

Harmonizing National Forest Inventories

Ronald E. McRoberts, Erkki O. Tomppo, Klemens Schadauer, and Göran Ståhl

INTERNATIONAL AGREEMENTS INCREASINGLY REQUIRE that countries report estimates of national forest resources. The United Nations Framework Convention on Climate Change requires that countries submit annual reports of greenhouse gas emissions and removals by sources and sinks. The Convention on Biological Diversity requires that countries identify and monitor components of biological diversity for purposes of conservation and sustainable use. The primary forestry sustainability conventions, Forest Europe (the Ministerial Conference on Protection of Forests in Europe) and the Montréal Process, require that member countries report on sustainability and biodiversity indicators. National forest inventories (NFIs) are a primary source of data for national and large-area assessments of sustainability and biodiversity and for international forest resource reporting. However, estimates produced by different countries lack comparability because of differences in NFI definitions, plot configurations, measured variables, and measurement protocols.

Two approaches to resolving the comparability problem are apparent. Standardization entails agreement on a common system of nomenclature, definitions, and methods and would produce the greatest comparability. However, the unique features of individual NFIs have been developed over time to accommodate their particular topographies, climates, forest types, commercial interests, and rates of change. Thus, although standardization may be a long-term solution, it is often not a realistic short-term option. Harmonization, the other alternative, acknowledges that individual countries have developed the unique features of their NFIs for specific purposes and are justified in their desire to maintain them. Harmonization, therefore, focuses on developing methods for producing comparable estimates despite the lack of standardization.

Action E43, “Harmonization of National Forest Inventories in Europe: Techniques for Common Reporting” of the European program, Cooperation in Science and Technology (COST), focused on developing methods for producing harmonized NFI estimates. The harmonization approaches developed by COST Action E43 featured two components, reference definitions and bridges. Reference definitions are precise definitions that can be used as common international NFI definitions or to compare and integrate national definitions. Although they are used for harmonization, they also represent a first step toward standardization. Bridges span the gap between national and reference definitions and facilitate calculation of estimates in accordance with the reference definition even though the data were collected

using national definitions. With the expectation that countries in the same geographic regions will increasingly move toward acceptance of common reference definitions, bridges may be seen as a temporary, transitional solution to NFI harmonization. However, despite agreement on common NFI reference definitions among countries, the definitions used by international agreements often lack details and consistency. Thus, simultaneous, comparable reporting to different agreements also requires either common detailed definitions or harmonized estimation. The result is that from broader international and geographic perspectives, bridges may be necessary to facilitate harmonization for a very long time.

The special issue includes 10 articles, of which one is an overview and two are general papers. Tomppo and Schadauer (2012) introduce COST Action E43 with a brief review of international reporting requirements, previous international harmonization efforts, the Action’s objectives and the methods used to accomplish them, and the three working groups (WGs). Details on construction of reference definitions and bridges are provided. The article concludes with a review of the Action’s accomplishments. Gabler et al. (2012) report a mathematical approach for comparing national and international definitions. Formal, mathematical definitions are developed, and a combination of set theory and logic is used to identify six relevant cases that illustrate how national definitions of *forest* can differ from the definition of the United Nations Food and Agriculture Organization. Two examples illustrate the effects of assessment methods on the ability to report according to a common definition. Ståhl et al. (2012) describe issues related to constructing bridges for harmonizing estimates based on data collected using national definitions. Three types of bridges are identified: reductive bridges for which national data are in surplus, expansive bridges for which national data are insufficient, and neutral bridges for which the scopes of national and reference definitions are the same, although subdivisions may differ. Relevant, data-oriented examples of each kind of bridge are presented.

The remaining seven papers are organized with respect to the three WGs: WG1 focused on developing reference definitions and measuring practices; WG2 focused on reference definitions and bridges to facilitate harmonized estimation for carbon pools and carbon pool changes; and WG3 evaluated the utility of NFI variables for estimating forest biodiversity and developed methods for harmonized biodiversity estimation.

One article was contributed by members of WG1.

Manuscript received April 10, 2012; accepted April 17, 2012; <http://dx.doi.org/10.5849/forsci.12-042>.

Ronald E. McRoberts, US Forest Service, Northern Research Station, Forest Inventory and Analysis, 1992 Folwell Avenue, St. Paul, MN 55108—Phone: (651) 649-5174; rmcroberts@fs.fed.us. Erkki Tomppo, Finnish Forest Research Institute—erkki.tomppo@metla.fi. Klemens Schadauer, Bundesamt und Forschungszentrum für Wald—klemens.schadauer@bfw.gv.at. Göran Ståhl, Swedish University of Agricultural Sciences—goran.stahl@slu.se.

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Tomter et al. (2012) develop and test bridges for harmonized estimation of growing stock volume. Bridges in the form of parametric models deal with three primary factors that affect estimates: minimum diameter threshold, inclusion or exclusion of stump volume, and inclusion or exclusion of stem top volume.

Two articles resulted from WG2. Heikkinen et al. (2012) focus on the problem of annually estimating stock and stock changes when sufficient data are not acquired for each individual year to produce annual estimates. A variety of compensatory techniques are investigated including interpolation, extrapolation, smoothing, and data aggregation. The primary conclusion is that accurate and precise annual estimation is difficult, although interpenetrating sampling designs generally contribute to better estimates. Dunger et al. (2012) report on a study whose objective was to develop and illustrate bridging techniques that contribute to consistent reporting for the Land-Use, Land-Use Change, and Forestry (LULUCF) sector. The focus was on area of forest and managed forest, aboveground biomass, and deadwood.

The special issue includes four articles from WG3. Chirici et al. (2012) provide an overview of the WG, recommendations on how NFIs can contribute to biodiversity assessments, and summaries for the seven sub-WGs that corresponded to the seven essential features of biodiversity: forest types and categories, deadwood, forest age, forest structure, ground vegetation, regeneration, and forest naturalness. Rondeux et al. (2012) report the results of a study that used deadwood data for 10 countries to assess the feasibility of developing procedures for harmonizing estimates and the effects on estimates of different deadwood definitions. Winter et al. (2012) used NFI data for tree height and diameter to assess the uncertainty of estimates of four indicators of gamma (large-area) structural diversity. The focus was on determining the minimum number of NFI plots necessary to obtain sufficiently precise estimates of the indicators and on the effects of geographic distance on estimates. McRoberts et al. (2012) provide a comprehensive review of the forest naturalness concept and NFI variables appropriate for estimating relevant indicators. Using three indicators based on parameters of height and diameter distributions, a multidimension approach to assessing forest naturalness is proposed.

COST Action E43 made additional scientific contributions beyond the articles published in this special issue. Tomppo et al. (2010) includes historical and background information relevant to the Action, a detailed review of methods and results for all three WGs, references for at least eight articles published in other journals, and a catalog of NFIs and their features for 38 countries representing more than 60% of the world's forests. Chirici et al. (2011) present a comprehensive summary of the work of WG3 on the current state of forest biodiversity assessment using NFI data. Finally, more than 100 common reference definitions were constructed. These reference definitions are increasingly being incorporated into European NFIs, either as primary definitions or as supplementary definitions for

which data are collected for purposes of international reporting. Additional information for COST Action E43 is available at <http://www.metla.fi/eu/cost/e43>.

Finally, the editors express their gratitude to Professor Edwin Green who, as former editor of *Forest Science*, accepted the proposal for this special issue; to Dr. W. Keith Moser, current editor of *Forest Science*, who assisted in bringing the special issue to completion; and to Matthew Walls, Managing Editor of *Forest Science*, without whose assistance the special issue would not have been possible.

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