support
	5,000	National Agroforestry Center	High-res land cover windbreak assessment
	10,366	NRS-Newtown Square	Carbon Accounting
	34,300	Colorado State University	Remote Sensing of Eastern Redcedar Encroachment in Great Plains
	5,500	Texas A&M	High resolution land cover and windbreak mapping
	5,000	Auburn University	Forest ownership dynamics
	11,000	Kansas State University	High-res land cover Nebraska/Kansas windbreak assessment
	75,000	Michigan State University	FIA Biomass Study
	5,500	North Dakota State University	High resolution land cover and windbreak mapping
	125,000	Northern Arizona University	National Biomass Study support
	13,500	Research Foundation for SUNY	Envirmental Effects of Urban Forestry
	5,000	State University of New York	Forest ownership dynamics across the United States
	40,500	State University of New York	i-Tree hydrological ecos services and feedbacks
	29,229	State University of New York	i-Tree Support
	63,504	University of Arkansas	Bayesian Temporal and Spatial Analysis
	74,999	University of Maine	FIA Biomass Study
	241,782	University of Massachusetts	NWOS/Family Forest Research Center
	27,500	University of Minnesota	FIA Biomass Estimation Data Access
	74,960	University of Minnesota	Forest Biometics Program Support
	350,000	University of Minnesota	Biometrical Refinements of US Forest Carbon Accounting
	50,000	University of Missouri	Tree Renegation
	40,000	University of Vermont	Refining Stand Dynamics USFS Carbon Accounting
	53,481	University of Nebraska	High-res land cover windbreak assessment
	276,487	University of New Hampshire	Urban FIA Partnership
	80,000	Texas A&M	Urban FIA Support
Northern total	**4,061,915**		
Pacific Northwest	8,077	Student Conservation Assocation	Implementation of base FIA
	187,371	Student Conservation Assocation	Implementation of base FIA
	1,946,012	Maritime	Coastal AK Boat/Helicopter services
	286,025	Department of Energy, Oakridge	Oak ridge Institute for Science and Education research participation program
	119,208	University of Guam	Measuring base FIA inventory plots
	41,375	University of Alaska, Fairbanks	Analyze soil samples for FIA interior Alaska
	135,619	University of Alaska, Anchorage	Using tree rings to understand the impacts of climate change in interior Alaska
	300,000	University of Montana	Implementation of FIA, Pacific West (CA, OR, WA, AK) TPO studies
	45,000	University of Montana	Alaska Logging Utilization measurements and data collection
	137,120	Oregon State University	Multi-decadal Landsat-based vegetation mapping in California, Oregon, and Washington

Table B-5. Grants and agreements entered into by FIA units, FY 2017 (continued).

Unit	Amount	Recipient	Purpose
	97,700	University of Washington	Analyzing environmental changes in interior Alaska (1982-2014) using field measurement, stereo aerial photos, and G-LiHT data
	88,528	Oregon State University	Analysis of forest service inventory data from forested habitats across the USA
	66,000	University of California, Berkeley	Rates, patterns, and potential causes of tree mortality in California's forests
	34,000	Portland State University	Bio-Monitoring urban forests
	25,000	Oregon State University	Techniques using Bio-indicators in urban forests
	145,000	Oregon State University	National Biomass Study
	14,944	Alaska Pacific University	Cooperative Ecosystems Studies Unit Tall Shrub Biomass Project
	40,000	University of Alaska, Anchorage	Incorporating interior Alaska FIA plot data into an assessment of proposed U.S. National Vegetation Classification Groups — Boreal National Vegetation Classification Key
	1,640,458	Alaska Department of Natural Resources	Implementation of FIA interior Alaska
	15,000	Oregon Department of Forestry	Assessment of annual forest inventories
Pacific Northwest total	**5,372,437**		
Southern	526,212	Alabama Forestry Commission	Implementation of Annual FIA
	447,207	Arkansas Forestry Commission	Implementation of Annual FIA
	36,000	Florida Department of Agriculture and Consumer	Evaluate Alternative Methods for Mangrove Ecosystem Inventory
	423,324	Florida Department of Agriculture and Consumer	Implementation of Annual FIA
	582,564	Georgia Forestry Commission	Implementation of Annual FIA
	345,162	Kentucky Division of Forestry	Implementation of Annual FIA
	485,356	North Carolina Dept. of Agric. and Consumer Serv	Implementation of Annual FIA
	352,669	Oklahoma Dept. of Agriculture Food and Forestry	Implementation of Annual FIA
	338,143	South Carolina Forestry Commission	Implementation of Annual FIA
	275,177	Tennessee Department of Agriculture	Implementation of Annual FIA
	1,071,684	Texas A&M Forest Service	Implementation of Annual FIA
	393,554	Virginia Department Forestry	Implementation of Annual FIA
	80,000	International Institute of Tropical Forestry (IITF)	Experimental Forest Study
	30,000	Auburn, Purdue, Idaho University	Tree Seedling Planting Survey
	54,000	Louisiana State University (LSU)	Wood Quality Assessment
	13,670	University of Georgia Athens (UGA)	Reinstate Table Generator
	58,063	University of Tennessee at Knoxville (UT)	Estimating Annual Forest Disturbance Trends
	49,968	University of Tennessee at Knoxville (UT)	Mill Dynamics - Exploring Mill Entry
	25,000	Virginia Tech University	Assessing NTFP Inventory using FIA Data
	130,000	Virginia Tech University	Improved Volume Biomass and Carbon Database
	210,000	Virginia Tech University	Fine Scale Modeling Estimates
	130,000	Virginia Tech University	Improved Volume Biomass and Carbon Database
	25,000	Virginia Tech University	RPA Land Use Modeling
	83,000	University of Tennessee at Knoxville (UT)	Information Management - Cooperative Research
	200,000	Eastern Forest Environmental Threat Center (EFETC)	SRS 4854 EFETAC ISA
Southern total	**6,365,753**		
Grand total	**20,704,357**		

AK = Alaska; CIO = Chief Information Officer; FIA = Forest Inventory and Analysis; FVS = Forest Vegetation Simulator; FY = fiscal year; GPO = Government Publishing Office; G-LiHT = Goddard's LiDAR, Hyperspectral, and Imager; GTAC = Geospatial Technology and Applications Center; ICE = Image-based Change Estimation; IM = Information Management; LiDAR = Light Detection and Ranging; NASA = National Aeronautics and Space Administration; NRS = Northern Research Station; NTFP = Nontimber Forest Products; NWOS = National Woodland Owner Survey; RMRS = Rocky Mountain Research Station; RPA = Resource Planning Act; RSAC = Remote Sensing Applications Center; SRS = Southern Research Station; TPO = Timber Products Output; USDI = U.S. Department of the Interior.

Table B-6. Number and hours of significant consultations by FIA staff by customer group, FY 2017.

Customer group	Pacific Northwest		Interior West		Southern		Northern		National Office		Total	
	No.	Hours	No.	Hours	No.	Hours	No.	Hours	No.	Hours	No.	Hours
Academic	18	72	19	246	102	391	126	336	4	45	269	1,090
Government	56	1,984	35	1,601	109	475	303	1,044	12	83	515	5,187
Industry	21	35	2	6	55	265	188	536	6	31	272	873
NGO	12	55	3	160	28	105	68	269	7	60	118	649
NIPF	2	4	-	-	7	16	1	1	3	9	13	30
Media	1	6	3	32	2	4	14	38	3	10	23	90
Other	5	20	1	8	75	182	48	640	2	12	131	862
	115	2,176	63	2,053	378	1,438	748	2,864	37	250	1,341	8,781

FIA = Forest Inventory and Analysis; FY = fiscal year; NGO = non-governmental organization; NIPF = nonindustrial private forest.

Table B-7. FIA data access by online tools and Spatial Data Services Center requests, FYs 2009–2017.

Indicator	Number of annual accesses									Total 2009-2017
	2009	2010	2011	2012	2013	2014	2015	2016	2017	
Online tools										
MapMaker	25,000		-	-	-	-	-	-	-	25,000
FVS		-	-	-	-	-	-	-	-	-
Fuel Treatment Evaluator		-	-	-	-	-	-	-	-	-
FIDO	55,494	70,943	72,946	52,099	57,567	57,974	47,263	33,293	11,898	459,477
NWOS	6,560	1,700	2,070	5,515	4,502	2,994	2,068	1,710	2,517	29,636
EVALIDator	3,920	2,900	55,468	34,901	33,759	35,839	36,532	34,082	38,597	275,998
EVALIDator API								75,449	38,313	113,762
National TPO tool						69,600	18,544	37,000	37,000	162,144
DATIM									1,092	1,092
DATA downloads	**2,014**	**3,033**	**1,929**	**1,512**	**7,383**	**19,768**	**66,000**	**69,025**	**53,315**	**223,979**
Total	92,988	78,576	132,413	94,027	103,211	186,175	170,407	250,559	182,732	1,291,088
Spatial data requests										
Academia	109	114	121	168	143	155	160	162	155	970
State	49	47	36	45	29	55	91	56	55	352
NFS	16	32	17	46	31	32	29	40	32	203
Oth. Federal	105	116	92	169	175	131	136	130	131	924
NGO	41	31	23	41	35	31	38	35	31	240
Industry	28	35	34	61	41	94	84	54	94	377
Other	57	48	91	75	67	88	66	55	88	492
Total	405	423	414	605	521	586	604	532	532	3,558

API = Application Programming Interface; DATIM = Design and Analysis Toolkit for Inventory and Monitoring; FIA = Forest Inventory and Analysis; FIDO = Forest Inventory Data Online; FVS = Forest Vegetation Simulator; FY = fiscal year; NGO = non-governmental organization; NFS = National Forest System; NWOS = National Woodland Owner Survey; TPO = Timber Products Output.

Table B-8. Mill, fuelwood, and ownership surveys processed and utilization sites visited, FYs 2000–2017.

Survey or site	Year initiated	Number of annual survey questionnaires or sites										Total 2000-2017
		2000-2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
Timber products	1947	15,906	2,657	1,727	3,521	1,375	2,675	1,142	2,750	1,341	130	33,224
Fuelwood	1947	2,919	-	-	-	-	2,360		-	-	-	5,279
Ownership surveys	1978	17,281	-	-	7,960	4,028	5,262		-	-	5,254	39,785
Utilization sites	1947	486	17	66	58	162	189	105	216	162	192	1,653

FY = fiscal year.

Table B-9. Forest health indicator, year of initiation, and number of samples collected, FYs 2000–2017.

Indicator	Year initiated	Number of annual samples										Total 2000-2017
		2000-2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
Crowns	1991	8,267	1,177	761		1,510	5,031	3,813	4,437	5,399	2,285	32,680
Lichens	1998	2,805	150	167		33			8	193	10	3,366
Soils	1999	6,014	201	266	2	595	565	439	487	456	716	9,741
Veg	2001	15,346	2,125	2,097	1,624	7145	6,703	7,098	6,666	6,757	6,294	61,855
Ozone	1994	9,052	1,003	1,018	107		-	-	-	-	-	11,180
DWM	2001	20,337	2,152	1,392	1,414	6263	8,271	8,635	8,186	8,459	9,092	74,201
Mortality[a]	2001	58,785	13,892	15,293	15,858	20,275	13,859	17,308	16,825	14,606	15,543	193,023

FY = fiscal year; DWM = down woody material.

[a] Number of remeasured annual inventory plots from which tree mortality can be estimated.

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

Region and area	Land area	Forest area	Percent forest	Number of major islands	Year of published report	Number of base field plots	Number of intensification plots	Available online data
Pacific (PNW):	- - - - - *Acres* - - - - -							
American Samoa	48,434	39,156	81%	4	2012	20		Yes
Guam	132,230	69,851	53%	1	2013	48	58	Yes
Palau	108,227	102,130	94%	10	2014	56		Yes
Commonwealth of the Northern Mariana Islands	74,907	60,207	80%	3	2015	37		Yes
Federated States of Micronesia	161,917	143,466	89%	4	2005	85	90	Yes
Marshall Islands	33,120	23,252	70%	10	2006	58		Yes
Hawaii	4,109,962	1,471,180	36%	8	2015	246	90	Yes
Atlantic (SRS):								
Commonwealth of Puerto Rico	2,191,815	1,219,177	56%	4	2013	287		Yes
U.S. Virgin Islands	82,164	46,967	57%	3	2013	48		Yes
Total	6,942,776	3,175,386	46%	47		885	238	

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

Table B-11. Land and forest area and FIA annualized implementation status by State and region, FY 2017.[a]

Region and State	Bureau of the Census land area	Forest land area defined by current FIADB	Forest land area defined by 2012 RPA Assessment	Annual inventory entry date	State annualized as of 2017
		Thousand acres		*Year*	
Northern	**606,841**	**182,325**	**182,299**		**24**
Connecticut	3,099	1,712	1,712	2003	Yes
Delaware	1,247	340	340	2004	Yes
Illinois	35,532	4,848	4,848	2001	Yes
Indiana	22,929	4,830	4,830	1999	Yes
Iowa	35,749	3,014	3,014	1999	Yes
Kansas	52,326	2,502	2,502	2001	Yes
Maine	19,739	17,660	17,660	1999	Yes
Maryland	6,252	2,461	2,461	2004	Yes
Massachusetts	4,992	3,024	3,024	2003	Yes
Michigan	36,185	20,127	20,127	2000	Yes
Minnesota	50,961	17,371	17,371	1999	Yes
Missouri	43,995	15,472	15,472	1999	Yes
Nebraska	49,167	1,576	1,576	2001	Yes
New Hampshire	5,730	4,832	4,832	2002	Yes
New Jersey	4,707	1,964	1,964	2004	Yes
New York	30,161	18,966	18,966	2002	Yes
North Dakota	44,161	760	734	2001	Yes
Ohio	26,151	8,088	8,088	2001	Yes
Pennsylvania	28,635	16,782	16,782	2000	Yes
Rhode Island	662	360	360	2003	Yes
South Dakota	48,519	1,911	1,911	2001	Yes
Vermont	5,899	4,591	4,591	2003	Yes
West Virginia	15,384	12,155	12,155	2004	Yes
Wisconsin	34,661	16,980	16,980	2000	Yes
Southern	**533,031**	**267,214**	**244,716**		**13**
Alabama	32,413	22,877	22,877	2001	Yes
Arkansas	33,303	18,755	18,755	2000	Yes
Florida	34,447	17,461	17,461	2001	Yes
Georgia	36,809	24,768	24,768	1998	Yes
Kentucky	25,271	12,472	12,472	1999	Yes
Louisiana	27,650	14,712	14,712	2000	Yes
Mississippi	30,031	19,542	19,542	2007	Yes
North Carolina	31,115	18,588	18,588	2003	Yes
Oklahoma	43,901	12,646	12,256	2008	Yes
South Carolina	19,239	13,120	13,120	1998	Yes
Tennessee	26,390	13,942	13,942	1999	Yes
Texas	167,188	62,425	40,318	2000	Yes
Virginia	25,274	15,907	15,907	1998	Yes
Interior West	**547,691**	**154,093**	**124,614**		**8**
Arizona	72,700	18,643	10,795	2001	Yes
Colorado	66,331	22,837	19,995	2002	Yes
Idaho	52,892	21,448	21,247	2004	Yes
Montana	93,149	25,573	25,169	2003	Yes

Table B-11. Land and forest area and FIA annualized implementation status by State and region, FY 2017[a] (continued).

Region and State	Bureau of the Census land area	Forest land area defined by current FIADB	Forest land area defined by 2012 RPA Assessment	Annual inventory entry date	State annualized as of 2016
		Thousand acres		*Year*	
Nevada	70,260	11,169	8,121	2010	Yes
New Mexico	77,631	24,840	16,615	2008	Yes
Utah	52,589	18,135	11,866	2000	Yes
Wyoming	62,140	11,448	10,807	2010	Yes
Pacific Northwest	**573,389**	**215,182**	**214,605**		**5**
Alaska, Coast	39,041	14,426	14,426	2004	Yes
Alaska, Int.	326,575	114,151	114,151	2016	Periodic
California	99,699	32,618	32,057	2001	Yes
Hawaii	4,110	1,748	1,748	2010	Yes
Oregon	61,432	29,804	29,787	2001	Yes
Washington	42,532	22,435	22,435	2002	Yes
TOTAL	**2,260,953**	**818,814**	**766,234**	**-**	**50**
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%**

AK = Alaska; FIA = Forest Inventory and Analysis; FIADB = Forest Inventory and Analysis Database; FY = fiscal year; RPA = Resource 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 2010-2017.

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

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

[a] Net of rescissions.

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

[c] Includes Federal grants and agreements.