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Editorial: Monitoring and responding to global change to promote resilient and productive forests through innovative forest inventory

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Editorial on the Research Topic
Monitoring and responding to global change to promote resilient and productive forests through innovative forest inventory

1. Introduction

National Forest Inventories (NFIs) provide critical information about the distribution and composition of forest resources and help assess sustainable forest management. Data on important topics such as biodiversity, carbon sequestration, and forest products inform planning, policy, and national and international reporting. The USDA Forest Service's Forest Inventory and Analysis Program (FIA) is the primary source of strategic-level information about the status of and trends in forests in the United States. The program is built on a statistically robust sampling network of permanent forest inventory and monitoring plots that serve as the basis for a diverse array of scientific studies (Tinkham et al., 2018; Lister et al., 2020). The papers presented here highlight research presented at the 2022 FIA Science Stakeholder Meeting, the 15th such meeting held since 1999, e.g., Morin and Liknes (2012), Stanton and Christensen (2015), Healey and Berrett (2017), and Brandeis (2020). The sampling of papers in this Research Topic represents the broad topical, geographic, and applied scope of the ongoing research associated with the national FIA Program, highlighting the impact of innovative methods and uses of forest inventory data in forest research and management across the U.S. and globally.

2. Improving estimation techniques in urban environments

The FIA program has a history of continuous improvements to its sampling methods, while still maintaining consistency (Bechtold and Patterson, 2005; Westfall et al., 2022). Federal legislation from 2014 emphasized specific FIA activities, including initiation of urban forest inventories (Edgar, 2022). A particular focus area for improvements is survey non-response (Patterson et al., 2012; Corona et al., 2014), and FIA's urban inventory is particularly impacted due to plots crossing multiple ownerships. Westfall and Edgar found that non-response bias in FIA urban forest inventories exceeded 10% in some cases. Non-response bias is thus a critical research focus for FIA as urban inventories expand.

3. Forest dynamics, ecology, and health

The stability of the inventory across decades allows FIA to monitor trends in forest status. Many aspects of forest dynamics, ecology, and health have been addressed with NFI data including disturbance impacts (Gray and Whittier, 2014), fire modeling (Fried et al., 2017), pest vulnerability and susceptibility (Healey, 2020; Goeking and Windmuller-Campione, 2021), management and timber supply assessments (Prestemon and Wear, 2000; Wurtzebach et al., 2020), and many others.

Edgar and Westfall quantified the timing and extent of forest disturbance in the Laurentian Mixed Forest of northern Minnesota, Wisconsin, and Michigan. Results from repeated measures of forest inventory plots indicated a large increase in forest disturbance between 1999 and 2015.

Potter et al. developed indicators of non-native tree regeneration to identify the most highly invasive tree species and the U.S. forest regions with the highest diversity of non-native tree species. The metrics they describe can help prioritize management of non-native tree species by accounting for environmental variation and the invasion process while also providing broad-scale information across geopolitical borders.

Woodbridge et al. assessed environmental conditions driving mesophication in eastern U.S. forests. Change analyses with remeasured NFI plots identified conditions associated with higher rates of mesophication over time. Canopy mesophication, which was greatest in the midstory, may impact future trait conditions and composition across eastern U.S. forests.

Kralicek et al. compared projected climate change impacts to observed change for five tree species in the Pacific Northwest U.S. by associating mortality and net-growth estimates with areas of shifting suitability and a naïve division of habitat based on elevation and latitude. Results indicated that population decline in a species' core range was greatest for California black oak (*Quercus kelloggii*).

4. Forest and habitat classification and mapping

Forest classifications based on ground collected and/or remotely sensed data have been used to address many topics, e.g., fire susceptibility (Shaw et al., 2017), vegetation types (Davis et al., 2022), wildlife habitat (Zielinski and Gray, 2018), and many others.

Lesmeister and Jenkins utilized forest inventory data and passive acoustic monitoring networks for northern spotted owls (*Strix occidentalis caurina*) to develop tools for predicting forest change impacts on wildlife populations. Results indicated that these data, along with complementary advancements in data computation and statistics, are effective for monitoring northern spotted owls. The next phase of the research will implement new technologies to expand the scope of inference from FIA-derived models.

Berdeen et al. assessed the change in abundance of potential nesting cavities for wood ducks (*Aix sponsa*) in Northern Minnesota U.S. forests across several decades. Total suitable stems and those of late-successional tree species generally increased at all scales during the analysis period. These results can inform research directions for future studies of nesting wood ducks and help forest management decisions.

Barnett et al. applied saturating, non-linear growth models to NFI plot data to model forest carbon accumulation over time and to classify and map mature and old-growth forests in the US. Approximately 6% of currently forested lands in the U.S. were classified as old growth and almost one-third as mature. Better integration of old-growth structural definitions and other improvements to forest development models are needed to help forest managers achieve old-growth retention and development targets.

5. Conclusion

These and other examples highlight ongoing research that relies heavily on FIA data and the cadre of scientists, managers, and other stakeholders that use FIA data to improve our understanding of the status of and trends in our nation's forest resources.

Author contributions

RM led the writing of this editorial with review and comments from SH, SP, KR, JW, and AG. All authors contributed to the article and approved the submitted version.

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Conflict of interest

SP was employed by National Council for Air and Stream Improvement.

The remaining authors declare that the research was conducted in the absence of any commercial or financial

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