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:		Bridging the gap: toward a French MS-NFI for territories
Take-home message:		*The objective was to set up a multisource inventory workflow for the French Forest and to evaluate the gain in precision obtain at different administrative levels.* *Our results confirmed the importance of 3D models of forest canopies as auxiliary information and demonstrate the interest of canopy changes to improve the precision of some forest attributes such as production volume and density, which are associated with fluxes.*
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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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Bridging the gap: toward a French MS-NFI for territories

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Introduction: National forest inventories are designed to produce statistics about forest attributes at a national to regional scales. Beyond these administrative units, the amount of points become limiting in terms of precision. In France the establishment of regional programs for forest and wood (PRFB) require estimates at a smaller scale. The multisource inventory approaches allowed to bridge this gap (Tomppo et al. 2008). The methods rely on the combination of field plot information with auxiliary data (Kangas et al. 2018). The objective was to set up a multisource inventory workflow for the French Forest and to evaluate the gain in precision obtain at different administrative levels.

Materials and methods: This research was conducted over a 7500 km^2 area located in centre of France, of which 50 % is covered by forests dominated by broadleaved species. The forest area included 775 NFI plots collected during the 2009-2014 period. The auxiliary data were acquired in 2013-2014 and selected to fulfil the following criteria: Relevant, *i.e.* well correlated with the forest attributed under survey; Actualized Regularly for updating; Exhaustive over the whole territory; and Economical ($RARE^2$). In this regard, we used the following data sources: Landsat images, 3D models derived from aerial photographs and a forest thematic map. We further evaluated the contribution of 3D models acquired 5 years apart in a subset area. The multisource approach relies on the non-parametric k-nearest neighbours (k-nn) approach owing to its multivariate capabilities. The k-nn was optimised for variable selection, number of neighbours (k) and distance metrics. Its performance was tested under a model-assisted framework using estimators from Mandallaz (2013) for various administrative levels.

Results: Among the auxiliary variables tested, the 3D data source from aerial photographs performed best, as compared to Landsat, or forest thematic maps. The best combination of data included all sources and provide relative efficiencies (RE) varying from 2.05 for volume to 1.03 for stand density. Over the subset area, the diachronic data allow to improve the RE from 3-26 %. The diachronic data markedly improved the efficiency in estimations of forest type volumes, basal area and stand density. Similar RE were obtained for small area estimation at the scale of Canton and Municipalities.

Conclusion: Our results confirmed the importance of 3D models of forest canopies and demonstrated the interest of canopy changes to improve precision of some forest attributes such as production volume and density, which are associated with fluxes.

References:

Tomppo et al., 2008, Remote Sens Environ, 112, 1982 - 1999

Kangas et al., 2018, Scand J For Res 33, 397 - 412.

Mandallaz, 2013, Can J For Res, 43, 441 - 449

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