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:		Tree species proportions and site index as an error source in forest management planning
Take-home message:		*In data acquisition, the main attention is typically given to the accuracy of total volume estimates. In decision making, many other variables are of importance. Accurate tree species proportion estimation in forest inventory can markedly increase the incomes of forest owners' by improved harvest decisions.*
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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

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.

Tree species proportions and site index as an error source in forest management planning

Arto Haara & Annika Kangas

Introduction: Competent forest management planning requires accurate forest inventory data. The quality of forest inventory data have been traditionally measured based on uncertainty of the data, like root mean square error of interesting variables (Kangas 2010). The quality of data can, however, also can be measured through its value in decision making (Birchler and Bütler 2007). This value of information (VOI) in forest decision making can be calculated from the difference in outcomes between decisions made with existing or new and more accurate inventory data. VOI can be calculated as a reduction in losses that occur due to sub-optimal timing of thinnings and clearcuttings when more accurate data comes available. The aim of this study was to estimate losses, which are caused by forest inventory errors of tree species proportions or site indexes.

Materials and methods: Our study data constituted altogether 1751 stand plots from central Finland. From all the plots there were accurate field data and four remote sensing data, namely 1) Airborne laser scanning (ALS) data with 2D aerial image data, 2) 2D aerial image data, 3) 3D digital aerial photogrammetry (DAP) data and 2D aerial image data and 4) satellite data. The estimation of tree species proportions was made with k-nearest neighbor method. The errors in the proportions of the tree species came from the observed errors of the four remote sensing data. The total basal area of the stand was kept fixed, i.e. we assumed errors only in the species proportions. As site index was not interpreted from any remote sensing material of our study, we used error levels of Lidar data observed in other studies. The field plot data were used as a true data. We assumed that optimized treatment schedules with that data were correct and economically most profitable. We then optimized treatment schedules 30 years with Net Present Value (NPV) as an objective with all four erroneous remote sensing data and site index data, and applied the obtained erroneous optimized schedules with true data to estimate the losses due to incorrect tree species proportions or site indexes.

Results: The mean losses of NPV because of erroneous tree species proportions at interest rate 3% varied from 124.4 €/ha to 167.7 €/ha. With ALS + 2D aerial imagery data the losses were smallest and with satellite data largest. When the errors are sufficiently small or the decision sufficiently clear, no losses occur. In those stands, respectively, in which tree species proportion errors actually caused losses, forest owners losses were 468€/ha on average with ALS data. In turn, site index errors caused only small losses, as the losses in NPV were 37.8 €/ha then.

Conclusion: Accurate tree species identification seems to be very important with respect to operational forest inventory. Also site index errors caused some losses, but not as high as the errors in the tree species. The explanation for this behavior in the results is that the used forest management planning system was more sensitive to the species-wise basal areas than to the site index. In order to assess quality of remote sensing data, it is necessary to account the actual use of the data. Value of information has typically been analyzed by comparing methods like DAP and ALS, but value of individual variables has been addressed less often. In the future, it would be important to assess both the main error sources and their interactions.

References:

Birchler and Bütler, 2007. Information economics. Routledge advanced texts in economics and finance. Routledge, London

Kangas, Value of forest information. Eur. J. For. Res. 129, 863-874

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