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Introduction to the Special Section on Forest Inventory and Analysis

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Eighteen years ago, in this journal, Gillespie (1999) described the transition of the US Department of Agriculture (USDA) Forest Service Forest Inventory and Analysis (FIA) program from its historical practice of periodic, state-level inventories to a spatially and temporally balanced annualized inventory. The article offered a rationale for the change and also noted some of the concerns and challenges of implementing this approach nationally. One of the key points in Gillespie's (1999, p. 16) rationale was that conducting annual inventory in all states every year would "make it easier for partners (mainly state forestry agencies) to collaborate in program planning and implementation."

Some elements of annualized inventory have taken longer than expected to implement. The 5-year remeasurement cycle specified in the Agricultural Research Extension and Education Reform Act of 1998 ("Farm Bill"; PL 105-185) is only implemented in some eastern states, enabled through state partnerships. The remainder of eastern states are on a 7-year remeasurement cycle, and western states are on a 10-year cycle. Wyoming was the last of the coterminous 48 states to be brought into the annual inventory, beginning in 2011. Although annual inventory of the coastal portions of Alaska began in 2004, the logistical challenges associated with inventory of the interior portions of the state are still being addressed (e.g., Andersen et al. 2015). Interestingly, successful implementation of the interior Alaska portion of the national annual inventory is being achieved by exactly the kind of partnerships (Mueller and Irvine 2015) envisioned by Gillespie (1999).

Gillespie (1999) also discussed the need for change as a way to satisfy customer needs, as identified by two blue ribbon panels on FIA (American Forest & Paper Association 1992, 1998). Inside FIA today, there is not a great distinction between partners and customers. Although this was probably also true in the 1990s, in Gillespie's context the term "partners" was more closely identified with those involved in the implementation of forest inventories, whereas "customers" referred more to the consumers of FIA data and information. The number of customers that consume FIA data and information has grown substantially since 1999. For example, a Google Scholar[1] search using the phrase "forest inventory and analysis" and publication year of 1999 yields about 100 titles, not including citations. The same search restricted to any of the past few years yields approximately 500 titles per year. Although a substantial fraction of this growth is attributed to higher productivity within the FIA program, a growing fraction is due to the rapid growth of partners in research.

Another emerging customer and partner base is one that might surprise those outside of the USDA Forest Service: the USDA Forest Service National Forest System (NFS). Before the 1998 Farm Bill, national forests were responsible for the portion of FIA plots that were located on NFS lands; in some cases, forests funded FIA to do the work. These data were used within the national forests to varying extents and were added to data collected by FIA on other ownerships to allow FIA to develop resource summaries at the state level. After responsibility for FIA plots on NFS lands was transferred to the regional FIA programs under the annualized inventory system, there evolved a "disconnect" between many national forests and FIA because of a perception that FIA data did not serve managers' needs. However, since the announcement of the 2012 planning rule for NFS land, there has been increasing collaboration between FIA and NFS regions and forests. FIA data are increasingly recognized as a valuable resource within the NFS, and considerable effort is being made to use FIA data to the full potential as national forests proceed through the next round of planning in partnership with FIA.

Rationale for a Special Section

In the run-up to the joint conventions of the International Union of Forest Research Organizations (IUFRO) and the Society of American Foresters (SAF) that were held in 2014 in Salt Lake City, Utah, convention chairs requested the organization of a 12-hour session that would focus on a diversity of applications and analyses that used FIA data as a major component. They also requested that the presentations in the FIA-centric session emphasize the "how to" of working with the FIA program and data, and feature the work of investigators outside FIA who worked with FIA data independently or in partnership. The rationale for this nontraditional technical session included a desire not only to showcase the diverse applications of FIA data but also to serve as a primer for new potential partners who might consider working with FIA data. As a result, the session was distinguished from traditional technical tracks by being billed as the "Inventory, Monitoring and Assessment Training Workshop."

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The session consisted of 22 presentations in 6 topic areas: FIA Data and Tools, Special Data and Analyses, Regional Analyses, New Inventories and Assessments, Trend Analysis and Projection, and Statistical Tools and Methods. All four of the regional FIA programs (Pacific Northwest, Interior West, Northern, and Southern) were represented in the program, so there was a breadth of topic areas and geographic coverage. Individual presentations spanned a wide range of subjects: introductions to the history and structure of the national FIA program, public access to online tools and data, design of FIA inventory in new areas (interior Alaska) and in urban forests, and applications related to wildlife and aquatic habitat. All presentations were open to inclusion in the special section in this issue, but several were live demonstrations that were not easily converted into a journal format. Six of the presentations are included in this issue and two (Goeking 2015, Ganey and Witt 2017) were already in some stage of review at the time of the workshop and were published earlier.

Three of the six articles in this issue largely use FIA data as they are available to the public.[2] Some studies were accomplished using very simple data sets. Thompson (2017) focused on a single species, lodgepole pine, and required only a limited set of variables (e.g., species or live/dead status) to conduct the analysis of mountain pine beetle impacts in Colorado. Although FIA does not specifically target many nontimber forest products, several aspects of these commodities are captured in the inventory. Kauffmann et al. (2017) identified 11 tree species valued for their bark in the FIA database and used slippery elm as an example of how to estimate distribution, abundance, and change; their methods may be useful for other species with nontimber values. Russell and Woodall (2017), in contrast, used a relatively complex subset of FIA data to forecast downed woody material dynamics.

The other three papers use FIA data in ways much differently from the first three and much differently from each other. Fried et al. (2017) use FIA data in conjunction with the Forest Vegetation Simulator (Dixon 2002) and a number of other data sources to conduct regional-scale analyses and explore the implications of management policies. Shaw et al. (2017) explore the potential for using FIA data and another nationally standardized, geographically comprehensive data set—wildland fire polygons and associated burn severity data produced by the Monitoring Trends in Burn Severity program (Eidenshink et al. 2007, Finco et al. 2012)—to analyze fire effects of stand conditions on fire severity and the effects of fire severity on subsequent stand structure and development. DeRose et al. (2017) do not use FIA data at all; rather, they use the FIA framework and sample trees to develop a unique tree-ring database that has multiple applications and will eventually link a large body of tree growth data to the existing FIA database. These ancillary data will allow analyses in the western states that have never before been possible using FIA data alone.

Although this issue highlights a variety of applications of FIA data, analyses based on FIA data appear frequently in this journal. In the *Journal of Forestry* issues that have appeared since the Inventory, Monitoring and Assessment Training Workshop, articles have covered early recovery of the forest products sector in the southern United States (Brandeis and Hodges 2015), invasive characteristics of eastern redcedar in the Midwest (Meneguzzo and Liknes 2015), the incidence of fusiform rust in stands of different type and origin (Randolph et al. 2015), a rationale for improving FIA biomass equations nationally (Weiskittel et al. 2015), methods for comparing the results of older FIA periodic inventories to annualized FIA data (Goeking 2015), the decline of southern pine timberlands (South and Harper 2016), characteristics and attitudes of family forest owners (Butler et al. 2016), and changes in snag abundance in two forest types on National Forestland in Arizona (Ganey and Witt 2017). The wide variety of topics featured in the *Journal* illustrates how diverse the FIA program has become since its establishment in the 1920s as the US Forest Survey, which was directed to "make and keep current a comprehensive survey and analysis of the present and prospective conditions of and requirements for renewable resources of the forests and rangelands of the United States" (Smith 2002, p. S233).

FIA into the Future

The elements of Gillespie's (1999) rationale for annualized inventory have largely been realized over the past 18 years. The goal of measuring plots in every state, every year is close to full implementation. Summary data are produced for each state annually, and extensive reports on each state are produced on an approximately 5-year cycle. Integration of the downed woody material protocol of the Forest Health Monitoring (FHM) program (USDA Forest Service 1998) into the FIA program was cited by Gillespie (1999) as an option to gain efficiency in forest monitoring.

Although the FHM protocols (also known as phase 3) were integrated, the lower plot sampling intensity of the phase 3 plots (about 1/16 of the regular FIA plot network) provided somewhat limited opportunity for analysis at some scales. However, the availability of variables with broad application, such as those acquired under the downed woody material and understory vegetation protocols, was in high demand from many users, in particular those concerned with wildland fire and wildlife habitat. This demand eventually led to a standard for collecting these variables on all FIA plots. Other phase 3 protocols are under review within FIA with the intent of expanding their coverage and improving their value.

Today the national FIA program continues to address the needs of its ever-increasing customer base, much as it did following the recommendations of the blue ribbon panels. At the same time it evolves, FIA attempts to remain true to its core mission by maintaining the consistency in the inventory that will allow FIA analysts and users to assess the status and trends of the Nation's forests now and into the future. General direction for the program comes from updates to the Farm Bill, which in turn guides development of the FIA Strategic Plan. The current Strategic Plan, based on the 2014 Farm Bill,[3] includes several priorities to maintain the FIA base program and meet new partner and customer needs: (1) bring the data collection to "full field operations," which means annually measuring 10% of the plots in the West and 15% in the East, and an annualized program in all of Alaska, (2) enhance timber products monitoring, (3) enhance forest landowner studies, (4) improve carbon/biomass estimates, (5) expand land use/land cover monitoring to include all lands (i.e., not only forestland), and (6) expand the inventory of urban forests. At funding levels beyond what is needed to accomplish these goals, the next priority is to bring the data collection effort up to the 20% of plots in all states that was originally specified in the 1998 Farm Bill. The path to achievement of the Strategic Plan elements and other goals of the FIA program is currently organized as a group of portfolios. There are separate portfolios for

the Strategic Plan elements mentioned above, as well as others for small area estimation (bridging the scale of the FIA plot network and more localized information needs), a national information technology framework, and "digital engagement." The digital engagement effort is directed to improving the dissemination of FIA data and information by engaging users with more online and interactive content. This is part of a continuing response to Gillespie's (1999, p. 18) notion that "information may be accurate and precise, yet still not useful to users" if the data and information are not timely and readily accessible.

As FIA continues to evolve in response to partner and customer needs, the program also continues its outreach effort through outlets such as the Inventory, Monitoring and Assessment Training Workshop, regional user group meetings, biennial FIA Stakeholder Science Meetings, and other opportunities for technology transfer. The organizers and presenters at the workshop and especially those who could contribute to the special section in this issue hope that the presentations and articles encourage new customers and partners to take advantage of what the FIA program has to offer.

Endnotes

1. For more information, see http://scholar.google.com.
2. For more information, see www.fia.fs.fed.us/tools-data/.
3. For more information, see www.fia.fs.fed.us/library/bus-org-documents/strategic-plans/docs/FIA%20Strategic%20Plan%20FS-1079.PDF.

Supplemental Podcast

This article includes a podcast interview. Visit the online version of this article to listen to the podcast.

Literature Cited

American Forest & Paper Association. 1992. *Report of the first blue ribbon panel on Forest Inventory and Analysis*. Washington, DC. 10 p.

American Forest & Paper Association. 1998. *The report of the second blue ribbon panel*. Washington, DC. 20 p.

Andersen, H.-E., C. Babcock, R. Pattison, B. Cook, D. Morton, and A. Finley. 2015. The 2014 Tanana inventory pilot: A USFS-NASA partnership to leverage advanced remote sensing technologies for forest inventory. P. 40–41 in *Pushing boundaries: New directions in inventory techniques and applications: Forest Inventory and Analysis (FIA) symposium 2015, 2015 December 8–10, Portland, Oregon*, Stanton, S.M., and G.A. Christensen (comps.). USDA Forest Service Gen. Tech. Rep. PNW-GTR-931, Pacific Northwest Research Station, Portland, OR. https://www.treesearch.fs.fed.us/pubs/50169.

Brandeis, C., and D.G. Hodges. 2015. Forest sector and primary forest products industry contributions to the economies of the southern states: 2011 update. *J. For.* 113(2):205–209. doi:10.5849/jof.14–054.

Butler, B.J., J.H. Hewes, B.J. Dickinson, K. Andrejczyk, S.M. Butler, and M. Markowski-Lindsay. 2016. Family forest ownerships of the United States, 2013: Findings from the US Forest Service's National Woodland Owner Survey. *J. For.* 114(6):638–647. doi:10.5849/jof.15–099.

DeRose, R.J., J.D. Shaw, and J.N. Long. 2017. Building the Forest Inventory and Analysis tree-ring data set. *J. For*. 115(4):283–291. doi:10.5849/jof.15-097.

Dixon, G.E. 2002. *Essential FVS: A user's guide to the Forest Vegetation Simulator*. USDA Forest Service, Forest Management Service Center, Fort Collins, CO. 246 p. Available online at https://www.fs.fed.us/fmsc/ftp/fvs/docs/gtr/EssentialFVS.pdf.

Eidenshink, J., B. Schwind, K. Brewer, Z. Zhu, B. Quayle, and S. Howard. 2007. A project for monitoring trends in burn severity. *Fire Ecol.* 3(1):3–21. doi:10.4996/fireecology.0301003.

Finco, M., B. Quayle, Y. Zhang, J. Lecker, K.A. Megown, and C.K. Brewer. 2012. Monitoring trends and burn severity (MTBS): Monitoring wildfire activity for the past quarter century using Landsat data. P. 222–228 in *Moving from status to trends: Forest Inventory and Analysis (FIA) symposium 2012, 2012 December 4–6, Baltimore, Maryland*, Morin, R.S., and G.C. Liknes (comps.). USDA Forest Service Gen. Tech. Rep. NRS-P-105, Northern Research Station, Newtown Square, PA [CD-ROM]. https://www.treesearch.fs.fed.us/pubs/42750.

Fried, J.S., L.D. Potts, S.M. Loreno, G.A. Christensen, and J.R. Barbour. 2017. Inventory-based landscape-scale simulation of management effectiveness and economic feasibility with BioSum. *J. For.* 115(4):249–257. doi:10.5849/jof.15-087.

Ganey, J.L., and C. Witt. 2017. Changes in snag populations on National Forest System lands in Arizona, 1990s to 2000s. *J. For.* 115(2):103–111. doi:10.5849/jof.2016-062.

Gillespie, A.J.R. 1999. Rationale for a national annual forest inventory program. *J. For.* 97(12):16–20. http://www.ingentaconnect.com/contentone/saf/jof/1999/00000097/00000012/art00007.

Goeking, S.A. 2015. Disentangling forest change from forest inventory change: A case study from the US Interior West. *J. For.* 113(5):475–483. doi:10.5849/jof.14-088.

Kauffmann, J.S., S.P. Prisley, and J.L. Chamberlain. 2017. Monitoring nontimber forest products using forest inventory data: An example with slippery elm bark. *J. For*. 115(4):292–299. doi:10.5849/jof.15-051.

Meneguzzo, D.M., and G. Liknes. 2015. Status and trends of eastern redcedar (*Juniperus virginiana*) in the central United States: Analyses and observations based on Forest Inventory and Analysis data. *J. For.* 113(3):325–334. doi:10.5849/jof.14-093.

Mueller, B., and D. Irvine. 2015. Collaborating for success: Implementation of the interior Alaska inventory. In *Pushing boundaries: New directions in inventory techniques and applications: Forest Inventory and Analysis (FIA) symposium 2015, 2015 December 8–10; Portland, Oregon*, Stanton, S.M., and G.A. Christensen (comps.). USDA Forest Service Gen. Tech. Rep. PNW-GTR-931, Pacific Northwest Research Station, Portland, OR. 197 p. https://www.treesearch.fs.fed.us/pubs/50361.

Randolph, K.C., E.B. Cowling, and D.A. Starkey. 2015. Long-term changes in fusiform rust incidence in the southeastern United States. *J. For.* 113(4):381–392. doi:10.5849/jof.14-138.

Russell, M.B., and C.W. Woodall. 2017. Development of a downed woody debris forecasting tool using strategic-scale multiresource forest inventories. *J. For.* 115(4):276–282. doi:10.5849/jof.15-113.

Shaw, J.D., S.A. Goeking, J. Menlove, and C.E. Werstak, Jr. 2017. Assessment of fire effects based on Forest Inventory and Analysis data and a long-term fire mapping dataset. *J. For.* 115(4):258–269. doi:10.5849/JOF-2016-115.

Smith, W.B. 2002. Forest inventory and analysis: A national inventory and monitoring program. *Environ. Pollut.* 116:S233–S242. doi:10.1016/S0269-7491(01)00255-X.

South, D.B., and R.A. Harper. 2016. A decline in timberland continues for several southern yellow pines. *J. For.* 114(2):116–124. doi:10.5849/jof.15-006.

Thompson, M.T. 2017. Assessing the impact of a mountain pine beetle infestation on stand structure of lodgepole pine forests in Colorado using the Forest Inventory and Analysis annual forest inventory. *J. For.* 115(4):270–275. doi:10.5849/jof.15-057.

US Department of Agriculture Forest Service. 1998. *Forest health monitoring 1998 field methods guide*. Research Triangle Park, NC. 473 p.

Weiskittel, A.R., D.W. MacFarlane, P.J. Radtke, D.L. Affleck, H. Temesgen, C.W. Woodall, J.A. Westfall, and J.W. Coulston. 2015. A call to improve methods for estimating tree biomass for regional and national assessments. *J. For.* 113(4):414–424. doi:10.5849/jof.14-091.