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:		Spatial analysis of airborne laser scanning point clouds for predicting forest variables
Take-home message:		3D remote sensing –assisted forest inventories can benefit from spatial summary characteristics such as the Euler number and empty space function.
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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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Spatial analysis of airborne laser scanning point clouds for predicting forest variables

Mari Myllymäki, Henrike Häbel and András Balázs

Introduction: With recent developments in remote sensing technologies, plot-level forest resources can be predicted utilizing airborne laser scanning (ALS) data. The prediction is typically assisted by ALS feature variables which most often summarize the vertical distribution of the pulse returns. Additionally spatial or horizontal distribution of the pulse returns may carry important information for predicting forest characteristics such as indices summarizing spatial structure of forest or variation in size.

Materials and methods: We introduce new ALS feature variables that focus on the spatial or horizontal distribution of the pulse returns. These spatial features are based on the patterns of patches of vegetation at a number of height levels, which are extracted from the ALS data using thresholded canopy height models. We propose to use spatial summary characteristics, most importantly the Euler number and the empty-space function, to capture the structure of the patches and the empty space around them. We illustrate usefulness of the proposed spatial features for predicting spatial structure of forest, size distribution and development class of the forest on the example of a study site in Central Finland. We employ the proposed spatial features, in addition to features from literature, in the well-known k-NN estimation method (Tomppo and Halme, 2004).

Results: The spatial ALS features seem to be useful additions to the vertical features. They were selected relatively frequently by the genetic algorithm in the k-NN estimation method, making up around a third of all selected features. RMSE was reduced from the case of using only vertical features. Different indices summarizing the spatial structure of forest were tested and the aggregation index R was predicted most accurately in our case of relatively small sample plots.

Conclusion: The spatial features seem to be useful additions to the vertical features in 3D remote sensing –assisted forest inventories, for example, for estimating spatial structure of forest or diameter distributions. Their usefulness should be studied further in various settings.

References:

Tomppo and Halme, 2004, Remote Sens. Environ., 92(1), 1 – 20

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