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.

Abstract title:		Small area estimation on multiple scales in the Norwegian National Forest Inventory
Take-home message:		*The Norwegian NFI's forest resource map, SR16, was compared to a forest management inventory. RMSD of 11%-17% on stand level were observed. Moderate systematic deviations were removed by assimilating very few additional plots in laser scanning areas not well covered by NFI plots.*
Presenter name:		
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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
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Small area estimation on multiple scales in the Norwegian National Forest Inventory

Johannes Breidenbach, Johannes Rahlf, Marius Hauglin, Rasmus Astrup

Introduction: Norwegian National Forest Inventory (NFI) observations in combination with 3D remotely sensed data are used on different scales for estimating (predicting) forest characteristics. Airborne laser scanning (ALS) and image matching are currently used as auxiliary information in the NFI's forest resource map SR16, a raster map with a pixel size of 16x16 m (Astrup et al. 2019). While model-dependent methods are used on the scale of pixels and forest stands (Breidenbach et al. 2015), model-assisted estimators are used on the scale of municipalities and larger area of interests (Breidenbach and Astrup 2012). Here, we will focus on SR16 utilizing ALS for stand-level estimates and compare it to independent data from a forest management inventory (FMI).

Materials and methods: The first step in current FMIs in Norway is the manual delineation of stand borders based on aerial images with a simultaneous stratification of stands into 5-8 forest-type strata. Systematic (cluster) sampling is used to obtain 30-50 sample plots in each stratum and ALS project which are used to fit stratum-specific models. We used NFI data to fit stratum-specific SR16 models and used sample plots from the surrounding ALS projects to increase the number of observations. For local adjustment, we fit mixed-effects models with a random effect on ALS-project level. SR16 models were validated using the FMI field plots and SR16 estimates were compared to FMI estimates on stand-level.

Results: Root mean squared differences (RMSD) between FMI and SR16 estimates of timber volume on stand-level ranged on average between 11% and 17%. While no systematic deviation was visible for stands in mature pine forest, underestimation of 12% on average by SR16 was observed for mature spruce forests, especially in ALS projects where the NFI data did not cover the full range of explanatory variables. An assimilation of three well-chosen additional plots into the SR16 model was sufficient to remove the systematic deviation and further reduce RMSD. Comparisons in other strata suggest that FMI models based on few observations may over-fit the data.

Conclusion: The accuracy of SR16 may be sufficient for most small-scale forest owners and for some strata also for larger forest enterprises. The accuracy can be considerably improved and systematic errors removed by assimilating very few sample plots into models in cases where NFI plots do not cover the range of explanatory variables within an ALS project well.

References:

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Authors affiliation: Norwegian Institute of Bioeconomy Research NIBIO, 1431 Ås, Norway.
Firstname.Lastname@nibio.no