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

Abstract title:		Hierarchical model-based inference for biomass assessment using a fusion of remotely sensed data
Take-home message:		Hierarchical model-based estimation allows estimation of forest biomass in areas where there may be none or very limited field data by taking advantage of multiple levels of remotely sensed data. The approach accounts for the uncertainty in all models applied and thus produces reliable estimates of precision.
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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
Submitted to the Invited Session titled "Innovative uses of remotely sensed data in support of large area forest inventories" and organized by Ronald E. McRoberts (USDA).		

Hierarchical model-based inference for biomass assessment using a fusion of remotely sensed data

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Introduction: Forests play an essential role in mitigating climate change and assessments of forest biomass and volume are becoming increasingly important. Recent development in remote sensing techniques provides opportunities to decrease uncertainties in forest assessment and also decrease costs of field work. Nowadays, several types of remotely sensed (RS) data are acquired on annual, monthly and even weekly basis from many parts of the world. Whereas one source of RS data may not be suitable for all needs, fusion of several data sources is sometimes efficient. Data fusion involves combining several types of RS data that may differ in spatial resolution, coverage or sensor origins. Examples of statistical applications based on data fusion are multi-phase model-assisted estimation, composite estimation, data assimilation, and hierarchical model-based estimation. The objective of this presentation is to demonstrate the hierarchical model-based estimation approach to model-based inference.

Methods: Hierarchical model-based estimation has been proposed as a promising way of combining: (i) wall-to-wall optical data that are only weakly correlated with forest structure; (ii) a discontinuous sample of RS data that are more strongly correlated with structure; and (iii) a sparse sample of field data (Saarela *et al.,* 2016; 2018; under review). Model predictions based on the strongly correlated RS data source are used for estimating a model linking the target quantity with weakly correlated wall-to-wall RS data. Basing the inference on the latter model, uncertainties due to both modelling steps are accounted for to obtain reliable variance estimates of estimated population parameters, such as totals or means.

Results and conclusions: Hierarchical model-based inference allows estimation of forest variables of interest in areas where there may be none or very limited field data by taking advantage of multiple levels of RS data. It also provides reliable estimates of precision, accounting for both the modelling steps involved.

References:

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