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

Dear author. This is a two-page template that in the first page will ask for information on presenter name, topic, and preferred presentation form.

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:		Taper models as a basic concept for estimation of standing and merchantable volume - an example from the German NFI
Take-home message:		Large scale inventories require a methodology which accounts for varying conditions and can be applied at country level ensuring consistent estimates. Taper models as basic functions enable estimation both of tree volume and of merchantable assortments and provide such a consistent conversion from standing volume to the amount of marketable timber.
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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.		

Taper models as a basic concept for estimation of standing and merchantable volume - an example from the German NFI

Gerald Kändler

Growing stock in terms of standing volume of living trees, its composition according to tree species and dimensions, and its change over time is a major result of national forest inventories. Beyond that the amount of commercial timber volume contained in the growing stock is of interest, especially in connection with timber supply forecasts based on NFI.

Traditionally growing stock is expressed as above-ground volume (m^3 over bark) according to definitions which may vary by country. Merchantable volume is expressed as roundwood volume in m^3 under bark. In Germany growing stock volume is defined as so-called solid volume including all above-ground parts of a tree with a minimum diameter of 7 cm over bark.

Volume estimation is a basic method for monitoring forest and has been established with the beginning of regular forestry in the 19th century. The original methodology was the compilation of volume tables assigning mean volumes obtained from felled sample trees to diameter- and height-classes. With improved statistical possibilities single tree volumes were expressed as function of diameter, height and additional co-variables. One draw-back of volume tables and functions is the fact that they often are regionally specific and do not account for varying tree-taper. Therefore a new approach of volume estimation based on a uniform taper model was developed for the first German National Forest Inventory in the 1980s.

Taper models describe mathematically stem shape and are used for diameter prediction at any location along the stem of a tree. Mostly taper functions are mean functions of multiple linear or nonlinear regression models with diameter at breast height and tree height as predictor variables. The variation of stem taper can be reduced by considering an upper diameter as an additional predictor variable which is often the case in large-scale inventories.

The presentation describes the basic concept of the taper model, its current application, but also limitations. As taper models predict diameters at any position along the stem they allow calculating the stem volume as a rotation integral up to a defined height where a minimum diameter is reached; furthermore, assortments can be calculated by means of grading algorithms. Using only one additional upper diameter may be a limiting feature. Therefore an improved flexible stem taper and volume prediction method based on mixed-effects B-spline regression (Kublin et al, 2013) was developed that overcomes some restrictions of the existing model.

It is evident, that taper models are a crucial methodological basis for providing consistent volume estimates covering varying conditions as encountered in large scale inventories.

References:

Kublin et al., 2013, Eur J Forest Res (2013) 132: 983-997

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