Abstract title:		**In search of a robust variance estimator for systematic sampling in forest inventories**
Take-home message:		*Efficient model-based variance estimators for systematic sampling are available and often easy to use. There is no compelling rationale for using a conservative estimator for simple random sampling.*
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General topic, see website: (please double click on the check box and activate the relevant one)	x	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:	x	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.

In search of a robust variance estimator for systematic sampling in forest inventories

Steen Magnussen

Introduction: Field sampling in national forest inventories typically follows a systematic or semi-systematic design in pursuit of a spatially balanced sample. Variance estimators for simple random sampling (SRS) are often used to portray uncertainty in published estimates with a footnote that they may produce conservative estimates because the design efficiency of a spatial balance is not taken into account. There is a rich supply of alternative estimators to choose from but they are, of course, model-based as we have no design-unbiased estimator of variance for a strictly systematic sampling design. The performance of model-based alternative estimators are influenced by the spatial covariance structure in the surveyed population and inter-plot distances. Hence, no generic recommendations can be given. Realistic simulation studies will help an analyst to narrow the choice of a more efficient estimator of variance.

Materials and methods: This study compares, in simulated systematic sampling from artificial populations with varying degrees of a distance dependent spatial autocorrelation processes, seven existing and one new alternative estimators of variance for systematic sampling.

Results: In settings without auxiliary variables, Ripley's estimator (Ripley 2004, p. 23) emerged as most attractive followed by the estimator by Matérn (B. 1980, Ch. 6.7.1), a variogram estimator (Chilès, J.P., and Delfiner, P. 1999, p.132), and the random tessellated stratified estimator (Cordy, 1993). In settings with an auxiliary variable and the use of regression ratio estimators, Ripleys estimator was again attractive, but followed by the new estimator and the model based estimator by Opsomer et al. (2012)

Conclusion: A model-based alternative to the SRS estimator of variance used for data from a systematic sample may be desired to better reflect the expected efficiency of spatially balanced sampling. However, the alternative must be decided prior to sampling and be based on the anticipated consistency of the chosen estimator in the population under study. This may require prior testing with simulated sampling from populations with and without spatial autocorrelation.

References:

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