Sources of sampling errors due to the changes of sampling design in forest monitoring. Merganic, J., Merganicova, K., Mistrik, M. (*Technical University Zvolen, Slovakia; j.merganic@forim.sk; merganicova@tuzvo.sk; mistrik@tuzvo.sk*).

Forest inventory and monitoring represent methods of efficient gathering of data that are important for decisionmaking and planning of sustainable forest management. Historical development of these methods from relatively simple sampling designs up to more complicated versions and their designs, as well as their practical application and implementation in the field measurements brings a number of challenges. Multiresource principles stimulate design modification and widening of the information spectrum, while data collection should be optimized from the point of costs and accuracy. In the presented study, we analyze the sources of errors that occur when sampling units are changed during successive forest inventories. This is the case of the regional inventory at the University Forest Enterprise of Technical University of Zvolen, Slovakia, which was already repeated four times (in 1986, 1992, 1998, and 2011/2012), however each time using a different sampling unit. The analysis aims at examining the error sources from the production and biodiversity points of view. The results indicate that the changes of sampling units primarily affect ecological characteristics of forests.

A synthesis of recent model evaluation activities conducted in support of Canada's national forest carbon monitoring, accounting, and reporting system. Metsaranta, J., Kurz, W., Shaw, C., Stinson, G., Boisvenue, C. (*Canadian Forest Service, Canada; jmetsara@nrcan.gc.ca; wkurz@nrcan.gc.ca; cshaw@nrcan.gc.ca;; Celine.Boisvenue@NRCan-RNCan.gc.ca*), Smyth, C., Hember, R., Greenberg, D.

Canada's National Forest Carbon Monitoring, Accounting, and Reporting System (NFCMARS) reports annually on greenhouse gas emissions and removals for 230 million ha of Canada's managed forest using a one inventory plus change approach. Good practice guidance suggests that a system like NFCMARS should be subject to on-going evaluation and improvement. We have recently undertaken a number of evaluation exercises for NFCMARS and its core ecosystem model, the Carbon Budget Model of the Canadian Forest Sector. These include (1) model inter-comparison studies at various spatial scales, (2) comparisons against field measured above- and below-ground carbon stocks at ground plots of Canada's National Forest Inventory, and (3) comprehensive uncertainty and sensitivity analyses. In coming years, new modeling tools and systems for a next generation NFCMARS will be developed. Our recent evaluations show that the results can increase understanding about both modeling systems and ecosystems that they represent, but also that interpreting results and translating them to the best course of action remains challenging. Among others, these include methods for weighting model results in inter-comparison studies, standards for judging success when models are compared against ground measurements, and effective communication of model uncertainties.

The role of remote sensing in U.S. forest inventories: past, present and future. Moisen, G. (*U.S. Forest Service, USA; gmoisen@fs.fed.us*), Brewer, K., Czaplewski, R. (*U.S. Forest Service (retired), USA; ckbrewer01@gmail.com; ray.czaplewski@gmail.com*), Healey, S., Megown, K., Finco, M. (*U.S. Forest Service, USA; seanhealey@fs.fed.us;; mfinco@fs.fed.us*).

In the current budget climate, the U.S. Forest Inventory and Analysis program is under increased pressure to do more with less. While reliance solely on field data under the current annual inventory system is a suitable solution when funding is adequate and stable, decreasing budgets and increasing need for timely information may necessitate solutions that can augment field data collection with remote sensing and forest projection models in a cost-effective way. There is a long, rich history of using remote sensing in forest inventory applications. As the role of remote sensing has expanded, so has the need for more flexible statistical procedures to take advantage of increasingly better ancillary data. In this paper, we document pivotal remote sensing projects in our history, and simultaneously track the evolution of statistical methods accompanying them. We highlight current studies improving statistical efficiency and information quality, and recommend viable alternatives for reducing costs in forest inventories across the continental United States.

Efficient sampling techniques for the estimation of deadwood volume and carbon storage in managed forests. Ritter, T., Saborowski, J. (*University of Göttingen, Germany; tritter@gwdg.de; jsaboro@gwdg.de*).

Deadwood is an important component of many ecosystems and plays a major role for biodiversity, soil protection and carbon sequestration. However, it is not in the main focus of traditional forest inventories. Statistically, deadwood is a rare event with strong clumping and high spatial variability. Due to limited search areas, traditional sampling techniques, as commonly used in forest inventories around the globe, may therefore be inefficient for surveys of deadwood. A sampling technique that seems to be more sufficient here is point transect sampling, where as a matter of principle, all objects that are sighted from a fixed location (e.g., a sample point) are counted and used to estimate a so-called detection function. We compare the efficiency of point transect sampling to well-established sampling approaches (fixed area sampling, line intersect sampling, angle count sampling) for the estimation of volume, necromass, and carbon storage in terms of precision and sampling effort. Drawing on the example of the state forest district inventory in the German state Lower-Saxony, it is shown that efficiency is tremendously increased using point transect sampling for standing deadwood and line intersect sampling for coarse woody debris.

Recent technical changes to the United States forest carbon inventory. Woodall, C. (*U.S. Forest Service, USA; cwoodall@fs.fed.us*).

A national system of field inventory plots is the primary data source for the annual assessment of US forest carbon (C) stocks and stock-change to meet reporting requirements UNFCCC. The Forest Inventory and Analysis (FIA) program of the U.S. Forest Service is charged with conducting the field inventory of US forest C. The FIA program does not directly measure forest C stocks. Instead, a combination of empirically derived C estimates (e.g., standing dead trees) and models (e.g., forest floor C stocks related to stand age and forest type) are used to estimate forest C stocks. A series of recent refinements in FIA estimation procedures have replaced some of the purely modeled forest C stock estimates (e.g., downed dead wood) with estimates based on direct measurements from the national field inventory. Results indicated that models of non-live tree C pools differ significantly from field-based estimates at the plot-level but demonstrate only slight divergences of total C estimates at the national scale. The results of these studies in the context of forest carbon accounting and future refinements are discussed.