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

Dear author. This is a two-page template that in the first page will ask for information on presenter name, topic, and preferred presentation form.

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.

Abstract title:		Using airborne and satellite remote sensing to support forest inventory in interior Alaska
Take-home message:		*Remote sensing will play a significant supporting role in achieving the aims of the FIA inventory of interior Alaska (USA), including helping to provide relatively precise, unbiased estimators of various inventory attributes at several different scales. In this study, we demonstrate that multiple sources of auxiliary (remote sensing) data can be utilized, in combination with field plot data, through the use of a two-phase sampling design and a model-assisted estimator to improve the precision of total biomass estimates in the context of a FIA inventory.*
Presenter name:		Hans-Erik Andersen
Presenter contact info:		USDA Forest Service Pacific Northwest Research Station University of Washington Box 352100 Seattle, WA 98195-2100 USA
General topic, see website: (please double click on the check box and activate the relevant one)	☐	Improving future NFIs by learning from the past
	☐	NFIs today and in the future
	☒	Cutting edge and futuristic inventory techniques and technologies
Preferred presentation form:	☒	Oral presentation
	☐	Poster

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.

1. USDA Forest Service Pacific Northwest Research Station, Seattle, WA, USA 2. Michigan State University Department of Forestry, East Lansing, MI, USA, 3. NASA Goddard Space Flight Center, Greenbelt, MD, 4. American University, Washington DC, USA. Corresponding author: *handersen@fs.fed.us*

Using airborne and satellite remote sensing to support forest inventory in interior Alaska

Hans-Erik Andersen[1], Chad Babcock[2], Bruce Cook[3], Doug Morton[3], Andrew Finley[2], Michael Alonzo[4], and Jacob Strunk[1]

Introduction: The USDA Forest Service Forest Inventory and Analysis (FIA) program is mandated by Congress to assess current status and trends for all forest lands of the United States. The foundation of this inventory is a network of field plots distributed with an intensity of 1 plot per 2,428 hectares across all forested lands. The statistical reliability of plot-based FIA inventory estimates are further improved through the use of auxiliary data (GIS layers and remote sensing) that are employed to post-stratify the population. In recent years, more sophisticated approaches to estimation, such as model-assisted approaches, have been proposed that can more fully utilize the rich information content of satellite and airborne remote sensing that is increasingly available to the FIA inventory program.

Another area where remote sensing will likely play an integral role in FIA is in extending the inventory into the more remote regions of the country, such as interior Alaska. Interior Alaska FIA has implemented a modified sampling design using a reduced sampling intensity for field plots (1 plot per 12,140 ha), supplemented with high-resolution airborne imagery acquired by NASA-Goddard in a strip sampling mode.

In this study, we present an application of a two-phase, model-assisted survey design to estimate aboveground tree biomass within Tanana Valley State Forest (728,434 ha) and Tetlin National Wildlife Refuge (283,279 ha) using a relatively sparse sampling of FIA plots, airborne lidar/hyperspectral sampling, and a wall-to-wall forest/nonforest classification. The results from the two-phase, model-assisted estimator are compared with estimates obtained using standard FIA post-stratified estimation, and the statistical properties of the calibration estimator are assessed via simulation.

Materials and methods: FIA inventory plots were established within Tanana Valley State Forest and Tetlin NWR in the summer of 2004. To augment the relatively sparse sample of field plots, single, linear swaths of high-resolution airborne remote sensing measurements, spaced approximately 9.2 km apart and covering every FIA plot, were acquired using the Goddard Lidar-Hyperspectral-Thermal instrument (G-LiHT) mounted on a fixed-wing platform.

Results: The results of this study indicate that significant gains in precision for estimates of total aboveground biomass are possible through the use of multiple sources of auxiliary information (lidar strip sampling, NLCD-based forest/nonforest classification) and a two-phase, model-assisted estimation framework. The use of the two-phase, model-assisted estimator generally led to a substantial reduction (50%-75%) in the relative standard error compared to the FIA post-stratified estimate at both TVSF and Tetlin NWR. In addition, we demonstrate that estimation by forest type can be achieved through fusion of airborne lidar and hyperspectral imaging.

Conclusion: Given the high costs of establishing field plots in remote regions such as interior Alaska, it is expected that remote sensing will play a significant supporting role in achieving the aims of the FIA inventory, including helping to provide relatively precise, unbiased estimators of various inventory attributes at several different scales. In this study, we demonstrate that multiple sources of auxiliary (remote sensing) data can be utilized, in combination with field plot data, through the use of a two-phase sampling design and a model-assisted estimator to improve the precision of total biomass estimates in the context of a FIA inventory.

1. USDA Forest Service Pacific Northwest Research Station, Seattle, WA, USA 2. Michigan State University Department of Forestry, East Lansing, MI, USA, 3. NASA Goddard Space Flight Center, Greenbelt, MD, 4. American University, Washington DC, USA. Corresponding author: *handersen@fs.fed.us*