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Aerial photograph, on near-infrared-sensitive film, of a predominantly coniferous, intensively managed forest landscape in Sweden
National Survey of Sweden/Lantmäteriet

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EDITORIAL

Forest assessment and monitoring

The point of forest assessment is not information for information's sake. One of the most important objectives of forest resources assessments is to support decision-making for forestry policies and programmes, at all levels – subnational, national, regional and international.

The Global Forest Resources Assessment 2000 (FRA 2000) is now completed, but work has already begun on the next global assessment. The expert consultation "Global Forest Resources Assessments – Linking National and International Efforts", known as Kotka IV, brought together international experts in July 2002 to address future concepts and strategies. The articles in this issue of *Unasylva* are adapted for a wider audience from papers prepared for the meeting. Without going into technical detail, they explore links among assessment and monitoring, national and international information needs, criteria and indicators for sustainable forest management, and reporting of forest-related information to international instruments. The technical details can be found on the FAO Web site (www.fao.org/forestry) and will be published in the Kotka IV proceedings.

The lead article, by P. Holmgren and R. Persson, provides an overview of the evolution of global forest assessments, and examines the potential scope of future assessments. Forest assessments, once primarily concerned with measuring availability of wood, and later increasingly concerned with forest area and change in forest area, are now moving to address the full variety of benefits from forest and tree resources. The authors highlight the role of country-provided information – and the attendant advantages and disadvantages.

In the next article, C. Kleinn examines new technologies and methodologies for obtaining forest information at the national level. He predicts that evolving technology will continue to improve the accuracy, efficiency and cost-effectiveness of national inventories, although he does not foresee revolutionary changes.

FRA 2000 included a pan-tropical remote-sensing survey to augment information provided by countries. E. Tomppo and R.L. Czaplewski examine the feasibility of extending this type of survey to the entire globe. Their simulation study suggests that high-resolution and very-high-resolution images could meet the needs of an independent remote-sensing-aided global forest survey with an acceptable level of error and moderate costs.

Yet remote sensing cannot provide all the answers. Although field sampling is more costly, certain information can be obtained only from the ground. An article by T. Thuresson demonstrates that field inventory with relatively low sampling intensity can provide information useful for decision-making, at acceptable cost.

The availability of country-level information is a central issue. M. Saket studied information provided by developing countries to FRA 2000 and concluded that insufficient information was available for many subjects considered important for forest policy development. For more than 60 percent of the developing countries, key forestry statistics are based on expert opinion or coarse mapping. For many countries, forest area estimates are the only data available. Tree resources outside forests have generally not been assessed. This article is followed by short articles on the state of forest information in Poland, South Africa and Mexico and examples from seven countries' national inventories.

Granted the limitations in data availability, does FAO's Global Forest Resources Assessment meet the needs of those who use forest information? E. Matthews and A. Grainger interviewed some interested individuals and representatives of organizations about FAO's methodology and findings. Based on the replies, the authors summarize the positive aspects (comprehensive scope; transparent, participatory and collaborative approach) and deficiencies (in terms of accuracy, comparability with earlier reports and consistency of definitions) of FRA 2000, and suggest some future approaches.

In an increasing number of countries, forest stakeholders are involved in identifying comprehensive criteria and indicators which define the constitutuents of sustainable forest management and provide a framework for monitoring and assessing progress towards this goal. C.F.L. Prins examines the possible synergies between the criteria and indicators process in Europe and regional forest resources assessment work.

A.C. Newton and V. Kapos then look at the potential role of biological diversity indicators in national forest inventories. They suggest how biodiversity indicators, drawn from the work of international criteria and indicators initiatives, might be used to provide information on status and trends in forest biodiversity in future global assessments.

Synergy is also sorely needed in national reporting of forest-related information at the international level. Requests for country reporting to international conventions, agreements and bodies have led to a daunting burden for countries. S. Braatz describes efforts and needs for harmonization and streamlining.

Global forest assessments could have a role in reducing the reporting burden. D. Schoene shows how information on forest carbon stock changes from FRA 2000 has been used in climate change negotiations. He points out that coordination is necessary, however, to prevent future discrepancies with information reported by countries to the United Nations Framework Convention on Climate Change.

The last article in the issue reviews the outcome of the Kotka IV meeting, providing recommendations for the future of national and global forest assessments and for linkages between the two.

The major obstacle in meeting national and international information requirements is the continued lack of basic data. FAO will continue its efforts in country capacity building and support to national forest assessments. ◆

Evolution and prospects of global forest assessments

P. Holmgren and R. Persson

Global forest assessments move towards the goal of addressing a full range of benefits from forests and tree resources.

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The future of the world's forests and trees is at the centre of several major environmental and development issues – including conservation of biological diversity, climate change, food security, sustainable livelihoods and recreation for enhanced quality of life. At the same time, forests continue to provide a wide range of goods including timber, energy and non-wood forest products. Forests also represent opportunities for agricultural expansion in many parts of the world, so society has developed an awareness of resource conflicts and shortage.

A considerable amount of both public interest and political will – locally, nationally, regionally and internationally – is directed towards progress in good and sustainable use of the forests. To sustain the political will there is a need to monitor this progress.

Global forest assessments provide information on development, changes or progress in forests and forestry required for decision-making by international fora and by countries. For this purpose it is not enough to quantify forest resources; assessments increasingly aim to address all benefits from forests – i.e. the use of the resources.

Yet much of the necessary information at the country level is lacking. Few countries have forest inventories that give the basic data required. Of 137 developing countries, only 22 have repeated inventories, 54 have relied on a single inventory, 33 have partial forest inventory and 28 countries have no inventory (FAO, 2001). Very few developing countries have up-to-date information on their forest resources, and even fewer have national capacity for generating such information. This problem is not limited to the developing world; the situation is also less than satisfactory in several industrialized countries. The absence of reliable source data, in turn, has an impact on the reliability of global assessments.

This article describes the evolution in scope and methods of global and national forest assessments and attempts to define a conceptual platform for future global forest assessments.

HISTORY OF NATIONAL ASSESSMENTS

The earliest national inventories were established to find out how much wood was available. No other benefits or uses from the forest were considered. Sweden, for

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To sustain the political will directed towards progress in good and sustainable use of the forests, there is a need to monitor development, changes or progress in forests and forestry

example, began a national forest inventory (NFI) in 1923 because the country feared the beginning of a wood shortage (a fear shown to be unfounded by the first results ten years later). The scope of national inventories has gradually widened with the widening scope of forestry issues.

Support to national inventories in developing countries became a popular form of forestry assistance in the 1960s. The forest resources were normally described in the same way as in Europe, and the inventories therefore failed to pose some of the questions that are important for developing countries. The typical objective was to find out how much wood of commercial sizes and species was available for exploitation. Major issues such as the expansion of agriculture into forest areas and the role of forests in poverty alleviation were not well studied. Moreover, assistance to developing country inventories generally supported one-time undertakings and failed to build sustainable inventory organizations, so that few developing countries now have good knowledge about their forest resources. The inventory results were seldom used for meaningful planning, except to identify areas suitable for exploitation. The interest of governments and donors in supporting inventories of this kind has decreased considerably since the 1970s.

From the 1970s on, a belief spread that field inventories were no longer required because remote sensing would give all the information needed (FAO, 1968). Large sums of money have been used to produce glossy maps and to test ideas about the potential uses of remote sensing. Meanwhile in Africa, for example, the information about the forests and their use seems to have decreased since field inventories were abandoned. Remote sensing has potential for certain area measurements, but a land cover map is not a forest assessment. There is currently a growing awareness that the strong focus on remote sensing in forest assessments may have sidetracked the discipline. A return to field inventories to supply policy-relevant national information seems to be appearing.

HISTORY OF GLOBAL ASSESSMENTS

In 1910 the United States Forest Service prepared a report on the world's forest resources (Zon, 1910). This seems to be the earliest attempt to make a comprehensive presentation of all forests and their uses. The assessment aimed at both a quantification and a valuation of forest products for all countries. Ownership, management and sustainability aspects were covered. Indeed, this almost century-old publication was remarkably similar in scope to the report of FAO's Global Forest Resources Assessment 2000 (FRA 2000) (FAO, 2001).

FAO's first World Forest Inventory (WFI), recommended by the Conference of FAO in 1945, was carried out from 1947 to 1948. It was later decided that World Forest Inventories should be undertaken every fifth year. WFIs were done for the years 1953, 1958 and 1963.

The objective of the WFIs is clear in the first words of the WFI 1948, and reflects the concerns at the national level: "The whole world is suffering from shortages of forest products" (FAO, 1948). To evaluate the balance between supply and demand, information was needed about the resources. FAO carried out continued regional and global timber trends studies in the 1960s. It was no doubt also hoped that

I. ERIKSSON

Locating a field sample plot, Thailand: after a decades-long focus on remote sensing, field inventories are again being recognized as a vital source of policy-relevant national information

FAO has carried out global assessments of forest resources for more than 50 years

changes could be shown by carrying out inventories every five years.

In the 1970s FAO carried out a series of regional assessments but no global surveys. An independent global synthesis of the regional results (Persson, 1974) also emphasized the forests as a resource, but deforestation was discussed as well.

FAO's Global Forest Resources Assessment 1980, carried out with funds from the United Nations Environment Programme (UNEP), emphasized deforestation. FRA 1990 also had deforestation as a main theme, but other topics such as biological diversity also received consideration.

FRA 2000 was designed to cover a much wider range of forest benefits than earlier assessments (Finnish Forest Research Institute, 1996); deforestation was considered important, but interest in conservation issues had grown and topics such as biodiversity, protected areas and forest fires were also included. FRA 2000 was also designed to give information about productive aspects, such as overall wood supply, forest plantations, trees outside forests and non-wood forest products. The final results of FRA 2000, however, revealed a shortage of information to describe several of these forest benefits. It was also observed that users and the media still appeared to be primarily interested in forest area and area change.

METHODS OF PAST GLOBAL ASSESSMENTS

The methods and definitions used in global forest assessments have changed continuously to accommodate experience gained and new demands from users. Definitions and methods that give unsatisfying results must be changed – but the changes make it difficult to make comparisons between consecutive assessments.

The WFIs from 1948 to 1963 used a questionnaire to obtain information from countries. When this method was tried again in the late 1960s it failed, because the capacity of many countries had been reduced. The regional studies of the 1970s and FRA 1980 used an "expert method": all available information about the forests in countries was collected, and an "expert" tried to summarize the information and give a consistent picture. This approach was subjective, and the dialogue with countries was greatly reduced.

In FRA 1990 a more scientific method was wanted. A database, the Forestry Information System (FORIS) was constructed to assemble information from the countries (with the information adjusted to fit FAO's definitions). The use of FORIS strengthened the dialogue with countries. A remote sensing method was also introduced to give information about forests and deforestation at the global and regional levels and to check if regional figures compiled from FORIS were of the right order of magnitude.

In FRA 2000 the methods from FRA 1990 were developed further. The partnership with countries was strengthened further through the request for validation of results from all countries. The relationship between the FRA 2000 global data set and the data reported by countries was presented in a transparent way. It is believed that providing the means of tracing all estimates to source documents will also improve the quality of future assessments. A remote sensing survey was again used as an independent instrument to study land cover changes and compare them with national estimates at the regional level.

SCOPE OF FUTURE GLOBAL FOREST ASSESSMENTS

Following FRA 2000, the process of defining the next global assessment of forests has begun, involving stakeholders at the national and international levels (see the account of the recent Expert Consultation on Forest Resources Assessment [Kotka IV] which closes this issue). In defining the generic scope of the global assessment, it is assumed that the primary objective of forest assessments is to monitor and assess overall progress in forestry towards sustainable forest management and other political goals at the international level, and to put these efforts in a broader development perspective. Is it, for example, better to invest in more forest plantations than in improved infrastructure? Is it better to use some land for agriculture than to keep it under forest?

In addition, the assessment should facilitate important analyses, for example related to trends in trade and forest industry. Forest assessment should both assemble data from forest inventories and describe and evalu-

ate forest benefits, or at least indicators of such benefits, based on the inventory data. The scope may also include projection of future forest benefits (alternative scenarios) to facilitate decision-making.

The assessment should be subject to quality control in terms of statistical significance and objectivity, so that progress can be confirmed. Measurements and observations need to be stable so that comparable time series can be established.

As shown above, forest assessments have gradually become more complex, incorporating more forest benefits. Ideally, a global forest assessment should address all benefits from forests, ranging from biological diversity to pulpwood. In addition, it should take account of the full range of beneficiaries, ranging from local land users to the global population. There is otherwise a risk that information tied to the prominent global issues (such as climate change and biological diversity) will dominate and that local production and rural development aspects will be marginalized. The global forest assessment can therefore be defined as a process of monitoring the value of all forest benefits for all beneficiaries, including past trends and projections into the future concerning these benefits. One way to express this is through the criteria for sustainable forest management adopted by regional forestry processes.

In other words, a global forest assessment should study not only the biophysical forest and tree resources, but also the management and uses of these resources, with an emphasis on long-term trends. The current focus on forest area and area change provides a very poor evaluation of forest benefits, as most of them depend on other parameters.

SIMPLIFICATION: THE USE OF INDICATORS

The study of all benefits from the forests over time is obviously very complicated, so certain simplifications and approximations have to be accepted. It is necessary to keep an eye on these simplifications to ensure that the connection to the conceptual base is maintained and to prevent the simplified information set from becoming a goal in itself – as seen in the extraordinary focus on reducing a single figure, the global rate of deforestation.

Fortunately, there are international processes that facilitate the task, for example through the development of criteria and indicators of sustainable forest management.

FAO REGIONAL OFFICE FOR ASIA AND THE PACIFIC/M. KASHIO

A global forest assessment should address all benefits from forests, ranging from biological diversity to pulpwood; and not only the biophysical forest and tree resources, but also the management and uses of these resources

The criteria are straightforward. They express the objectives of forestry, as negotiated in political processes. They are vaguely formulated (see Box below), but they express a goal of multiple functions, including the full range of benefits from forests. Criteria are therefore a good starting point for designing global forest assessments.

However, the process of identifying indicators to show how well a country meets the criteria and to monitor progress over time has been more problematic. The indicators are not optimal because, as a result of the desire for rapid progress, they have been selected based very much on the data that are available. It cannot be assumed that indicators are equally valid, or equally weighted, in different countries. Therefore, it is not yet known how to generate systematic and valid information related to the criteria for all countries. This will be a major challenge for the next global assessment. The solution may be to use a set of generally agreed criteria, while methods for assessing the progress towards these criteria may vary among countries and regions.

INFORMATION PROVIDED BY COUNTRIES

Global forest assessments are largely made by aggregating and standardizing national information; this was the approach taken in FRA 2000. This approach is necessary because practically all forest information (with some exceptions, such as land-cover surveys, which are done over larger expanses) is compiled at the national level through country-led initiatives. It is also a desirable approach, because the involvement of countries leads to a higher acceptance of findings, helps build capacity in countries and provides a bridge from the global to the national level, where policies are implemented.

However, forest information provided by countries needs to be scrutinized carefully by a neutral organization, because it is often political. For example, much interest has recently been attached to changes in forest area, as this is the hottest issue and the most easily understood indicator of the state of the forests. Some countries may want to hide their high deforestation rates, while others may want to exaggerate the figures so as to seek increased assistance to forestry. The Kyoto Protocol may trigger further manipulation of figures. The choice of definitions also influences the results and the interpretations: the global area deforested annually could be anywhere from almost 0 (if only true virgin forests are counted) to over 50 million hectares (if all temporary forest clearings are counted). Several NGOs have not accepted the deceleration of deforestation reported by FRA 2000. Thus, even the simple use of deforestation as a development indicator is not undisputed. Despite efforts to harmonize definitions, there is still room for interpretation, even for the most straightforward variables.

The reported forest condition depends highly on the national policy context. For example, some countries downplay the proportion of forest plantations, as they want to highlight the existence of natural forests, whereas others choose to exaggerate the part played by plantations in order to highlight wood production potential. Some countries claim that all of their forests are under protection because of general forest legislation, whereas others report as protected areas only those areas under strict conservation.

For many of the issues of particular current interest, such as biodiversity conservation, the effect of air pollution on forest ecosystems, the carbon cycle, the social functions of forests and the type and intensity of forest management, there is still little agreement on relevant concepts and relationships. As a result national reporting is often irregular and subjective.

In addition, many national forest inventories are based not on sampling, but on a

An example of criteria for sustainable forestry: six criteria defined by the Ministerial Conference for the Protection of Forests in Europe

Criteria tend to be vague, but express the goal of multiple functions:

- **Maintenance and appropriate enhancement of forest resources and their contribution to global carbon cycles**
- **Maintenance of forest ecosystem health and vitality**
- **Maintenance and encouragement of productive functions of forests (wood and non-wood)**
- **Maintenance, conservation and appropriate enhancement of biological diversity in forest ecosystems**
- **Maintenance and appropriate enhancement of protective functions in forest management (notably soil and water)**
- **Maintenance of other socio-economic functions and conditions**

summary of management plan inventories. This method can produce considerable errors. For example, in Armenia the real volume growth was found to be twice that estimated from management plans (see Box in the article by Thuresson, p. 22).

In the absence of neutral and systematic facts, forest information has become politicized. Countries may exert pressure to hide information that they consider embarassing. Information is sometimes released or interpreted to fit a policy purpose. This usage erodes confidence in forest information.

FAO and others can (and do) take a number of steps to monitor the reliability of country-provided information, including remote sensing surveys and third-party validation. A transparent approach, in which statistics are made easily available to all, is likely to benefit the process. On the whole, the advantages of country participation are believed to outweigh eventual data quality problems (FAO, 2001).

BUILDING NATIONAL CAPACITY FOR GATHERING AND USING INFORMATION

An international organization cannot on its own collect detailed information about countries. Expert methods and remote sensing can give the rather rough information that so far has been requested at the international level, but if better information is wanted, countries must be more involved. It is thus necessary that capacity be developed in countries so that they can improve their information.

The interest in forest inventories formerly observed at the professional level seems to have declined. In the 1960s and after, a number of inventory organizations were established in tropical regions. Today, outside Asia there is no longer much capacity in this field. Few organizations are strong enough to be of value in the policy process. Moreover, donor programmes have dealt primarily with collecting information, not using it. Capacity building must be begun anew.

Some current problems at the national level are related to poor links between information supply and demand. Forest information seems to have been supply driven in recent decades, partly through the promotion of remote sensing at the expense of fieldwork. The policy process has been guided by what could be collected through remote sensing, not by the information needed.

Thus the situation cannot be remedied by just introducing or improving national forest inventories and related data gathering. It is necessary to consider the role of information in the policy process, and at all stages of it (Janz and Persson, 2002):

- public, political or scientific debate,
- identifying problems and potentials,
- designing options for (political) action,
- analysing the consequences of such action,
- decision-making (choice of options),
- implementation,
- monitoring.

The process is circular – implementation and monitoring generate new debate and new problem identification – implying a continuous need for updated information.

REQUIREMENTS AT THE INTERNATIONAL LEVEL

At present forest information is requested by many international organizations and instruments in an uncoordinated way. Countries are irritated by this. As questionnaires are often answered by different organizations in the countries, the information provided by a country can also be inconsistent. It would be a great advantage if the various bodies such as FAO, the Convention on Biological Diversity (CBD) and the International Plant Protection Convention (IPPC) would cooperate and assist countries in producing country reports that would give the information needed by most international processes (see the article by Braatz in this issue on harmonization of the reporting requirements of international instruments).

There is a need to ensure that the information requested at the international level can realistically be supplied by countries. In this context also it is necessary to strengthen capacity at the national level. Considerable progress towards meeting these needs at the international level could be made in one or two decades with modest amounts of money if donors and international organizations joined together in a collaborative system.

International processes individually emphasize some but not all benefits from forests, with some variation over time. Currently, carbon sequestration and biological diversity dominate debate and also the demand for information, whereas 30 years ago the emphasis was the supply of wood. It is likely that new topics will take precedence in the future, perhaps related to water balances or energy. Global forest assessments should highlight currently important topics, but they also need to take a long-term view, looking backwards as well as into the future.

CONCLUSIONS

Global forest assessments have been under continuous development. This development will continue, driven largely by international reporting requirements. It is certain that the information needed and the methods available will look different ten years from now. By adopting the generic platform of addressing all benefits from forests and tree resources for all beneficiaries, future global forest assessments can maintain a neutral status, independent from the specific agendas of international processes and various organizations.

Global assessments will continue to draw from national efforts by extracting information relevant at the international level. Information and knowledge is best gener-

ated at the national level and should be integrated with national policy processes. Improvement of global forest assessments requires good cooperation with countries and professionals in countries. This is most easily achieved if the benefits of cooperating are apparent to the countries. For example, the global FRA process may support multipurpose field inventories that will assist countries in collecting the information that they need.

The political processes of establishing criteria and indicators to monitor progress towards sustainable forest management represent an opportunity for global forest assessments. The use of the criteria as a starting point in designing assessments may tie the inventory and assessment work closer to policy implementation and monitoring.

The role of indicators is equivocal. On one hand they represent an effort to use existing or accessible data to monitor the criteria. On the other, they may often be oversimplifications and may not be applicable at different scales. The global FRA process should participate in developing and refining indicators, as well as their applications.

Many international processes deal with a partial set of benefits from the forests, e.g. prevention of climate change or biological diversity. It is therefore essential that synergies be found to make good use of financial resources and competence. Lack of resources may not be the main problem. If available resources were used to strengthen capacity in developing countries and to generate policy-relevant information in the field – rather than to produce land cover maps based on remote sensing, for example – much could be achieved, on both the national and international levels. One solution might be a collaborative system for policy processes and improvement of statistics. ◆

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