POLICY BRIEF

NATIONAL FOREST INVENTORY – TOOL FOR DECISION MAKING

SUMMARY

Forests satisfy a range of interests and demands, but conflicts can arise when there are competing expectations. National forest inventories (NFIs) deliver objective, reliable and representative information, that provide measures of the ecological, economic and socio-economic benefits of forests.

INTRODUCTION

Forests are vital for human life, protecting air quality, providing habitats for plants and animals, livelihoods for humans, watershed protection, climate change mitigation and supplying renewable energy and raw materials, including wood.

Forests are resilient, but are affected by changes in land use, forestry operations, climate change or climatic events such as storms, droughts and fires. Informed decisions on maintaining or enhancing the ability of forests to deliver their multiple benefits need up-to-date, reproducible, reliable and comprehensive information about the state of forests. NFIs are cost-efficient systems for the provision of comprehensive targeted information.

DATA ASSESSMENTS AND STATISTICS ARE THE CORE OF AN NFI

The core elements of NFI are statistical sampling and mathematics, exact nomenclature and measurements that follow a well-defined protocol.

Statistical sampling is a cost-efficient and reliable method of collecting information, focusing on selected sample locations. Remote sensing using aerial laser scanning, aerial images or satellite images can cut down the need for field work. The strict observance of statistical science principles is essential for gathering accurate and reliable information.

Figure 1: Example of a sampling grid, Germany
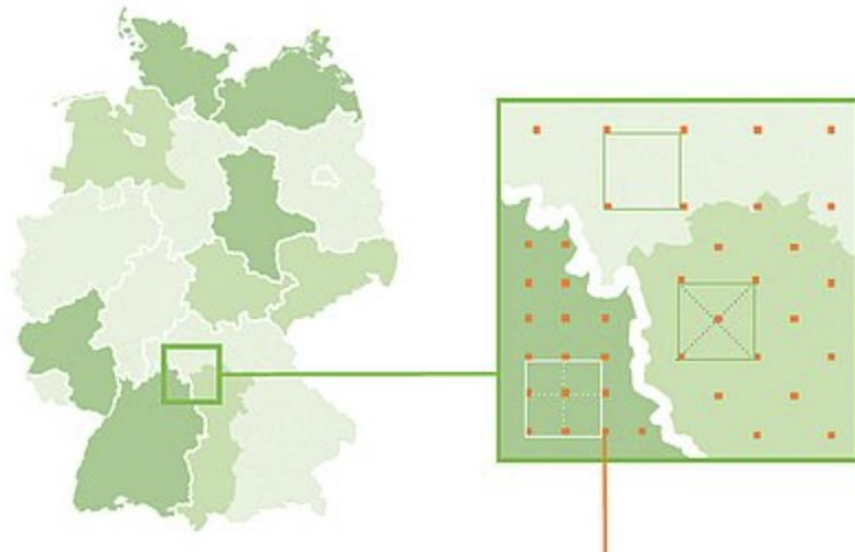
Source: www.bundeswaldinventur.de/weham-2013-bis-2052/das-modell-zum-wald/datengrundlage/

Note: the federal states aggregated the sampling network in different densities

Clear nomenclature requires unambiguous descriptions of terminology, measuring units and measurement rules used for data collection. The starting point of NFI nomenclature is defining forest. The forest definition includes elements of vegetation cover and land use – not all land containing trees is classed as forest – and may be tailored to specific forest structures in a country. The definition of forest may differ, therefore, between countries. FAO has a standard definition for forest, "*Land spanning more than 0.5 hectares with trees higher than 5 metres and a canopy cover of more than 10 per cent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use*".

Field manuals contain the terminology and exact measuring practices to support accurate and high-quality data collection. Using quality assurance is recommended: this may include a clear definition of staff responsibilities, systematic and documented training, a quality control system for field measurements, including calibration of measuring devices, and data plausibility checks.

NFIs cover the entire forest area of a country but are carried out as sample surveys and not full tallies. The statistical design determines what fraction of the forest area will be sampled. The selected samples are assessed intensively. Expanding the sample data, using statistical methods, provides an assessment of the overall forest extent. As statistical sampling inevitably contains uncertainties, NFI estimates always carry an error. A key element of every sampling procedure is estimating the size of estimation uncertainties by presenting sampling errors for every parameter.

Modelling is an essential part of all NFIs. It is extremely difficult and costly to measure tree volume or biomass directly in the field. Instead, measuring tree diameters and heights allows volume or biomass to be estimated in efficient way, with the help of statistical models.

INFORMATION PROVIDED BY NFIS

The first stage of setting up an NFI is an information needs assessment. What information is needed? What is the relevant reporting sub-units? How often should information be provided? What level of accuracy is required? NFIs can provide information about:

- Forest area
- Growing stock volume and biomass
- Annual/periodic increment and natural mortality of growing stock
- Annual/periodic fellings
- Biodiversity indicators, such as dead wood, and species distribution
- Silvicultural status and forest management
- Forest damage

Information may apply to the entire forest area or sub-units, such as forest type, dominant tree species, ownership, or protection status.

NFIs cannot capture information about the status of rare or endangered species, for instance, nor for seasonal features such as mushrooms, or birds/animals that range across large areas of forest. NFIs can only provide habitat data for these types of information, but no direct observations. The same limitations apply to features of short duration, such as seasonal disturbance by insects or disease.

Merging NFI field and remote-sensing data, such as satellite images, improves the reliability of NFI statistics, especially for sub-national units or small categories. In addition, forest resources can be presented as maps.

NFIs form an important basis for the assessment of sustainability by quantitative indicators and are thus indispensable for the evaluation of the progress towards the sustainability of the multiple function of forests.

**Figure 2: Forest resource map based on NFI and satellite images**

Source: http://www.paikkatietoikkuna.fi/web/en/map-window
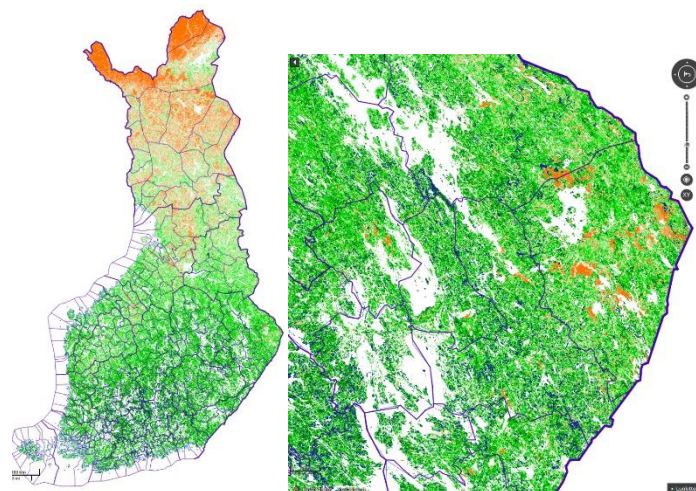
SCENARIO MODELLING, USING NFI DATA

NFI data provide the basis for a variety of further analyses, using modelling methods. Examples include forecasting future wood supply or the sequestration of atmospheric carbon dioxide by forest growth. Models require assumptions about how different factors might influence forest development. For example, how climate change or different management approaches affect wood supply or carbon storage? Such scenario analyses make it possible to predict how different approaches to managing forests, such as stopping harvesting, aiming to maximize added value, implementing close-to-nature approaches or increasing forest carbon pools, might affect forests in future. Such a tool would describe potential synergies and trade-offs between the different, and sometimes contradictory demands made on forest management.

Figure 3: Realized development of growing stock volume in Finland in the past (blue line) and possible future development according to two alternative scenarios (grey and orange lines).
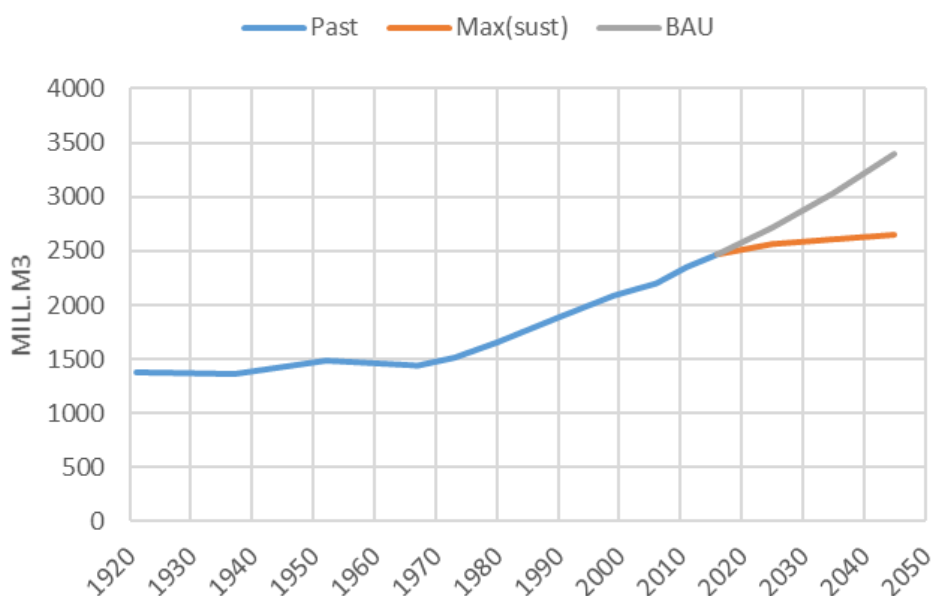
INSTITUTIONALIZING NFI

Carrying out an NFI requires:

- Access to all forests, including private land
- A stable budget for a number of years
- Specialists in statistics, mathematical computing, modelling, data management, remote sensing, and forest mensuration
- Staff trained in data collection and capable of field work
- Technology and tools for navigation, measurement, data management and information sharing

Forest legislation in many countries already has provision for regular NFIs. This ensures that objective and representative information on the status and development of forests is available to politicians, the economy, the environment and society.

Involving higher education institutes, like universities and polytechnics, will help to ensure that up-to-date technical and scientific knowledge is applied.

NFI VS. MANAGEMENT PLANNING INVENTORIES

NFIs serve country-level or regional decision making, policies and monitoring. Management planning inventories are inventories, covering all forest, and guide operational forestry decisions at the level of individual forest stands, compartments or forest holdings.

Methods used in management planning inventories cannot produce reliable data for several national level information needs. With current technologies, it is cost-efficient to separate sample based NFIs from management planning inventories. Merging satellite images and NFI field measurements can produce forest resource maps but the information content is often not sufficient for detailed forest planning.

INTERNATIONAL ASPECTS

NFIs are also the basis for international reporting on forests. Several international processes are clients of NFIs as they collect forest-related information from various countries. Among these are the Global Forest Resources Assessment, or FRA (FAO), the pan-European reporting of sustainable forest management (UNECE/FAO/Forest Europe), and the United Nations Framework Convention on Climate Change (UNFCCC). These reporting processes provide guidance on definitions and reporting practice. By presenting information on ecological, economic and social aspects of forest development, they provide a measure, over time, of progress towards sustainable forest management, at a regional or global level.

The European NFI's have established a voluntary network the European National Forest Inventory Network (ENFIN). This operates as a platform for harmonizing forest inventory information at the European scale. It optimizes synergies between NFIs, shares expertise and supports the adaptation of data collection to current societal and political information needs.

POLICY IMPLICATIONS

Rational decisions can only be made on the basis of objective information. This is especially true at the political level, which must seek a balance between different, sometimes conflicting interests.

Forest inventories provide information on the multiple benefits supplied by forests. By presenting objective assessments of forest condition, NFIs establish a basis for comparing options for forest management that properly consider synergies and trade-offs.

CONCLUSIONS

National Forest Inventory is an objective and reliable information source about the current state and development of forests. The collection and assessment of information uses scientifically-sound methods and web-based tools allow for public viewing of the information.

It is main source of information for meeting international forest data reporting obligations. and it is an indispensable tool for all who have responsibility for forests and their sustainable management. Its value in economic and environmental terms far exceeds its cost but relevant financing must be secured to fully benefit

from this tool. It must be undertaken at regular intervals to provide objective information on the current state of forests and changes. Therefore, a legal basis should be created for the regular implementation of NFIs.

NFI should cover all land use, including forest, agriculture, and fallow land, since land use changes over time. It is important as the focus on forest land could result in afforestation being overlooked.

The multi-sectoral nature of NFI renders the involvement of all relevant sectoral institutions, including forestry, agriculture, environment, and rural development, necessary. Survey methods and data collected must be adapted to changing information needs for assessing the sustainability of forests in meeting the complex and, at times, competing demands of society.

This policy brief was developed as a part of the United Nations Development Account (UNDA) project Accountability Systems for Sustainable Forest Management in the Caucasus and Central Asia

Project manager: Roman Michalak

Project coordinator: Roksolana Shelest

Authors of the policy brief: Kari T. Korhonen & Michael Köhl

ANNEX1: REFERENCES CITED – TO LEARN MORE ABOUT NFI

FAO voluntary guidelines on national forest monitoring, http://www.fao.org/3/a-I6767e.pdf

Tomppo, E., Gschwantner, Th., Lawrence, M., McRoberts, R.E. (Eds.), 2020: National Forest Inventories, Springer, Heidelberg

Vidal, C., Alberdi, I., Hernández, L., Redmond, J.J. (Eds.), 2016: National Forest Inventories – Assessment of Wood Availability and Use, Springer, Heidelberg

Köhl, M., Marchetti, M., 2016: Objectives and Planning of Forest Inventories, in: Pancel, L., Köhl, M. (eds.): Tropical Forestry Handbook, Vol. 1, Springer, Heidelberg, 749-776

Köhl, M., Magnussen, S., 2016: Sampling in Forest Inventories, in: Pancel, L., Köhl, M. (eds.): Tropical Forestry Handbook, Vol. 1, Springer, Heidelberg, 777-837

European National Forest Inventory Network: http://enfin.info/