

## Abstract template for the conference “A century of national forest inventories – informing past, present and future decisions”

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On page two, you are asked to fill in your abstract in the format and font size indicated. Please remember to include authors affiliation information in the footer section of page two. The length of the abstract may not be more than one page including references.

<b>Abstract title:</b>		A small area estimation tool for FIA applications
<b>Take-home message:</b>		Small area estimation can bring the best information to bear on management decisions by integrating ground-based data with remotely sensed estimates to produce defensible estimates with measures of uncertainty. This can be done over spatial and temporal scales that were previously unattainable through traditional inventory. The emphasis here is on moving small area estimation research into operational settings.
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<b>General topic, see website:</b> <small>(please double click on the check box and activate the relevant one)</small>	<input type="checkbox"/>	Improving future NFIs by learning from the past
	<input checked="" type="checkbox"/>	NFIs today and in the future
	<input type="checkbox"/>	Cutting edge and futuristic inventory techniques and technologies
<b>Preferred presentation form:</b>	<input checked="" type="checkbox"/>	Oral presentation
	<input type="checkbox"/>	Poster
<i>Abstracts will be reviewed by members of our scientific committee and you will be given information on decisions in due time after the submission deadline has passed.</i>		

# A small area estimation tool for FIA applications

*Gretchen Moisen\**

**Introduction:** Plot data collected by the Forest Inventory and Analysis (FIA) Program in the U.S. is intended for estimation over large geographic areas and is often too sparse to construct reliable estimates within small areas such as those scheduled for fuel treatment, harvest, or wildlife habitat enhancement. The FIA base grid has plots located approximately 2,500 ha apart. When trying to understand vegetation characteristics at a project scale useful for forest land managers, the number of sample plots per project area is typically small, resulting in estimates that lack the statistical rigor needed to support good project decisions based on this data. Additionally at the planning scale, areas of interest such as delineated ecological systems and management areas encounter the same limiting issues. To enhance the science in project- and planning-level analysis, a tool is being developed to leverage existing small area estimation packages and create a user-friendly interface for deriving estimates of vegetation composition and structure based on forest inventory data collected by FIA, from both the small areas of interest, and from additional representative data sources identified by the tool.

**Materials and methods:** Using ArcGIS Pro, this tool takes advantage of existing R packages through r-bridge. The process of extracting and summarizing relevant plot and ancillary data occurs in the R package FIESTA (Frescino et al. 2015). The statistical estimation is based on empirical best linear unbiased prediction at both the unit- and area- level, which is well-established by Rao and Molina (2015), and carried out by R packages JoSAE (Breidenbach, 2018) and sae (Molina and Marhuenda, 2015). An interface with the user is built at the front end for defining information needs and available data, and at the back end for reporting specifications. Development and maintenance of this tool involves close collaborative work between staff in the US National Forest Systems, in the Geospatial Service and Technology Center, and in the Interior West FIA unit.

**Results:** Within the tool, an automatic process identifies the large area from which to borrow strength and picks boundaries to constitute domains of interest. Ground plot data are extracted and intersected with relevant ancillary data layers. Models are built automatically and small area estimates provided. The tool is illustrated through case studies involving fire, carbon, wildlife, and harvest.

**Conclusion:** Small area estimation can bring the best information to bear on management decisions by integrating ground-based data with remotely sensed estimates to produce defensible estimates with measures of uncertainty. This can be done over spatial and temporal scales that were previously unattainable through traditional inventory. The emphasis here is on moving small area estimation research into operational settings.

## References:

- Breidenbach. 2018. JoSAE: Unit-Level and Area-Level Small Area Estimation. <http://CRAN.R-project.org/package=JoSAE> R package version 0.3.0.
- Frescino, Patterson, Moisen, and Freeman. 2015. FIESTA—An R estimation tool for FIA analysts. Gen. Tech. Rep. PNW-GTR-931 U.S. Forest Service.
- Molina and Marhuenda. 2015. sae: an R package for small area estimation. R J. 7 (1), 81–98.
- Rao and Molina. 2015. Small area estimation. John Wiley & Sons, Inc.

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