



Food and Agriculture
Organization of the
United Nations



1948-2018

Seventy years of FAO's
Global Forest Resources Assessment

Historical overview and future prospects

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FOREWORD

Seventy years have passed since the publication of the results of the Food and Agriculture Organization of the United Nation's (FAO's) first Global Forest Resources Assessment (FRA) in 1948. Since then, FAO has been conducting periodical global assessments of the world's forest resources. This publication arose from the desire to share the story of these seven decades of FRA, as a way to mark this important anniversary.

In tracing the history of FRA, the publication provides an overview of the main characteristics, findings and challenges of each assessment, to highlight the fact that FRA has been continuously evolving. Through the years, each assessment has responded to new information requirements to improve global knowledge of forest resources. Studies of timber supply dominated the assessments through the 1960s, while recent assessments have adopted a more comprehensive approach to address all aspects of sustainable forest management.

This publication offers insight into the ways FRA has contributed to improve our awareness about the importance of forest, how it has stimulated the dialogue on not only forestry but also forests and land use in the national and international arenas, and influenced public and private forestry investments.

The warning messages sent by earlier assessments about the rapid conversion of tropical forest into agricultural

land, helped to turn the spotlight on the problem of deforestation. To tackle this problem, countries, including decision-makers and stakeholders, have undertaken significant steps towards sustainable forest management. These efforts have, in turn, contributed to the reduction in the rate of tropical forest loss. At the same time, forest area and growing stock changes detected through FRA have also contributed to an improved understanding of forests in the global carbon balance and of their role in climate change mitigation.

However, the story is not over. While forest area continues to decline, population and demand for forest products continue to increase; the issue of sustainable use of forest resources is more urgent than ever. So much work still needs to be done, but by building on such broad experience and benefiting from a well-consolidated reporting process, future FRAs are ready to meet these new challenges.



Hiroto Mitsugi

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ACRONYMS

CBD	Convention on Biological Diversity	SDG	Sustainable Development Goal
CFRQ	Collaborative Forest Resources Questionnaire	SFM	sustainable forest management
COFO	Committee on Forestry	UN	United Nations
CPF	Collaborative Partnership on Forests	UNECE	United Nations Economic Commission for Europe
FAO	Food and Agriculture Organization of the United Nations	UNEP	United Nations Environment Programme
FINNIDA	Finnish Development Agency	UNFF	United Nations Forum on Forests
FRA	Global Forest Resources Assessment	UNFCCC	United Nations Framework Convention on Climate Change
FRIMS	Forest Resources Information Management System		
GCS	global core set		
IPCC	Intergovernmental Panel on Climate Change		
IPF	Intergovernmental Panel on Forests		
ITTO	International Tropical Timber Organization		
IUCN	International Union for Conservation of Nature		
Luke	Natural Resources Institute Finland		
MDG	Millennium Development Goal		
METLA	Finnish Forests Research Institute		
NFI	national forest inventory		
RSS	remote sensing survey		

INTRODUCTION

Our forests, a mere fraction of their once vast acreage, and, indeed, a fraction of what they may again become, are an essential item in the over-all problem of meeting human needs. It was no accident that brought forestry within FAO's far-reaching scope. Forestry is an essential part of our work and a vital contributing factor to our plans for raising existing standards of living and providing the future food supplies which an expanding and hungry humanity will require. ... One of the immediate problems of today is Europe's shortage of timber. Our Forestry and Forest Products Division, through the FAO/ECE Timber Committee, is working out plans to secure increased supplies of wood products now and in the coming years so that houses and resources may be available for Europe's homeless thousands. But in Europe, obsessed as it is by its immediate problems we are not limiting our activities and plans to the near future. Through the regional Forestry and Forest Products Commission we are taking a longer view into the future and aiming at the co-ordination of European forestry programs and practices so as to ensure that forestry plays its full part as a conserver of our natural food-producing resources as well as a supplier of timber. This activity is not limited to Europe. ... Gradually we shall cover the globe in our planning of a long-term forestry program and the effective development of timber supplies to meet humanity's needs. ... Certainly, forestry has much to offer the world, if wisely directed, as an insurance against future catastrophe. It can play a great part in

counteracting some of the improvident practices, which, over the last decades and centuries, have reduced our natural resources and so endangered future food supplies. FAO's policy in this field is to advise and assist in all such long-term conservation policies and at the same time to ensure that, the best possible use is made of such timber supplies as can be made available without endangering our long-term projects.

This text, extracted from the first Food and Agriculture Organization of the United Nations (FAO) report on the forest resources of the world published in 1948 was written by Norris E. Dodd, the second Director General of, then recently founded, FAO.

Although these words were written 70 years ago, they remain relevant. Our concerns with the problem of deforestation, the concept of sustainability, the importance of forests for food security and human livelihoods, and the role of forests in mitigating effects of catastrophic events were already well-known issues in 1948.

After reviewing the results of this first global assessment, the sixth session of the FAO Conference recommended that FAO should "maintain a permanent capability to provide information on the state of forest resources worldwide on a continuing basis" (FAO, 1951). Accordingly, since 1948, FAO has periodically conducted a Global Forest Resources Assessment (FRA) at intervals of five to ten years, delivering a key source of information for analyses aimed at tackling these important issues.

This publication tells the story of those seven decades of FRA.



Norris E. Dodd acclaimed for his appointment as Director-General of FAO at a special session, 1 April 1948.

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BACKGROUND

Public interest in the state of the world's forest resources has been increasing over the past 70 years and, through its regular FRA, FAO has been providing the global community with much of the information needed to understand these resources. Over time, the scope of the reporting framework has had to evolve and adapt to changing information needs. FAO's assessments have embraced a more holistic perspective to address all the aspects of sustainable forest management (SFM).

The main concern driving the first FAO-led assessment was well expressed in the first sentence of its report: "The whole world is suffering from shortages of forest products" (FAO, 1948). From 1948 until 1963, FAO's global assessments focused largely on timber and information was collected through questionnaires that requested data available mainly from national forest inventories (NFIs). From the 1970s, information began to be collected from a wider variety of sources.

While the earlier assessments were FAO driven, with limited country involvement, a more bottom-up approach has been taken since the 1980s, with countries becoming more involved in both data collection and the process of reclassification, estimation and forecasting of national data to a common set of global categories. During the same period, the technical approach was improved, with assessments based on analysis of country sources supported by expert judgements, remote sensing and statistical modelling. Increased emphasis was also put on assessing trends in forest areas and stocks. Since FRA 1990, assessments have been published every five years.

The United Nations Conference on Environment and Development (UNCED), or the Earth Summit, held in Rio de Janeiro, Brazil in 1992, led to the establishment of the Rio Conventions, namely the Convention on Biological Diversity (CBD), the United Nations Convention to Combat Desertification (UNCCD) and the United Nations Framework Convention on Climate Change (UNFCCC). As a consequence of the Rio Conventions, the demand for global forest-related information expanded considerably and the scope of the assessments was broadened to capture information about the environmental and socio-economic functions of forests. The global assessments had to become more comprehensive to satisfy this demand, to help countries meet new reporting requirements and to measure progress towards SFM. FAO also recognized that the quality of the results would benefit from the increased frequency of reporting, as this would help maintain institutional memory, capacity and the knowledge base between successive assessments. Meanwhile, the use of complementary remote sensing and information systems that allow tailor-made analysis of data continued to evolve.

From FRA 2000 onwards, assessments have become part of FAO's Regular Programme, thus securing the human and financial resources needed to conduct them. FRA 2000 covered a wider range of forest resources than earlier assessments and for the first time applied a consistent definition of forest for all countries.

As the amount of forest-related information needed to comply with international reporting requirements grew,

there was a need for consistency of terms and definitions both to harmonize with other international reporting processes and to minimize the reporting burden on countries. In April 2001, the Collaborative Partnership on Forests (CPF) was formed, with the objectives of supporting the work of the United Nations Forum on Forests (UNFF), and its Member Countries, and of enhancing forest cooperation and coordination among CPF members. The CPF has played an important role in efforts to streamline forest-related reporting and reduce the reporting burden for countries.

Since FRA 2005, FAO's FRA Secretariat has been collaborating with CPF members to further improve definitions and streamline reporting, and has initiated a consultative and collaborative relationship with other international reporting processes and organizations involved in the collection of forest-related data. This approach led to an improved process for FRA 2005 and FRA 2010, and to the formalization of the Collaborative Forest Resources Questionnaire (CFRQ), which was introduced with FRA 2015.

As the scope of FRA evolved, FAO decided to seek further advice and support from international experts, and the first formal Expert Consultation took place during the

preparations for FRA 2000. Since then, Expert Consultations have been held to guide the work of each assessment. In 2002, an Advisory Group was also established to advise FAO on FRA-related matters.

To further strengthen the country-driven reporting process, the FRA Secretariat established a network of officially nominated national correspondents, responsible for providing information for FRA through standardized country reports. This network was institutionalized for FRA 2005, increasing country ownership of FRA data and reinforcing the mutual trust between FAO and its Member Countries.

Since FRA 2005, assessments have covered a reporting period of 15 to 25 years, allowing countries to review historical figures and past trends whenever new information becomes available. This record has improved the assessment of changes and trends by overcoming the problem that information from different assessments could not be used for comparative analysis where there were differences in baseline information, methods and definitions.

From FRA 2015, the increased use of online tools has facilitated both the reporting process and the analysis and dissemination of FRA-related data; in addition, it has led to better integration of FRA data with other databases maintained by FAO and by other information providers.

BOX 1 FAO'S FOREST MANDATE

In May 1943, while the world was still suffering from the tragic events of World War II, a conference was held in Hot Springs, Virginia in the United States of America, to discuss the challenges relating to food and agriculture. This Hot Springs Conference, as it was later called, followed an initiative of American President Franklin D. Roosevelt and recommended the establishment of an Interim Commission entrusted with formulating “a specific plan for a Permanent Organization in the field of food and agriculture.” It also articulated the basic concepts of food and nutrition security, and the guiding principles of the new permanent organization that was to become the Food and Agriculture Organization of the United Nations (FAO). In the original mandate of this new organization no reference was made to forestry (except for a general reference to non-wood products in one of the recommendations). However,

the Interim Commission later made a specific proposal to include forestry, which gained the support of President Roosevelt, and a Technical Committee on Forestry and Primary Forest Products was established within the Interim Commission. This Technical Committee stressed the “close relationship between forestry and agriculture” and highlighted “the importance of the contribution of the forestry sector to the world’s economy.” On 16 October 1945, when the first session of the FAO Conference was held in Château Frontenac in Quebec, Canada, 42 countries signed the Constitution for a permanent organization in the field of food and agriculture, and officially brought FAO into existence. FAO’s first Conference endorsed the Technical Committee’s recommendations and forestry was included in FAO’s mandate.

Source: (Phillips, 1981)



The Hot Springs Conference on Food and Agriculture held in Virginia, United States of America that laid the foundation for FAO in May 1943.

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The foundation of FAO held in October 1945 at the Château Frontenac, Quebec, Canada.

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1948-2018

Seventy years of FAO's Global Forest Resources Assessment

FAO'S GLOBAL AND REGIONAL ASSESSMENTS 1948–2000

FOREST RESOURCES OF THE WORLD 1948

THE WORLD'S FORESTS: A SOURCE OF TIMBER

BACKGROUND AND METHODOLOGY

At the first session of the FAO Conference in 1945, the need for up-to-date information on the forest resources of the world was fully recognized. This need reflected concerns about a possible future lack of timber, not least due to reconstruction after World War II, and support to development in tropical countries. The Conference recommended that FAO undertake a global forest resources inventory.

In May 1946, FAO's Forestry and Forest Products Division came into existence and work started on FAO's first worldwide assessment of forests. This assessment was published two years later in two issues of *Unasylva*¹ titled *Forest resources of the world* (FAO, 1948).

The first FAO global assessment was based on information gathered through questionnaires completed by countries and territories. Before being sent to the countries, these questionnaires were discussed and refined during two international conferences on forest statistics held in 1947, and were finally approved by the FAO Conference at its third session later in the same year. Copies were prepared in English, French and Spanish and sent from the Director General to all countries.

The questionnaires included parameters such as forest

area, types of forest by accessibility of wood resources, growing stock, growth, felling and ownership. The forest area was further divided into the subcategories of productive forest (broadleaved and coniferous) and other forest. For the first time in history, a single definition of forest was applied (Table 1). The rationale for collecting data on these parameters was to assess current and future availability of timber for post-war reconstruction.

One hundred and one countries, representing around two-thirds of the world's forest area, replied to the questionnaire. Regional totals were derived by estimating missing data from countries that did not reply to the questionnaire.

RESULTS AND CONCLUSIONS

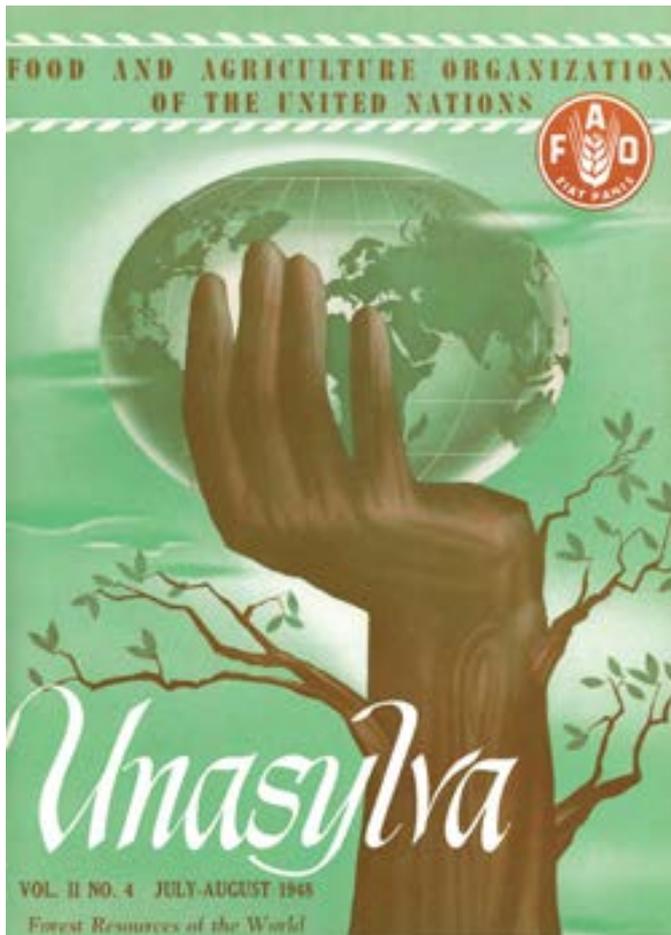
This first assessment estimated that the world's forest area was about 3 978 million hectares, of which 66 percent (2 612 million hectares) was composed of productive forest. Based on these figures, one of the main conclusions of the assessment was that there were sufficient forest resources available to satisfy the demand for timber and that this balance could be maintained in the future, if the productive forests were managed in a sustainable way.

¹ *Unasylva*: First published in 1947, *Unasylva* is FAO's journal of forestry and forest industries. Produced in separate English, French and Spanish editions, *Unasylva* covers all aspects of forestry: policy and planning, conservation and management of forest-based plants and animals, rural socio-economic development, species improvement, industrial development, international trade and environmental considerations, including the role of forests and trees in maintaining a sustainable base for agricultural production, as well as the effects of environmental change on forestry.

The main issues faced by the assessment included difficulties in the harmonization of national and global definitions, and the lack of reliable forest inventory information.

In evaluating the results of this first global assessment, it was recognized that there was scope for improvement; nevertheless, the exercise had provided “reasonably

accurate approximations” of the world’s forest resources. Consequently, it was recommended that such surveys should be continued so that future assessments could monitor progress made by countries.



The cover page of Unasylva presenting the results of the Forest Resources of the World 1948.

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TABLE 1 THE DEFINITION OF FOREST IN FAO'S FOREST RESOURCES ASSESSMENTS

Year	Forest definition
1948	Forested lands: lands bearing vegetative associations dominated by trees of any size, capable of producing timber or other products or of exerting an influence on the climate or on the water regime; also, lands from which forests have been recently clear-cut or burned, but which will be reforested in the near future.
1953	Forests: all lands bearing vegetative associations dominated by trees of any size, exploited or not, capable of producing wood or of exerting an influence on the local climate or on the water regime. Includes: lands from which forests have been recently cut or burned but which will be reforested in the near future; public and private forests of any size; tree nurseries; forest roads; mangrove forests, forests of low growth and of dwarfed or stunted forms. Excludes: brush lands, groups of trees outside the forest, trees along roads, etc., and on agricultural lands and parks.
1958	Forest: all lands bearing vegetative associations dominated by trees of any size, exploited or not, capable of producing wood or other forest products, of exerting an influence on the climate or on the water regime, or providing shelter for livestock and wildlife. Includes: lands from which forest have been clear-cut or burned, but which will be reforested in the foreseeable future; public and private forest of any size; forest of slow growth and of dwarfed or stunted forms e.g. subalpine; bamboo lands; all lands which are not part of a recognized fallow rotation of the shifting cultivator, and which will return to forest when he/she abandons the land; also lands under shifting cultivation on which forest production is maintained concurrently e.g. <i>Acacia senegal</i> in Sudan; <i>Savanna</i> types with crown density averaging at least 5 percent; wattle (<i>Acacia</i> spp.) plantations; tree nurseries; forest roads. Excludes: areas occupied by orchards of fruit or nut trees, and plantations for non-forest crops such as rubber and <i>Cinchona</i> ¹ spp.; areas occupied by individual trees or lines or groups of trees, for example along roadways, canal and streams, or in city parks, private gardens and pastures too small to be managed as forests; areas of windbreak and shelter belt trees that are in small groups or narrow strips too small to be managed as forests; lands primarily managed for permanent agriculture; all lands which are part of a recognized fallow rotation of the shifting cultivator, or which will not return to forest even though they bear a light timber crop before being cut, burned over and recultivated.
1963	Forest land: all lands bearing vegetative associations dominated by trees of any size, exploited or not, capable of producing wood or other forest products, of exerting an influence on the climate or on the water regime, or providing shelter for livestock and wildlife. Includes: land from which forest has been clear-cut or burned, but which will be reforested in the foreseeable future; public and private forests of any size; forest of slow growth and of dwarfed or stunted forms, e.g. subalpine; bamboo stands; all lands affected by shifting cultivation, other than those now being prepared or used for agricultural crops, which will become stocked with forest in the foreseeable future; <i>Savanna</i> types with crown density averaging at least 5 percent, estimated on the basis of how completely the tree crowns fill the space in the stand, measured as a ratio of the area of vertical projections of the crowns to the total area of the stand; wattle plantation (<i>Acacia</i> , spp.); one-rotation plantations for production of timber; nurseries of forest trees; forest roads and other small open areas that constitute an integral part of the forest. Excludes: areas occupied by orchards of fruit or nut trees and plantations for non-forest crops such as rubber and <i>Cinchona</i> ; areas occupied by individual trees or lines or groups of trees; for example, along roadways, canals and streams or in city parks, private gardens and pastures too small to be managed as forests; areas of windbreak and shelterbelt trees that are in small groups or narrow strips too small to be managed as forest; lands primarily managed for permanent agriculture; all lands under shifting cultivation being prepared or used for agricultural crops and such lands, which will not return to forest in the foreseeable future.
1970	Forest: areas covered with trees and/or shrubs and not used primarily for agriculture or other non-forestry purposes. Includes: public and private forest and other wooded areas; all plantations, including one-rotation plantations primarily used for forestry purposes and including wattle plantations (<i>Acacia</i> spp.); forest roads and streams and other small open area, as well as forest nurseries, that cannot be readily excluded by the survey system used; national parks. Excludes: city parks and gardens; areas occupied by orchards of fruit or nut trees, and plantations for non-forestry crops such as rubber and <i>Cinchona</i> spp., wooded pastures and range lands; areas not meeting the condition of forest and other wooded areas as described above, even if administered by forest authorities.
1980	Forest: all vegetation types where trees (woody perennial with a single main stem, a more or less definite crown and a minimum height of more than 5 to 7 meters when mature) cover more than 10 percent² of the ground. Closed forest: forest with trees whose crowns cover more than 40 percent² of the ground. Open forest: forest with trees whose crowns cover between 10 and 40 percent of the ground. Forest plantations: forest stands established artificially either by afforestation on land which previously did not carry forest, or by reforestation on land which carried out forest within the previous 50 years or within living memory and involving the replacement of the previous crop by a new and essentially different crop.

¹ Species growing as large shrubs or small trees which are planted for the production of quinine extracted from their bark.

² Percentage limits of tree crown cover derived from the United Nations Educational, Scientific and Cultural Organization (UNESCO) "International classification and mapping of vegetation" (UNESCO, 1973). All mixed forest-grassland vegetation types, whatever the percentage of crown cover more than 10 percent, are classified as open forest.

Year	Forest definition
1988	<p><u>Developing countries</u> Natural woody vegetation: land where the woody elements cover more than 10 percent of the ground. Forest: an aggregate to indicate what is normally understood as forest, namely natural forest and forest plantation.</p> <p><u>Developed countries</u> Closed forest: all land with a forest cover, i.e. with trees whose crowns cover more than about 20 percent of the area and used primarily for forestry.</p> <p>Includes: all plantations, including one-rotation plantations, primarily used for forestry purposes; areas normally forming part of the closed forest areas which are unstocked as a result of human intervention or natural causes, but which are expected to revert sooner or later to closed forest; young natural stands and all plantations established for forestry purposed which have not yet reached a crown density of more than 20 percent; forest roads and streams and other small open areas, as well as forest nurseries, that constitute an integral part of the forest; closed forests in national parks and nature reserves; areas of windbreak and shelterbelt trees sufficiently large to be managed as forest.</p> <p>Excludes: isolated groups of trees smaller than 0.5 hectares, city parks and gardens; areas not meeting the conditions of closed forests as described above, even if administered by forest authorities.</p>
1990	<p><u>Developing countries</u> Forests: ecological systems with a minimum tree crown coverage of the ground (here assumed as 10 percent) and generally associated with wild flora, fauna and natural soil conditions; and not subject to agronomic practices (same definition of a tree as in 1980 and 1988 assessments). Only forest areas more than 100 hectares (minimum area) are considered.</p> <p><u>Developed countries</u> Forests: land with tree crown cover (stand density) of more than about 20 percent of the area; continuous forest with trees usually growing more than about 7 metres in height and able to produce wood, including both closed forest formations where trees of various stories and undergrowth cover a high proportion of the ground and open forest formations with a continuous grass layer in which tree synusia cover at least 10 percent of the ground.</p>
1995	Same definition as 1990.
2000	<p>Forests: lands of more than 0.5 hectares with a tree canopy cover of more than 10 percent, which are not primarily under agricultural or urban land use.</p> <p>Explanatory notes: Forests are determined both by the presence of trees and the absence of other predominant land uses. The trees should be able to reach a minimum height of 5 metres <i>in situ</i>. Areas under reforestation which have yet to reach a crown density of 10 percent or tree height of 5 metres are included, as are temporarily unstocked areas, resulting from human intervention or natural causes that are expected to regenerate.</p> <p>Includes: forest nurseries and seed or chards that constitute an integral part of the forest; forest roads, firebreaks and other small open areas; forest in national parks, nature reserves and other protected areas such as those of specific scientific, historical, cultural or spiritual interest; windbreaks and shelterbelts of trees with an area of more than 0.5 hectares and width of more than 20 metres; plantations primarily used for forestry purposes, including rubberwood plantations and cork oak stands.</p> <p>Excludes: trees planted primarily for agricultural production; for example, in fruit plantations and agroforestry systems.</p>
2005	Forest: land spanning more than 0.5 hectares with trees higher than 5 metres and a canopy cover of more than 10 percent, or trees able to reach these thresholds <i>in situ</i>. It does not include land that is predominantly under agricultural or urban land use.
2010	Explanatory notes: Forest is determined both by the presence of trees and the absence of other predominant land uses. The trees should be able to reach a minimum height of 5 metres.
2020	<p>Includes: areas with young trees that have not yet reached but which are expected to reach a canopy cover of at least 10 percent and tree height of 5 metres or more; areas that are temporarily unstocked due to clear-cutting as part of a forest management practice or natural disasters, and which are expected to be regenerated within 5 years. Local conditions may, in exceptional cases, justify that a longer time frame is used; forest roads, firebreaks and other small open areas; forest in national parks, nature reserves and other protected areas such as those of specific environmental, scientific, historical, cultural or spiritual interest; windbreaks, shelterbelts and corridors of trees with an area of more than 0.5 hectares and width of more than 20 metres; abandoned shifting cultivation land with a regeneration of trees that have, or are expected to reach, a canopy cover of at least 10 percent and tree height of at least 5 metres; areas with mangroves in tidal zones, regardless whether this area is classified as land area or not; rubber wood, cork oak and Christmas tree plantations; areas with bamboo and palms provided that land use, height and canopy cover criteria are met.</p> <p>Excludes: tree stands in agricultural production systems, such as fruit tree plantations, oil palm plantations, olive orchards and agroforestry systems when crops are grown under tree cover. Note: Some agroforestry systems such as the Taungya system where crops are grown only during the first years of the forest rotation should be classified as forest.</p>

1953 WORLD FOREST INVENTORY

EMERGING CONCERNS ABOUT DEFORESTATION AND SUSTAINABLE FOREST MANAGEMENT

BACKGROUND AND METHODOLOGY

After evaluating the results of the 1948 assessment, the FAO Conference, at its sixth session in 1951, directed that available information on the forest resources of the world should be collected and published at five-year intervals. Following this recommendation, experts met in 1952 in Geneva to consider definitions and determine the scope of a new global inventory. Questionnaires were agreed and distributed to Member Countries and, at the same time, FAO staff gathered information from both official and unofficial sources relating to non-Member Countries.

The results of this second assessment of the world's forest resources were published by FAO in 1957 under the title *World forest resources – results of the inventory undertaken in 1953 by the Forestry Division of FAO* (FAO, 1957).

The 1953 questionnaire contained revised definitions and allowed countries and territories to explain the ways in which their national definitions differed from global ones. Changes in the definitions were deemed necessary because those used for the 1948 assessment reflected the experience of developed countries and were not always valid for developing countries. For example, many countries had been unable to report separately on productive and non-productive forests for the 1948 assessment and so the 1953 questionnaire referred to “accessible” and “inaccessible” forests. The former category was further subdivided into “in use” and “not exploited.” More detailed information was

requested about the management of the accessible forest that was in use; namely, the area of forest under working plans, the quality of cutting practices and the allowable cut. The questionnaire also attempted to subdivide the area of forests in use into those with a predominantly economic character and those with mainly protective functions. A separate section of the report dealt with roundwood supply from trees outside forests, which was considered an important topic in many countries, particularly in Europe and the Mediterranean Basin. A revised and more precise definition of forest was also applied (Table 1).

The 1953 assessment notably introduced a section dealing with changes in forest area and other changes, such as inaccessible forests becoming accessible, afforestation and deforestation.

One hundred and twenty-six countries and territories, representing about three-quarters of the world forest area, replied to the 1953 questionnaire. The dataset was completed by using information from the 1948 questionnaire for 10 additional countries and by using official statistics for the remaining 57 countries.

RESULTS AND CONCLUSIONS

The total forest area was estimated to be 3 837 million hectares, of which almost half was classified as inaccessible forest. About two-thirds of the accessible forest was classified as in use.

The 1953 assessment reflected considerable improvement since 1948, in terms of the scope and reliability of reported figures. No attempt was made to derive estimates on forest area change through comparison with the 1948 assessment because of changes in the definitions and, more significantly, because the differences mainly reflected improvements in statistical coverage and accuracy, rather than real forest area changes.

As in 1948, the 1953 assessment concluded that the world's forests were theoretically capable of providing adequate forest resources for a growing population, given the "immense unexploited reserves of standing timber,"

over 680 million hectares of which were accessible. However, it also warned against "reckless misuse of the forests" noting that every country should "give serious consideration to establishing well-founded land use plans, aimed at securing a considered balance between land required for agriculture and other uses and that which should be dedicated to forests."

The main limitation of the 1953 assessment was the lack of compatibility between available data from many countries and territories, as well as the scarcity and poor reliability of such data. For these reasons, the assessment noted that the data which had been collected did not provide a comprehensive picture of the world's forest resources, notwithstanding the advances made by many countries since the previous assessment.

1958 WORLD FOREST INVENTORY

BROADENING THE SCOPE: A MORE COMPREHENSIVE APPROACH

BACKGROUND AND METHODOLOGY

The third global assessment was carried out by FAO in 1958 and the results were published two years later as the *World forest inventory 1958* (FAO, 1960). This report was prepared by the Forestry and Forest Products Division of FAO in collaboration with the United Nations Economic Commission for Europe (UNECE).

This assessment, like the previous ones, was based on country questionnaires that were prepared, designed and revised by a group of experts. While preparing the questions and designing the scope of the assessment, experts recognized the importance of preserving comparability with previous assessments, but at the same time, agreed on the need to apply a number of changes to improve the assessment. Some new concepts and variables were introduced and previous definitions were refined.

The definition of forest was revised to take into account the difficulty, raised by the previous assessments, of defining the boundary of a forest where, for example, trees gradually became smaller and less frequent (Table 1). To overcome problems with local variation in the classification of land as forest, the revised definition specifically excluded land with low stocking. It also excluded non-forest crops, such as rubber and *Cinchona* spp., but included bamboo and *Acacia* plantations.

The attempt, in the 1953 assessment, to subdivide the area of forests in use into those with a predominantly economic

character and those with predominantly protective functions had not been successful as it implied that forests with protective functions were “non-economic.” For this reason, the 1958 assessment adopted a distinction between “productive” and “unproductive” forest, as this information was considered more meaningful and more readily available. The definition of “accessible forests” was also revised. While in the 1953 inventory these areas were defined as forests within reach of economic management or exploitation, the 1958 inventory defined accessibility as “physical accessibility by existing transportation systems,” recognizing that the term “within reach of economic management” was open to subjective interpretation and could be affected by fluctuations in the price of wood.

The 1958 assessment collected data on forest area in relation to such categories as ownership, composition, management, growing stock, growth, felling and removals from forests in use and from other roundwood sources (namely trees outside forests, and forests other than those in use), and changes in forest area. For the first time, specific data were also requested on bamboo, given its important role in the economies of many Asian countries. Questions about composition, growing stock and increment, referred only to accessible forest because previous inventories had shown that this type of information was generally not available for inaccessible forests. As in the 1953 assessment,

countries were asked to indicate the area of forest which had become accessible during the previous five-year period and to estimate the area of currently inaccessible forest that was expected to become accessible within a ten-year period. The aim was to collect more information about potential additional wood resources from inaccessible forests as well as accessible forests that were not yet in use; for the same reason, a question was added on the estimated area of productive forest which had become unproductive during the preceding five-year period. Countries were also asked to report separately on the volume losses due to shifting cultivation, to assess its impact.

One hundred and forty-three countries and territories, representing nearly 90 percent of the world forest area, replied to the questionnaires. The survey was completed by using the replies to the 1953 questionnaire for 13 countries, by using replies to the 1947 questionnaire for 5 other countries and by estimating missing values to provide regional and global totals.

RESULTS AND CONCLUSIONS

The 1958 global assessment estimated that the total forest area was 4 405 million hectares, of which about two-thirds

were classified as accessible forest. Over half of the accessible forest area was reported as forest in use. Commenting on the comparison with 1953, the report noted that the 1958 assessment was more comprehensive than its two predecessors, with encouraging progress in the coverage and standard of forest statistics.

The assessment also noted indications of land being lost to forest through settlement for permanent agriculture, often as a result of shifting cultivation, stating that this was “a disturbing feature, not merely for the forest wealth so destroyed, nor even for the disastrous consequences that may ensue for the soil and water regime, but also for its social aspects.” It added, however, that afforestation data “suggest that the last five years have witnessed the most energetic effort in history to extend the area of forest in those countries where forest cover is deemed inadequate for the forest to effectively play its productive and protective role.”

The assessment also suggested that many areas of forests in use were underexploited, and that accessible forests not yet in use could be considered as additional sources of wood supply. It expressed fears, however, “that some of the figures reported are somewhat overoptimistic” and commented on the opportunity to improve harvesting methods to reduce losses in timber during logging and transportation.

1963 WORLD FOREST INVENTORY

MORE INFORMATION BECAME AVAILABLE

BACKGROUND AND METHODOLOGY

The 1963 world forest inventory, published by FAO in 1965 (FAO, 1965), represented the fourth quinquennial assessment of the world's forest resources compiled by the Forestry and Forest Products Division of FAO, in collaboration with UNECE. It continued to be based on information collected through country questionnaires. According to the coordinators of this assessment, the questionnaires were changed to gain a better idea of the meaningfulness of the information that was collected and to consider areas of forest not previously assessed. Once again, the changes were minimized as far as possible in order to facilitate comparisons with previous assessments.

A special focus of this fourth global assessment was to gather as much information as possible about the area of forests not yet in use. It was recognized that progress made in forest surveys, including the use of aerial photographs, improved sampling techniques and the availability of computers, had made it easier to produce more information on these areas of forest. Thus, the questionnaires requested data on ownership, management and silviculture, density, composition, growing stock and annual growth of all forest land. To maintain comparability with previous assessments, this information was also recorded separately for forests-in-use. Because of the difficulty of defining accessible forests, in either economic or physical terms, this variable was dropped.

A new question was introduced on the area of unstocked forest land, which was defined as including both “lands from

which forests have been clear-cut or burned, but which will be reforested in the foreseeable future” and “lands not suitable for bearing tree cover by their nature, e.g. forest roads, small rivers and small water areas.” The rationale for requesting this information was to exclude these areas from the calculations of density, composition and growing stock. Growing stock information was disaggregated into three broad volume per hectare categories (namely, less than 50, 50 to 150, and more than 150 m³/ha) with the intention of estimating the quantitative composition of the assessed forests.

The 1963 assessment included wooded lands with a crown density of 0.05 to 0.09 (that is, 5 to 9 percent of canopy cover) in the definition of forest; (these areas would later be defined as “other wooded land” in subsequent assessments, and reported separately). No information on forest area changes was requested in 1963. However, a noteworthy innovation, aimed at better understanding of data sources, was made by asking countries to specify whether their data came from expert estimations or from actual forest inventories.

The 1963 assessment saw a slightly lower response rate (105 compared with 130 for the previous assessment), which was partly attributed to the temporary strains on administration in countries that were at that time gaining their independence. Totals were adjusted where there were incomplete datasets to derive figures for global and regional analysis.

RESULTS AND CONCLUSIONS

The total forest area was estimated to be about 4 126 million hectares, of which 3 779 million hectares was the extent of the forest excluding the unstocked areas. The assessment also reported that low density wooded land (with a crown density of 5 to 9 percent) extended to 100 million hectares, of which approximately half was found in the African region. About 40 percent of the world's forest area was reported to be unproductive.

Again, care had to be taken when comparing the 1963 estimates with earlier estimates and, as pointed out by the authors of the report, "large differences for some countries result more from better knowledge about the forests, or stricter application of definitions, rather than from effective changes in the forest resources."

The report noted that, in the more industrialized parts of the world, countries with large forest resources were intensifying their utilization and extending their area. By contrast, the report noted that in less industrialized regions, utilization was mainly limited to the production of fuelwood, described as a "basic requirement for people with a low standard of living" and there were "vast

opportunities" for increased "industrial utilization of their impressive resources, mainly tropical broadleaved forests" to help improve the living standard in these regions.

However, the report concluded with a "most serious warning" about plantation programmes failing to make adequate progress "against the destructive pressures exerted on the forest by a fast-growing population." It added that this had implications not only for wood production but also for the protective role of forests as "scarcity of forest may have a damaging effect on the local climate, and may irreversibly destroy the equilibrium of the soil and water regime, with disastrous consequences for economic and social conditions." The report suggested that deforestation should only be allowed where it contributed to the improvement and intensification of land use.

As with previous assessments, the main limitations of the 1963 survey were missing or incomplete replies, outdated data and difficulties in reclassification of national data to fit global definitions.

REGIONAL FOREST RESOURCES ASSESSMENTS 1970s

A REGIONAL APPROACH

BACKGROUND AND METHODOLOGY

Mainly because of a lack of resources, work undertaken for a fifth global assessment was never completed. In 1966, it was decided that there should, instead, be a series of regional assessments, which would better reflect the nature of the world's forest resources. These regional assessments were carried out as separate surveys at different times. The decision to carry out regional assessments was also motivated by a concern that the first four global assessments had failed to capture real changes in forest resources, with variations between estimates reflecting changes in definitions and the availability of new data from forest inventories rather than underlying trends on the ground. Doubts were also expressed about the value of a standardized questionnaire for all the regions, given the very different forest conditions around the world.

The work on regional assessments began in 1968 with a plan to cover all the regions over a five-year period. Questionnaires specific to each region were prepared, and the first questionnaires were sent to all industrialized countries in 1968. A report on the *Forest resources of the European region* was published in 1976 (FAO, 1976a). The questionnaire for Europe was essentially the same as that used for the 1963 assessment, except that the forest definition was slightly revised; the results of the European assessment were similar to those from the 1963 assessment for that region.

Questionnaires were also sent to countries in Asia and Latin America, and the results were published in *Forest resources in the Asia and Far East region* (FAO, 1976b) and *Appraisal of the forest resources of the Latin American region* (FAO, 1976c).

Different questionnaires were also prepared for the African region, but they became quite complicated given the attempt to capture information of importance for the region.

Mainly because of a lack of resources within FAO, the Department of Forest Survey of the Swedish Royal College of Forestry was invited to complete this work, which was published in *Forest resources of Africa – an approach to international forest resources appraisal, Part I: country descriptions* (Persson, 1975) and *Forest resources of Africa. Part II: regional analyses* (Persson, 1977).

Thanks to an agreement between FAO and the Royal College of Forestry in Stockholm, a global synthesis of these regional findings had also been published as *World forest resources – review of the world's forest resources in the early 1970s* (Persson, 1974).

The synthesis included variables such as forest area and growing stocks by forest types (coniferous and broadleaved) and planted forests (defined as “man-made” in the assessment); notably, eucalyptus and pine plantations. No data were collected on management status and on the

protective forests. The assessment provided some estimates of forest area change, defined as “probable decrease;” for example, where forests were facing degradation due to overcutting for fuel and other household wood. The questionnaires focussed on data available from NFIs and this information was supplemented with other information, such as vegetation, land use, topographic and forest maps, logging operations statistics, and botanical information. Five accuracy classes were used to classify data sources, ranging from very good (for example, NFI) to very bad (for example, guess-estimates).

RESULTS AND CONCLUSIONS

The global synthesis estimated a total forest area of around 4 030 million hectares, of which 2 800 million hectares were closed forest and 1 000 million were open woodland. It was noted that while the 1973 estimate of total forest land was close to the 1963 estimate, the area classified as closed forest in 1973 was much smaller than the area of stocked forest in 1963. A possible explanation for this was that the 1973

definition of closed forest was more precise than the 1963 forest definition, which included considerable areas of open woodland, scrub and bushland.

The author of the report recommended that the world's forest assessments should be updated every second or third year; that FAO should create a World Forest Resources databank (holding, and making publicly available, all the latest information about the world's forest resources); and that future assessments should adopt a detailed forest definition that was better fitted for detecting forest changes over time.

In May 1974, the FAO Committee on Forest Development in the Tropics decided, at its third session, to undertake an assessment of the world's tropical forests. Based on available information held by FAO (such as vegetation and land-use maps, atlases, reports and other literature), a country-by-country evaluation of forest areas (with some indications on total volumes and growths) was carried out. The results by subregions and regions were published in an article in *Unasylva* (Sommer, 1976).

TROPICAL FOREST RESOURCES ASSESSMENT 1980

SHIFTING THE FOCUS: DEFORESTATION AND FOREST DEGRADATION

BACKGROUND AND METHODOLOGY

From 1978 until 1981, with the financial assistance of United Nations Environment Programme (UNEP) and within the framework of the Global Environment Monitoring System (GEMS), FAO carried out an assessment of tropical forest resources. The 1980 assessment relied extensively on all sorts of existing information at national and subnational levels having a relation to woody vegetation types (including that derived from land use and permanent and shifting agriculture studies), in statistical or cartographic forms, which was gathered and analysed. Dialogues with national and international experts helped to confirm country estimates. Thanks to the extensive work on forest inventories in tropical countries that the Organization had conducted and continued to carry out at that time within the framework of its field programmes, FAO experts could also provide valuable inputs to the 1980 assessment.

Information on the status of, and changes in, forest area, plantation resources and wood volume was collected from 76 tropical countries (37 in Africa, 16 in Asia and 23 in Latin America and the Caribbean), representing 97 percent of the land area of tropical developing countries. In major forested areas for which existing information was lacking, manual interpretation of satellite imagery (at a scale of 1:1 000 000) was used, including in six Latin American countries, two African countries, two Asian countries and parts of two other Asian countries. These interpretations covered about 70 percent of these countries, using 55 satellite images, and provided additional data which

were combined with information supplied from other sources. In three countries, the major part of the work was carried out directly by the respective national institutions. Extended narratives, explanatory text and qualitative information complemented the statistical data set.

While previous assessments had relatively broad definitions that were open to different interpretations by countries, the 1980 assessment applied a forest definition with measurable parameters, so that country information could be adjusted to a common standard (Table 1). Expert estimates were used to project the information to the common reference years. The adoption of a less subjective forest definition, with a common reference period for reporting, led to more consistent and comparable results at both regional and global levels.

The findings of the 1980 tropical assessment were presented in four technical reports. The first three reports dealt with the tropical areas of America, Africa and Asia, respectively. Each report consisted of a regional synthesis (in Spanish for the Latin American area, in French and English for Africa, and in English for Asia) together with a collection of country briefs written in the official language used for communication between the relevant country and FAO (FAO, 1981a-d). A fourth report, *Tropical forest resources*, collated all the findings in one overall synthesis for the tropical world (Lanly, 1982).

RESULTS AND CONCLUSIONS

The 1980 assessment estimated that tropical developing countries had an area of approximately 1 200 million hectares of closed forest (of which 97 percent was broadleaved), 735 million hectares of open tree formations, around 410 million hectares of “forest fallow” and 625 million hectares of shrubland. According to the results of the assessment, the area of closed forest which had not yet been disturbed by logging covered some 990 million hectares, of which a little less than 675 million hectares were classified as productive forests. Approximately 210 million hectares of closed productive forests had been subject to logging, of which 42 million hectares were under intensive management.

The assessment estimated a yearly net forest loss of 10.2 million hectares during the period from 1981 to 1985. An

attempt was also made to assess degradation, including the transformation of productive closed forest into unproductive closed forest. Thus, for the first time, the focus had shifted from assessing wood availability to assessing the deforestation and degradation of tropical forests.

The assessment noted that although information about tropical forests was abundant, it was scattered and extremely diverse and so it was not easy to analyse it in a coherent way to derive estimates for tropical countries. The 1980 assessment represented, to a large extent, a collaborative effort between FAO experts and their national counterparts within the framework of the Organization's field projects. National forest agencies generally welcomed the exercise, but results were published as FAO estimates, and not as official country data.

Tropical deforestation was first flagged as a major concern at the 1972 United Nations Conference on the Human Environment. With funding from the newly created United Nations Environment Programme (UNEP), FAO's Forest Resources Division (FOR) carried out a pilot project in 1976 to 1978 with three countries of tropical Africa (Benin, Cameroon, Togo) to develop a methodology for forest cover monitoring at national level. This project used imagery from the first earth resources observation satellites and airborne radar programmes. However, the time needed to extend this participative exercise to the entire tropical world was prohibitive given the urgent need for an objective assessment of deforestation, its magnitude and distribution by countries and forest categories. Inaccurate figures began to circulate in the literature and media, mixing, *inter alia*, deforestation and forest degradation (a confusion which was

slow to disappear). In 1978, again with UNEP support, FOR decided to embark on the global Tropical Forest Resources Assessment (TFRA) project to provide a consistent picture on the state and trends in the world's forest resources, and in view of the fact that most changes were occurring in the tropics. Moreover, a considerable number of useful references had been gathered in previous assessments while a study on world pulp trends, which assessed the situation of forest plantations in developing countries, allowed the evaluation of a significant part of the most recent documentation. And never before had so many FAO field forestry experts, together with the national counterpart agencies, been able to contribute reliable updated information for a worldwide exercise.

Jean-Paul Lanly
TFRA Coordinator (1978–1982)

THE INTERIM ASSESSMENT 1988

FRA REVERTS TO A GLOBAL APPROACH

BACKGROUND AND METHODOLOGY

The eighth session of the Committee on Forestry (COFO)² in 1986, recommended the “strengthening of FAO’s programme of collection, evaluation and dissemination of information related to forest resources and resource development” and the “updating of information on tropical deforestation in order to provide reliable baseline data.” These recommendations were also endorsed by the FAO Council at its nineteenth session in 1986.

These recommendations led to FRA 1990, but while preparing FRA 1990, FAO carried out an interim assessment in 1988. The aim of the interim assessment was to extend the 1980 exercise by also collecting information from an additional 53 non-tropical developing countries. The interim assessment thus provided information on 129 developing countries and the results were published in *An interim report on the state of forest resources in the developing countries* (FAO, 1988). Meanwhile, information on the industrialized countries was collected by UNECE Geneva and the results were published in the report *The forest resources of the ECE region (Europe, the USSR and North America)* (UNECE and FAO, 1985).

While the assessment of developed countries was based

on information collected through country questionnaires, the assessment of the developing countries was based on a two-step approach. The first step involved the collection of all existing country data, supported in certain cases by interpretation of remote sensing imagery. In the second step, the collected information was evaluated by a team of experts and reclassified in accordance with the global definitions as well as being readjusted to a common reference year.

The forest definition differed between the industrialized and developing countries as the crown cover thresholds were set at 20 percent for industrialized countries and 10 percent for developing countries (Table 1). There were also some differences in key parameters for the two groups of countries.

A global synthesis of core elements was carried out to achieve a uniform global data set. Elements of the global synthesis included forest, operable forest, inoperable forest, other wooded land, and broadleaved forest and coniferous forest, as well as information on the state of forests in the year 1980 and changes over the period from 1981 to 1985. Separate country briefs were also prepared.

2 COFO is the highest FAO Forestry statutory body. The biennial sessions of COFO (held at FAO headquarters in Rome, Italy) bring together heads of forest services and other senior government officials to identify emerging policy and technical issues, to seek solutions and to advise FAO and others on appropriate action. Other international organizations and, increasingly, non-governmental groups participate in COFO.

RESULTS AND CONCLUSIONS

The findings from the interim assessment led to an estimate for the global forest area in 1980 of 3 603 million hectares and an estimate of a net forest loss (for tropical developing countries only) of 11.4 million hectares per year over the period 1981 to 1985. An attempt was also made to evaluate the reliability of the results based on the source of

information and the type of data by country; this revealed that for 15 countries, covering 40 percent of the closed forest area, the estimates for the area of forest and deforestation were very good or good.



General view of the opening of a Session of the Committee on Forestry, held in the Plenary Hall, FAO headquarters, Rome, Italy, March 2005.

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THE GLOBAL FOREST RESOURCES ASSESSMENT 1990

A DIFFERENT APPROACH: DEFORESTATION MODEL AND REMOTE SENSING ANALYSIS

BACKGROUND AND METHODOLOGY

Following the decision in 1986 to strengthen FAO's work on global assessments, the first Ad Hoc FAO/ECE/Finnish Development Agency (FINNIDA) Meeting of Experts on Global Forest Resources Assessment was held in October 1987, in Kotka Finland (Box 2), with the aim of providing guidance and agreeing on parameters, definitions and the approach for FRA 1990. The Kotka meeting highlighted the need for future assessments to be able to estimate the state of, and changes in, forest cover, volume and biomass; to provide up-to-date information on topics such as forest management techniques, harvesting and forest plantations; and to carry out a study of the environmental impacts and service functions of forests.

Building on this series of consultations, the FAO Forestry Department began the preparations for the 1990 assessment in 1987, in collaboration with FAO/UNECE Geneva, which was responsible for collecting and compiling the data from developed countries. The FAO Forestry Department in Rome was responsible for coordinating and conducting the assessment in developing countries, and for the preparation of a global synthesis of the two assessments.

FRA 1990 covered 179 countries and territories. Its results were published in separate reports for tropical countries (FAO, 1993), non-tropical developing countries (FAO, 1995c), non-tropical

developing countries of the Mediterranean region (FAO, 1994), tropical forest plantations (FAO, 1995b) and developed countries (UNECE and FAO, 1992). A global synthesis, including results from both developing and developed countries, was also published (FAO, 1995a). Other publications included an article in *Unasylva* (Singh, 1993) and a *Survey of tropical forest cover and study of change processes* (FAO, 1996).

The assessment for the industrialized countries was conducted through detailed questionnaires. The information collected through these questionnaires was complemented with official data from NFIs and other authoritative sources, including estimates provided by country experts, FAO Forestry Department estimates based on recent FAO and UNECE forest resources publications, forestry fact sheets and official journals.

The assessment for the tropical countries was implemented in two distinct phases. The first phase was based on a compilation of existing reliable survey data and the standardization of inventory data according to a common classification system. Data were then adjusted and projected to the common reference years of 1980 and 1990 to predict forest area loss and deforestation rates. A "deforestation model," partly driven by demographic parameters, was used to help improve estimates by eliminating the potential bias of expert opinion in the assessment of forest cover loss.

The second phase of the assessment for the tropical countries consisted of the validation of the estimates using data obtained from an independent pan-tropical remote sensing survey (RSS) of forest change. Given the many uncertainties associated with some national data, the purpose of the RSS was to provide a quality-controlled set of statistics for completing country information. This survey relied on a statistical sample representing 10 percent of the world's tropical forests, with 117 sampling units distributed throughout the tropics. Each sampling unit consisted of three multi-date Landsat satellite images, which provided the raw material for producing statistics on forest and other land cover changes between 1980 and 1990. Ground-truth data were incorporated for about half of the sample images. Based on the sample, estimates of the status of, and changes in, tropical forests were produced at regional, broad ecological and pan-tropical levels (but not at the national level). Results from the RSS helped generate a change matrix that illustrated and quantified how the forest and landscape had changed over time.

The 1990 assessment adopted different definitions of forest for developed and developing countries, respectively (Table 1) and covered parameters such as volume, biomass, annual harvesting, plantations and non-wood forest products. Because of increasing interest in the environmental functions of forests, in both developed and developing countries, brief summaries on conservation, forest management and biological diversity were also prepared. However, the compilation of country briefs, prominent in Tropical Forest Resources Assessment 1980, was discontinued.

RESULTS AND CONCLUSIONS

The global forest area for the year 1990 was estimated to

be 3 442 million hectares. The assessment highlighted that while forest area was relatively stable in the developed world, it was decreasing rapidly in tropical developing countries, at a rate of 13.6 million hectares per year.

The assessment also provided some findings related to forest management in developing countries, including an emerging trend of greater participation by local communities in forest management. There was also increased interest in the environmental functions of forests in both developing and developed countries.

The main limitation of the 1990 assessment arose from the decision to adopt different forest definitions for developing and developed countries; this made it difficult to obtain coherent and comparable statistics at global level and adversely affected the reliability of the total global estimates. While the assessment for the developed countries provided detailed national statistics, it was difficult to adjust these national statistics to fit into global FRA definitions. There was also lack of consistent information on forest area change in developing countries, as changes in the forest area had been combined with changes in the area of other wooded land. The assessment for the developing countries provided regional forest estimates, but recent data were generally lacking for many tropical developing countries. The report emphasized the general lack of adequate institutional capacity to cope with the demand for a broader range of information about forest resources and recommended the strengthening of capacities in forest resources assessment activities at national and global levels. It was also noted that the deforestation model approach previously referred to had resulted in a relatively high statistical error (that is, low precision) in country estimates, mainly because of the low number of variables used in the deforestation algorithm and the low number of observations used to construct the model.

BOX 2 GLOBAL FOREST RESOURCES ASSESSMENT EXPERT CONSULTATIONS

Date and venue	Related assessment	Objectives
Kotka I: Ad hoc FAO/Economic Commission for Europe (ECE)/FINNIDA Meeting of Experts on Forest Resource Assessment, 26–30 October 1987, Kotka, Finland	FRA 1990	To review FRA 1980 and develop a conceptual framework for FRA 1990 for tropical developing countries. Special focus on assessing changes in forest area (FINNIDA, 1987).
Kotka II: FAO/ECE Meeting of Experts on Global Forest Resources Assessment, 3–7 May 1993, Kotka, Finland	FRA 1995	To review FRA 1990 and develop a conceptual framework for FRA 2000. Scope was expanded from tropical developing countries to a Global Forest Resources Assessment. Common definitions were set and special focus given to environmental aspects (FINNIDA, 1993).
Kotka III: Expert Consultation on Global Forest Resources Assessment 2000, 10–14 June 1996, Kotka, Finland	FRA 2000	To propose a strategic plan and conceptual framework for FRA 2000. Focus on indicators of SFM and on the use of remote sensing data to support the estimates (METLA, 1996).
Kotka IV: Expert Consultation on Global Forest Resources Assessment: Linking National and International Efforts, 1–5 July 2002, Kotka, Finland	FRA 2005	To define the overall scope of FRA 2005. Focus on the linkages between FRA and other international reporting processes and on linking the assessment with criteria and indicators for SFM. Recommended the establishment of a FRA Advisory Group (METLA, 2002).
Kotka V: Expert Consultation on Global Forest Resources Assessment: Towards FRA 2010, 12–16 June 2006, Kotka, Finland	FRA 2010	To evaluate FRA 2005 and define the overall scope and framework for FRA 2010. Focus on strengthening the collaboration with other forest related reporting processes and on forest area dynamics. Recommended the definition of a Long-term Strategy (>15 years) for FRA and a user survey (METLA, 2007).
Expert Consultation on “A Long-term Strategy for Global Forest Resources Assessment,” 13–15 September 2011, Nastola, Finland	FRA 2015	To review the FRA Long-term Strategy and define the reporting framework for FRA 2015.
Expert Consultation on Global Forest Resources Assessment (FRA): Towards FRA 2020, 12–16 June 2017, Joensuu, Finland	FRA 2020	To provide guidance on the scope and reporting framework for FRA 2020, by identifying key information needs related to forests to ensure consistent and accurate reporting while reducing the reporting burden on countries.

These seven Expert Consultations were organized with the support of the Government of Finland, with financial contributions from the Ministry of Foreign Affairs and the Ministry of Agriculture and Forestry and the technical support of the Finnish Forest Resources Institute (METLA) and the Natural Resources Institute Finland (Luke).



**Participants at the first Ad Hoc FAO/ECE/
FINNIDA Meeting of Experts on Global
Forest Resources Assessment, in Kotka,
Finland, October 1987.**

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Participants at the second FAO/ECE Meeting of Experts on Global Forest Resources Assessment, during the field trip in Kotka, Finland May 1993.

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Participants at the third Expert Consultation on Global Forest Resources Assessment 2000, informal discussion, Kotka, Finland June 1996.

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Participants at the fourth Expert Consultation on Global Forest Resources Assessment: Linking National and International Efforts, technical session, Kotka, Finland July 2002.

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Participants at the fifth Expert Consultation on Global Forest Resources Assessment: Towards FRA 2010, plenary discussion, Kotka, Finland June 2006.

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Participants at the sixth Expert Consultation on “A Long-term Strategy for Global Forest Resources Assessment,” plenary discussion, Nastola, Finland September 2012.

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Participants at the seventh Expert Consultation on Global Forest Resources Assessment (FRA): Towards FRA 2020, group photo from the field trip, Joensuu, Finland June 2017.

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THE INTERIM ASSESSMENT 1995

FRA CONTRIBUTES TO THE 1997 STATE OF THE WORLD'S FORESTS (SOFO)

BACKGROUND AND METHODOLOGY

The second Meeting of Experts on the Global Forest Resources Assessment, Kotka II (Box 2), was held in 1993 and recommended using the year 2000 as the reference year for the next FRA. While preparing for FRA 2000, an interim 1995 assessment was undertaken, and published in *State of the World's Forests 1997* (FAO, 1997). This publication provided new statistics on forest area in all countries, with a reference year of 1995, and on change over the period from 1991 to 1995.

The 1990 figures for forest extent were revised using new inventory reports which had become available by 1996 and by using the FRA 1990 deforestation model, with updated population data, to adjust developing country statistics to standard reference years (1991 and 1995). FAO contacted all developing countries and requested their latest inventory reports; updated information was submitted by Bolivia (Plurinational State of), Brazil, Cambodia, Côte d'Ivoire, Guinea-Bissau, Mexico, Papua New Guinea, the Philippines and Sierra Leone. No adjustments to standard reference years were made for industrialized country statistics.

The two different forest definitions for developed and developing countries that had been used in the previous assessment were maintained. Consequently, data from developed and developing countries were again not comparable in terms of either definitions or reference year in this interim assessment.

RESULTS AND CONCLUSIONS

The 1995 interim assessment estimated that the total global forest area was 3 454 million hectares and that the net forest loss (in tropical developing countries) during the period 1990 to 1995 was 12.7 million hectares per year. The global net forest loss was estimated to be 11.3 million hectares per year.

THE GLOBAL FOREST RESOURCES ASSESSMENT 2000

A GLOBAL AND HARMONIZED DEFINITION OF FOREST

BACKGROUND AND METHODOLOGY

The scope and reporting framework for the Global Forest Resources Assessment for 2000 (FRA 2000) were discussed at the third Expert Consultation, known as Kotka III (Box 2), which was held in June 1996. Kotka III recommended that FRA 2010 should adopt a global harmonized approach, in terms of its methodology, the modality of data acquisition and the classifications and definitions to be applied.

The Kotka III findings were first considered by the Intergovernmental Panel on Forests (IPF), and subsequently by COFO, at its thirteenth session in 1997. Both meetings stressed the need for internationally accepted definitions of key terms and concepts, more reliable and comparable information at country level, and provision of assistance for national capacity building. It was also recognized that the scope of FRA should be broadened to meet the information needs of the Rio Conventions and implementation of Agenda 21³ programmes. A decision was also taken to increase the frequency of the assessment, from every ten years to every five years in order to improve the capture of emerging information needs. Building on these recommendations and requests, FAO developed and

implemented FRA 2000, and its results were published in the *FRA 2000 main report* (FAO, 2001).

FRA 2000 covered 213 countries, of which 160 actively participated in the information gathering and analysis. The backbone of FRA 2000 was the data, information and knowledge provided by countries. To broaden the scope and address emerging forestry issues and information demands, data were collected on several new parameters. These new parameters included biomass and availability for wood production as well as qualitative aspects of forests (such as biological diversity) and management parameters (such as the status of forest management planning and of protected areas). Data on these parameters were collected at the country level and summarized by subregion and region, and globally.

For the first time, a single definition of forest (Table 1), which set a threshold of ten percent canopy cover, was used for developed and developing countries of the world, as recommended by the IPF. The definition included both natural forests and forest plantations, but excluded stands of trees established primarily

3 Following the 1992 Rio Earth Summit, the United Nations established the IPF and its successor, the Intergovernmental Forum on Forests (IFF), to implement the Forest Principles and Chapter 11 of Agenda 21. The Forest Principles (also known as the Rio Forest Principles) is the informal name given to the *Non-legally binding authoritative statement of principles for a global consensus on the management, conservation and sustainable development of all types of forests* (1992) agreed at UNCED. Agenda 21 is a non-binding, voluntarily implemented action plan of the United Nations with regard to sustainable development. From 1995 to 2000, the IPF/IFF processes considered such issues as: underlying causes of deforestation, traditional forest-related knowledge, international cooperation in financial assistance and technology transfer, development of criteria and indicators for SFM, and trade and environment. This resulted in a set of 270 proposals for action for the promotion of the management, conservation and sustainable development of all types of forests.

for agricultural production, such as fruit tree plantations.

Efforts were made to increase the transparency and availability of background information, and countries were officially requested to endorse the data before publication. Statistics, together with their underlying analyses and assumptions, were also published on the FAO website.

FRA 2000 country-derived information was supported by an independent pan-tropical RSS which used the same 117 sampling units as had been used in FRA 1990. Furthermore, by adding new Landsat satellite images, it was possible to produce statistics on tropical forest and other land cover changes between 1980 and 2000. The resulting change matrix illustrated and quantified changes in the area of tropical forest and other land cover classes over time.

Revised estimates were made for the area of temperate and boreal forests in 1990 using the definition and methodology adopted in 2000.

RESULTS AND CONCLUSIONS

The estimate of the global total forest area for the year 2000 was 3 869 million hectares, of which 95 percent was “natural forest” and 5 percent was forest plantations. Net forest loss for the period 1990 to 2000 was estimated at 9.4 million hectares per year representing the difference between a deforestation rate of 14.6 million hectares per year of natural forests and an expansion of 5.2 million hectares per year of natural forests and forest plantations. In addition, 1.5 million hectares per year of natural forests were converted to forest plantations. Most of the forest losses were in the tropics. The rate of net change was slightly lower in the 1990s compared to the 1980s, due to a higher estimated rate of forest expansion in the 1990s

(primarily in non-tropical areas).

The RSS estimated that around half of the world's forests (47 percent) were found in the tropical zone, more than one third (33 percent) in the boreal, and the remaining forest was almost equally distributed between the temperate zone (11 percent) and the subtropics (9 percent).

The survey highlighted different deforestation patterns in the tropical regions. Direct conversion of forests to permanent agriculture or other land uses was much more prevalent than gradual intensification of shifting agriculture. Large-scale conversions dominated in Latin America, whereas direct conversion of forests into small-scale agriculture dominated in Africa. In Asia, intensified shifting agriculture practices accounted for a larger share of the overall changes, including migration into new areas as well as the gradual change of existing areas towards more permanent agriculture. At the global level, demand for agricultural land remained the driving force leading to deforestation; most tropical deforestation was the result of rapid, planned or large-scale conversion to other land uses, mainly agriculture.

Compared to previous assessments, there was more support for country capacity development and increased use of new technologies, such as remote sensing, to improve the reliability of the results. In some countries, there was a notable improvement in the availability of forest inventory data, and the reference year for national inventories was more often closer to the global reporting year than in the previous assessment. However, the main limitation of FRA 2000 remained the lack of basic data needed for accurate assessment.

The results of FRA 2000 were computerized in the Forest Information System (FORIS), which was designed to store, edit and retrieve forest resources information collected by FAO and to provide the world with baseline information on forest resources.

1948-2018

Seventy years of FAO's Global Forest Resources Assessment

GLOBAL FOREST RESOURCES ASSESSMENT 2005–2020

THE GLOBAL FOREST RESOURCES ASSESSMENT 2005

LINKING NATIONAL AND INTERNATIONAL EFFORTS

BACKGROUND AND METHODOLOGY

The fourth Expert Consultation on Global Forest Resources Assessment: Linking National and International Efforts, Kotka IV, was held in July 2002. It discussed and defined the overall scope of FRA scheduled for 2005. Kotka IV recommended an increased focus on linkages with other international reporting processes, including, in particular, criteria and indicators for SFM. Kotka IV also recommended the establishment of an Advisory Group to provide guidance to the FRA process (Box 3).

In October 2002, at the request of FAO, UNEP hosted the first meeting of the Advisory Group in Nairobi, Kenya. At this first meeting, the Advisory Group provided detailed technical specifications for the concept, process and implementation of FRA 2005 and proposed that FAO should request countries to nominate national correspondents to the FRA process. The Advisory Group further recommended organizing regional/global meetings of national correspondents to increase their level of involvement and to seek inputs and suggestions on ways to improve the reporting process.

The sixteenth COFO, held in March 2003, endorsed the recommendations from Kotka IV and the Advisory Group. Accordingly, the reporting framework for FRA 2005 was designed to encompass the social, economic and environmental dimensions of forest resources for measuring

progress towards SFM. It was to cover six of the seven thematic elements of SFM drawn from the criteria and indicator processes; namely, the extent of forest resources, forest biological diversity, forest health and vitality, and the productive, protective and socio-economic functions of forest resources (the seventh thematic element is the legal, policy and institutional framework).

This broader approach required increased collaboration with other reporting processes to reduce the reporting burden on countries by avoiding duplication of effort for similar variables reported to different processes. Variables relating to forest biomass and carbon were harmonized with the specifications of the Intergovernmental Panel on Climate Change (IPCC); variables on endangered species followed the International Union for Conservation of Nature (IUCN) red list of threatened species (IUCN, 2000); and wood removals were harmonized with the *FAO yearbook of forest products* (FAO, 2003). The proportion of land area covered by forest, reported to FAO as part of FRA 2005, was also used as one of the indicators for monitoring progress towards the Millennium Development Goals (MDGs) (Box 4) (United Nations, 2008a).

Building on recommendations from the FRA Advisory Group, the FRA 2005 reporting process was initiated through official requests to countries for nominations of national

correspondents. These correspondents, and their teams of experts in the countries, were responsible for coordinating inputs and preparing country reports for submission to FRA. The response level was high and nominations were received from 172 countries.

FAO worked closely with countries and specialists in the design and implementation of FRA 2005 which involved more than 800 people including national correspondents and their teams, the FRA Advisory Group, international experts, FAO and UNECE staff, consultants and volunteers from around the world. A global training session attended by more than 100 national correspondents was held in November 2003 in Rome, with the aim of finalizing the scope and framework for FRA 2005 and launching the reporting process.

Standardized country reports, including about 40 variables for three points in time (1990, 2000 and 2005) covering the extent, condition, uses and values of forests and other wooded land, were prepared with the aim of assessing a full range of the benefits from forest resources. Questionnaires were prepared in the form of country reports in English, French and Spanish. The standardized reporting format required countries to provide the reference for original data sources, an indication of the reliability of the data from these sources, and a description of their national definitions. Separate sections of the country reports dealt with analysis of data, including assumptions made and the methodologies used for estimates and projections of data to the three reference years; calibration of land area data to match the official land area data held by FAO; and reclassification of data to match the classes used in FRA 2005. In addition, countries could add comments on the tables to provide additional qualitative and descriptive information and to explain their calculations and assumptions.

The adoption of standardized country reports aimed to increase transparency, traceability and reliability of the reported data. The decision to ask countries to report on historical data (1990 and 2000) was driven by the fact that results from previous assessments could not be compared, and no reliable trends could be derived from the figures because of changes in methodology, definitions and scope. Thus, FRA 2005 attempted to provide a more comprehensive picture of the trends and, for the first time in FRA's history, to cover changes over a period of 15 years.

The questionnaires were sent to the respective national correspondents together with detailed instructions for reporting, including reference documents on specifications, guidelines and terms and definitions, (FAO 2004a, FAO 2004b and FAO 2004c). Regional focal points at FAO headquarters and its regional and subregional offices were in regular contact with national correspondents throughout the process. An electronic discussion forum and a list of frequently asked questions were provided on the FRA 2005 website to further facilitate the reporting process. A total of ten regional and subregional workshops were held to review the draft reports and provide technical assistance to countries in the finalization of the country reports. These workshops provided an opportunity to share experiences and to address specific questions and issues related to data availability and interpretation.

After they had been returned to FAO, the draft country reports underwent detailed review to ensure completeness and correct application of definitions and methodologies including the reclassification of national data to the FRA 2005 global definitions. Internal consistency was checked and a comparison made with information provided for FRA 2000, the FAO/Statistical Office of the

European Union (EUROSTAT)/International Tropical Timber Organization (ITTO)/UNECE Joint Forest Sector Questionnaire (JFSQ) and other published sources of information. Subject specialists at FAO analysed the data provided in the country reports and prepared subregional, regional and global overviews for each topic.

Before publishing the key findings and the global tables, all country reports were sent to the head of forestry in the respective country for final validation.

No independent RSS was carried out for FRA 2005 due to lack of financial resources, but recommendations were formulated for the implementation of a RSS to support country estimates for the next global assessment scheduled for the year 2010.

Results of the analysis by thematic elements were published in the FRA 2005 main report (FAO, 2006a). Within the framework of FRA 2005, seven special studies were carried out to provide complementary information on the following specific topics: planted forests (Del Lungo, Ball and Carle, 2006), mangroves (FAO, 2007b), bamboo (Lobovikov *et al.*, 2007), wildland fires (FAO, 2007c), forest pests (FAO, 2009), forests and water (Hamilton, 2008) and resource tenure (FAO, 2006b).

RESULTS AND CONCLUSIONS

FRA 2005 estimated a global forest area for the year 2005 of about 3 952 million hectares. The net annual forest area loss for the period 2000 to 2005 was estimated to be 7.3 million hectares, down from 8.9 million hectares per year in the previous decade (1990 to 2000). This decrease in net forest loss was mainly attributed to forest planting, landscape restoration and natural expansion of forests. The estimated deforestation rate was 12.9 million hectares per year for the

period 2000 to 2005, compared with 13.1 million hectares per year for the period 1990 to 2000.

Easier access to satellite imagery and the availability of recent national inventories resulted in updated information on forest area, but many developing countries experienced serious difficulty in reporting on key variables because their national monitoring systems were not adequate for international reporting or domestic needs. As with previous assessments, the main limitation of FRA 2005 was the lack of data availability and unreliable data quality, including from some major forest countries.

Nonetheless, FRA 2005 demonstrated the value of developing a truly global partnership. The network of national correspondents represented a tremendous strength of the reporting process. Countries were involved to a much higher degree than in previous assessments and this led to a higher response rate and better quality control of information at the national level. The transparent reporting process contributed to enhanced national capacity for the collection, analysis and reporting of data on forest resources, and so led to improved knowledge about the world's forests and their benefits.



Participants at the Meeting of the FRA National Correspondents for Latin America, Guatemala 6–10 September 2004 Workshop.
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BOX 3 THE FRA ADVISORY GROUP

The FRA Advisory Group was established in 2002 on the recommendation of the Expert Consultation held in Kotka, Finland in 2002 (Kotka IV). The FRA Advisory Group is informal in nature, but is recognized by COFO which generally endorses its recommendations. The Group has a long-term commitment to meet annually. The role of the Advisory Group is to review FRA activities and outputs, and make recommendations to strengthen existing institutional networks and to make future forest resources assessments more user-oriented and demand-driven, and more closely linked with other international processes.



Participants at the first meeting of the Advisory Group to the Global Forest Resources Assessment, 16–18 October 2002, Nairobi, Kenya.

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THE GLOBAL FOREST RESOURCES ASSESSMENT 2010

MEASURING PROGRESSES TOWARDS SUSTAINABLE FOREST MANAGEMENT

BACKGROUND AND METHODOLOGY

The fifth Expert Consultation on Global Forest Resources Assessment: Towards FRA 2010, held in Finland in 2006 (Kotka V), evaluated the results of FRA 2005. It recommended that the concept of SFM should continue to be used as a reporting framework and that this should include all seven commonly agreed thematic elements, including the legal, policy and institutional frameworks. Experts at the Kotka V consultation recognized that the increased country involvement was a key factor for the success of FRA 2005, and recommended the strengthening of the network of national correspondents. Experts also stressed the importance of maintaining globally consistent definitions in the FRA process to ensure consistency over time, and the importance of strengthening the linkages between FRA and other international reporting processes to reduce the overall reporting burden on countries.

At its eighteenth session in 2007, COFO endorsed these recommendations and asked FAO to continue collaborating with Member Countries, CPF members, and regional partners, including the UNECE, the UNFF and regional criteria and indicator processes for SFM. Consequently, FRA 2010 continued along the path defined by FRA 2005, with its broader scope and emphasis on being a country-driven process.

In FRA 2010, variables and definitions were changed as little as possible compared to FRA 2005 to facilitate the reporting process and allow countries to use the same figures that they had reported for FRA 2005. To help reduce the reporting burden, there was further streamlining of reporting to FAO, to ITTO and to the Ministerial Conference for the Protection of Forests in Europe (which now has a brand name of FOREST EUROPE). Methods for reporting on variables related to forest biomass and carbon were harmonized using the updated guidelines of the IPCC (2006). New variables were included which enabled the assessment of progress towards the forest-related 2010 Aichi Biodiversity Targets of the CBD and towards the four Global Objectives on Forests of the Non-legally Binding Instrument on All Types of Forests (now known as the UN Forest Instrument) adopted by the United Nations General Assembly at its sixty-second session (United Nations, 2008b). The proportion of land area under forests, reported to FAO as part of FRA 2010, continued to be used as an indicator for monitoring progress towards the MDGs (Box 4).

The reporting process for FRA 2010 was initiated with a formal request for countries to nominate national correspondents; as a result, 178 national correspondents were either confirmed or nominated. Standardized reports were prepared in three languages, English, French and Spanish, and prefilled whenever possible using data already provided to FRA 2005. Reports were then sent to the

respective countries, and national correspondents were requested to complete them with forecasts for the year 2010, or by updating historical figures in those cases where the availability of new data required a revision of previously reported figures. National correspondents were also provided with a set of background documents including specifications, terms and definitions and guidelines (FAO, 2007a; FAO, 2008a and FAO, 2008b) and a regional focal point in the FRA team was assigned to assist the countries throughout the reporting process.

The effective design and implementation of FRA 2010 was the result of a joint global effort. More than 900 contributors were involved, including the national correspondents and their teams. More than 70 FAO staff members at its headquarters and at its regional and subregional offices, as well as consultants and volunteers, contributed to the review of reports, the preparation of desk studies for countries and territories that did not have a national correspondent, and the analysis and presentation of the results. Several countries and organizations contributed extra budgetary financial resources or secondments to help support the country reporting process for FRA 2010; these included Denmark, Finland, Japan and the United States of America, along with ITTO. The UNECE/FAO Forestry and Timber Section in Geneva assisted with the assessment process for several European and Central Asian countries.

A global meeting of national correspondents was organized in Rome in 2008 with the aims of sharing information and knowledge on the FRA 2010 process and country reporting, and reinforcing their network. Ten regional and subregional workshops were organized after the global meeting with the aim of addressing technical issues and assisting national correspondents in the finalization of the country reports.

As in FRA 2005, countries were asked to validate their data before publication of the results.

Data were collected for around 90 variables covering the extent, condition, uses and values of forests and other wooded land at four points in time, namely 1990, 2000, 2005 and 2010. The 233 country reports, containing information on status and trends of forest resources over the period 1990 to 2010, were all published online. The final report of FRA 2010 (FAO, 2010), containing the global and regional analysis presented according to the seven thematic elements of SFM, was released in 2010 during the twentieth session of COFO and second World Forest Week. Other publications complementing the main report were a series of special studies on topical issues, including forest degradation (FAO 2011) and trees outside forests (de Foresta *et al.*, 2013), as well as the results of a global RSS, undertaken in collaboration with the European Commission Joint Research Centre (JRC) on changes in forest biomes between 1990 and 2005 (Lindquist *et al.*, 2012) (Box 5).

RESULTS AND CONCLUSIONS

FRA 2010 estimated that the world's total forest area in 2010 was 4 033 million hectares, and that in the period 2000 to 2010 around 13 million hectares of forest were deforested each year, compared with a deforestation rate of 16 million hectares per year in the 1990s. The assessment highlighted the fact that large-scale planting of trees had, however, significantly reduced the net loss of forest area globally. The net annual loss in forest area in the period 2000 to 2010 was estimated at 5.2 million hectares, down from 8.3 million hectares per year in the period 1990 to 2000.

FRA 2010 was designed to cover a wide range of forest benefits and functions, but information shortages made reporting on key trends difficult. Overall, the response rate was very high, but the concerns expressed in earlier assessments about poor availability of reliable information remained valid for FRA 2010.

The RSS produced similar results to that reported in the FRA 2000 survey; it estimated that just under half the world's forests were in the tropical domain (45 percent of total area), about one third in the boreal (31 percent) and

the remainder in temperate (16 percent) and subtropical (8 percent) domains.

The main achievements of FRA 2010 were to obtain better data, improve the transparency of the reporting process, and enhance national capacity for data analysis and international reporting. The participation of national experts from around the world and key international forest-related organizations ensured the sharing of the best and most recent forest information that could then be published and be made readily available for policy decision-makers.



Participants at the Pacific Workshop on the Global Forest Resources Assessment 2010, in Hanoi, Vietnam 18–20 April 2008.

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BOX 4 MILLENNIUM DEVELOPMENT GOALS AND SUSTAINABLE DEVELOPMENT GOALS

At the beginning of this millennium, world leaders gathered at the United Nations to shape a broad vision of how to fight poverty in its many forms. This vision, which was translated into eight Millennium Development Goals (MDGs), remained the predominant global development framework for the next 15 years.

Progress towards forest-related MDG targets, including, specifically, MDG 7 (“Ensure Environmental Sustainability”) indicator 7.1 (“proportion of land area covered by forest”) was informed by the Global Forest Resources Assessment (FRA).

In September 2015, the UN Member States agreed on a new framework for global development, spanning the next 15 years. The 2030 Agenda for Sustainable Development includes 17 Sustainable Development Goals (SDGs) and 169 targets. Sustainable forest management (SFM) is a central concept for Goal 15 and for targets 15.1 and 15.2. As with MDG indicator

7.1, data for SDG indicator 15.1.1 (“forest area as a percentage of total land area”) will be collected by FAO through the FRA.

In addition, the following, five sub-indicators are proposed under indicator 15.2.1 (“progress towards sustainable forest management”):

- forest area net change rate;
- above-ground biomass stock in forest;
- proportion of forest area located within legally established protect areas;
- proportion of forest area under a long-term forest management plan;
- forest area under an independently verified forest management certification scheme.

Information for reporting progress against five sub-indicators will also be collected through the FRA.

BOX 5 FRA AND REMOTE SENSING

The Global Forest Resources Assessment (FRA) has used remote sensing since FRA 1980 to complement the traditional FRA process of collection of official statistical information from countries. In FRA 1980, some countries used Landsat Multispectral Scanner (MSS) satellite imagery to estimate their forest area.

The first large-scale FRA remote sensing survey (RSS) was implemented as part of FRA 1990, with the aim of providing consistent and quality-controlled estimates of forest cover and changes within the pan-tropical region. The survey relied on statistical sampling (10 percent) of the world's tropical forests through 117 sample units located throughout the pan-tropical zone, and representing 87 percent of the world's tropical forest area. For each sample unit multi-temporal Landsat satellite images provided the raw material for producing statistics on forest and land cover changes from 1980 to 1990. The survey produced estimates of forest state and change at regional, ecological and pan-tropical levels, but not at the national level.

The FRA 2000 pan-tropical RSS built on the FRA 1990 survey, and complemented the sample units with more recent Landsat satellite images to assess forest and land cover changes for both the period 1980 to 1990, and 1990 to 2000.

While the FRA 1990 and FRA 2000 RSS only covered the pan-tropical region, the FRA 2010 survey was the first comprehensive global survey on forest land use change dynamics, including deforestation, afforestation and natural expansion of forests. The survey was implemented by FAO in collaboration with the EC Joint Research Centre and other partners.

FRA 2010 used a sample-based approach applying a systematic sampling design based on each longitude and latitude

intersection with reduced intensity above 60 degrees north due to the curvature of the Earth.

The whole land surface of the Earth was covered with about 13 500 samples, of which about 9 000 samples fell outside deserts and areas with permanent ice. The area covered at each sample site was 10 km x 10 km, providing a sampling intensity of about 1 percent of the global land surface.

For each sample plot, Landsat images dating from around 1990, 2000 and 2005 were segmented and classified using an automated supervised approach where national experts participated in the final validation. Nearly seven million polygons were analysed at each time interval to enable detection of forest area, forest gains and forest losses of 5 hectares or greater in size. In 2013, updated forest land use and change rates (losses and gains) were calculated at global, regional and ecological zone scales for 1990, 2000 and 2010.

Three global maps were first produced as part of FRA 2000: a forest map, a map of global ecological zones and a map of protected areas. The forest map had a resolution of 1 km and was based on pre-processed multi-date composite advanced very high resolution radiometer (AVHRR) images from 1992 to 1993 and 1995 to 1996.

In FRA 2010, the global forest map was updated, using MODIS vegetation continuous field (VCF) data, with some adjustments and calibrations to ensure that the forest area of the map was adding up to the FRA 2010 total forest area as of the country reporting.

In FRA 2015, no global forest map was produced; however, the map of global ecological zones was updated and a series of recommendations for further updates were presented.



Participants at the Regional Workshop for national correspondents and focal points for the Near East regions in Alexandria, Egypt, 13–16 October 2008.

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Mette Løyche Wilkie, Coordinator, FAO Foresty Resources Assessment 2010 (far left), and Eduardo Rojas, FAO Assistant Director-General for Forestry (far right) attending a press conference presenting key findings from FAO's "Global Forest Resources Assessment 2010 report", at FAO headquarters, Rome, Italy 25 March 2010.

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The Global Forest Resources Assessment 2010 (FRA 2010) continued the efforts of FRA 2005 to provide a broad picture of the status and trends not just in forest area and forest types, but also in the many products and services forests provide, the health of forests and the way in which they were managed. To do so, the 2010 assessment was built around the seven thematic elements of sustainable forest management, adopted as part of the UN General Assembly resolution 62/98 on the Non-legally binding Instrument on all types of forests in 2008. These elements were, in turn, based on many regional and organizational processes, facilitated and supported by FAO, to identify the criteria and indicators of sustainable forest management spearheaded by the International Tropical Timber Organization (ITTO) back in early 1990.

FRA 2010 marked the first time information was provided on the legal, policy and institutional frameworks governing forests. It was also the first time a concerted effort was made to estimate the global deforestation rate, as opposed to the rate of tropical

deforestation. This estimate was achieved in two ways: through country data indicating changes in forest area, afforestation and reforestation rates, and through a global remote sensing survey (RSS) – another first in the history of FRA.

This complex process and analysis was managed on a limited budget by a small, competent and dedicated team of experts, but this team faced additional challenges when the meeting of the Committee on Forestry, where the results were to be presented, was moved forward from March 2011 to October 2010, cutting five months off the production cycle very late in the process. With less time for the analysis and presentation of results, plans to redesign the report and include more infographics unfortunately had to be eliminated, but thanks to great teamwork the printed version in English and online versions in French and Spanish were ready on time, with the Arabic, Chinese and Russian versions following soon thereafter.

Mette Wilkie
Coordinator FRA 2005 and FRA 2010

THE GLOBAL FOREST RESOURCES ASSESSMENT 2015

IMPLEMENTING THE FRA LONG-TERM STRATEGY

BACKGROUND AND METHODOLOGY

The preparation for FRA 2015 began in June 2011 with the eleventh meeting of the FRA Advisory Group, which was to provide guidance on variables for FRA 2015 and discuss the FRA Long-term Strategy. This Strategy was intended to promote an approach to assessments that would be capable of meeting long-term global needs, as recommended by the Kotka V Expert Consultation. The twentieth session of COFO, in 2010, had endorsed this recommendation and had requested that FAO prepare a Long-term Strategy for the FRA programme consistent with prospects for sustainable funding. The Expert Consultation on the FRA Long-term Strategy, held in Finland in September 2011, provided important inputs for the finalization of the Strategy, and for the implementation of the FRA 2015 reporting process.

In October 2011, representatives from FAO, FOREST EUROPE, ITTO and the Montréal Process met in Canada for a joint workshop on the international criteria and indicator processes. A second meeting followed in February 2012 where a joint action plan for the collection, exchange and analysis of international forest data was developed: this was the origin of the CFRQ.

Another important step in the process of finalizing the Strategy and preparing for FRA 2015 was the Technical Consultation on FRA 2015, held in Ispra, Italy, in March

2012. Meanwhile, throughout 2012, the six Regional Forestry Commissions concluded a consultation process on the Strategy, which was finally endorsed by COFO at its twenty-first session in September 2012. The main strategic objectives set out in the Strategy were improved reporting, data quality and reliability; a reduced reporting burden on countries; and improved access to FRA data. FRA 2015 was the first assessment to consider the recommendations from the Long-term Strategy and to implement these strategic objectives.

To achieve the strategic objective of improved reporting, with better and more reliable data, FRA 2015 implemented a capacity-building plan with the aim of supporting countries throughout the reporting process. This plan focused on building capacities at the national level for completion of the FRA 2015 reports, on strengthening of national networks in support of the FRA 2015 reporting process, and on promoting the incorporation of remote-sensing data into FRA 2015 reports. Twenty-one workshops with more than 500 participants were organized at the global, regional and national levels.

To decrease the reporting burden and facilitate the work of the national correspondents, FRA 2015 focused on variables that were easy to collect and practical to analyse. In contrast to the previous two assessments (FRA 2005 and FRA 2010), the FRA 2015 reporting framework was no longer based on the thematic elements of SFM. Instead, a new set of variables

was introduced to evaluate progress toward SFM. Wherever possible, key variables and definitions were kept unchanged, and this facilitated the process of pre-filling the country reports with information previously submitted to past assessments.

The most important step that FRA 2015 undertook towards reducing the reporting burden was the implementation of the CFRQ. This joint questionnaire contained a subset of the FRA variables; namely, those that were also being requested by at least one other partner organization. Thus, data of common interest to different partner organizations and processes could be collected once and then shared, helping to decrease the reporting burden and leading to greater consistency in the published data.

To improve access and use of FRA data, FRA 2015 initiated the development of an online portal, the Forest Resources Information Management System (FRIMS). The system was developed to facilitate the reporting process, by simplifying data entry and the review process. The online system was also built to promote the interactive use of FRA 2015 data, allowing users to extract and analyse data in a more interactive, tailor-made way.

For FRA 2015, questionnaires were prepared for the online system and, once ready, countries were provided with log-in credentials and passwords to enter the system and begin data reporting. Through an automatic notification system, reviewers were notified when a country had submitted a report for technical review. Background documents of terms and definitions and a guide for country reporting were produced in three languages to help countries during the reporting process (FAO, 2012a and FAO, 2012b).

Information on about 120 variables covering a 25-year period over 5 points in time – namely, 1990, 2000, 2005, 2010 and 2015

– was collected and analysed. As in FRA 2005 and FRA 2010, countries were officially asked to validate national data before they were published. The 233 country reports (which included 79 desk studies for countries and territories that did not submit a report, representing 1.3 percent of global forest area) were compiled and published online (FAO, 2015a).

Key findings from the analysis of the FRA 2015 data were published by topic in the Synthesis Report (FAO, 2016), while tabular data by country were published in a separate desk reference (FAO, 2015b). The *Journal of forest ecology and management* published a special volume on FRA 2015, with contributions from more than 60 scientists and experts from all over the world (MacDicken, 2015). These publications were released in September 2015 on the occasion of The XIV World Forestry Congress in Durban, South Africa.

RESULTS AND CONCLUSIONS

FRA 2015 estimated that the global forest area in 2015 was 3 999 million hectares, equal to 30.6 percent of the world's land area. This result was less than the FRA 2015 revised estimate of the global forest area in 1990, which was put at 4 128 million hectares, or 31.6 percent of the world's land area. However, FRA 2015 also demonstrated that the global rate of net annual forest loss had slowed by more than 50 percent between the periods 1990 to 2000 and 2010 to 2015, falling from 7.3 to 3.3 million hectares per year, because of a combination of reduced forest area loss in some countries and increased gains in others.

In general, FRA 2015 was characterized by a strong innovative spirit, which helped in making progress towards implementing the key recommendations of the FRA Long-term Strategy. The newly introduced online reporting system, FRIMS,

was welcomed by countries and the automatic checks and calculations helped national correspondents in their work of compiling country reports. However, the efficiency of the review process was hampered by limitations in FRIMS, which did not adequately facilitate the flow of communication between countries and reviewers, and by the lack of designated regional focal points in the FRA Secretariat. Furthermore, because of technical limitations and resource constraints, the online system did not have a sufficiently well-developed and user-friendly database application for improving access to and use of FRA data.

Although the formalization of the CFRQ had helped to decrease the reporting burden, this benefit was partially counterbalanced by the increase in the number of variables, from 90 in FRA 2010 to 120 in FRA 2015.

The activities carried out to implement the capacity-building plan had positive results by increasing the understanding and the visibility of the FRA process among different

stakeholders at the national level. The remote sensing component of the capacity-building plan successfully helped to develop capacities and skills in the use of remote sensing techniques in a number of countries. However, some countries with limited resources were unable to take full advantage of the tool's capabilities to generate detailed country specific data suitable for domestic planning and monitoring of land use; this highlighted the need for more focused capacity building and follow-up projects.

The publication of a special volume of the *Journal of forest ecology and management* proved to be an interesting academic exercise, but problems relating to the ownership of published data had to be addressed since some of the data used in the analyses were not FAO data.

Analysis and packaging of FRA 2015 results revealed the need to highlight regional differences in ways that would facilitate debates on forests and forestry at regional conferences or by regional Forestry Commissions.



Plenary session of the Global Meeting in Preparation for FRA 2015 and the Collaborative Forest Resources Questionnaire Reporting in Chiang Mai, Thailand 6–10 May, 2013.

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THE GLOBAL FOREST RESOURCES ASSESSMENT 2020

THE WAY AHEAD

BACKGROUND AND METHODOLOGY

At the time of writing this publication, work was underway on the preparation of FRA for the year 2020. As a result of recent developments in the international forest policy arena, such as the Paris Agreement on Climate Change, the 2030 Agenda for Sustainable Development with its SDGs, and the United Nations Strategic Plan for Forests 2017–2030, there is a need for FRA to adapt, in terms of both its scope and reporting periodicity, in order to respond to evolving information needs.

The seventh Expert Consultation on FRA, held in Joensuu, Finland in June 2017, provided important inputs for the definition of the scope and reporting framework for FRA 2020. Recommendations focused on the development of capacities for FRA to provide timely responses to information requirements, while also seeking to reduce the reporting burden on countries. For the first time since FRA 2000, the number of variables was to be reduced (to around 60); however, annual reporting was to be introduced for a few key variables in order to provide support for countries in reporting progress towards SDGs.

FRA 2020 will also have a remote sensing component to complement information collected through the country questionnaires, and will benefit from the implementation of a new capacity development plan.

Building on lessons learned from FRA 2015, a new online

reporting system is being developed. Many automated functions for estimation and forecasting of forest area and calculation of biomass and carbon stock are being introduced in the online system to facilitate reporting; in addition, automatic consistency checks will help both the national correspondents and the reviewers. The system will also be structured to allow for the annual reporting of certain core variables for SDG reporting. The new online system aims to become a repository of the most up-to-date forest information worldwide. An important function of the system will be the interactive database to allow easy accessibility of FRA data and customizable analysis. The reporting process for FRA 2020 will begin in 2018 and results are expected to be released in 2020.

A continuously evolving landscape of country needs, international processes and data collection technology are shaping the scope and the reporting framework of FRA 2020.

The 2030 Agenda for Sustainable Development that came into effect in January 2016, will characterize FAO's work for the next 15 years. FAO is the custodian agency for 21 Sustainable Development Goal (SDG) indicators, which means that the Organization is responsible for collecting and analysing related data from national sources, maintaining the indicator documentation and contributing to their further methodological development and related capacity development. FRA is responsible for reporting on two SDG indicators: "Forest area as a proportion of total land area" and "Progress towards sustainable forest management."

Another important development took place in January 2017, when the Special Session of the United Nations Forum on Forests adopted the first UN Strategic Plan for Forests. The plan presented six Global Forest Goals and provided a framework for sustainable management of forests and trees outside of forests as well as for halting deforestation and forest degradation.

Nevertheless, as information needs increase so, too, can collected data as well as the reporting burden on countries, especially if the coordination between different reporting processes and institutions is insufficient.

To facilitate the reporting process and manage the reporting burden, FRA 2020

is strengthening the Collaborative Forest Resources Questionnaire partnership. It is also introducing a joint data collection for pan European reporting to help reduce reporting overlaps. In addition, FRA 2020 is strongly involved in the development of a Global Core Set of forest related indicators, which can be used to assess progress towards Global Forest Goals and other international commitments.

The introduction of an innovative online data collection, review, analysis and reporting platform will also reduce the amount of work needed to produce the FRA 2020 country reports. Through the platform, a number of new tools which facilitate generation of forest area and area change information from remote sensing data, will be made available to countries. The use of these tools, which have been developed in collaboration with FAO's other forest monitoring programmes and projects, are not limited to the generation of regional and global reference statistics, but will also be made available for national needs.

FRA is a process which is made possible by a network of determined and dedicated national correspondents, their alternates and a number of other national experts who collect and report the data. It is also supported by a number of international experts who contribute to the review of the data and analysis of the results. FRA 2020 is proud to build on this legacy.

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Coordinator, FRA 2020



Participants at the seventh Expert Consultation on Global Forest Resources Assessment (FRA): Towards FRA 2020, Joensuu, Finland June 2017.

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LESSONS LEARNED

The wealth of information made available by FAO in seventy years of regular global assessments has undoubtedly contributed to a broadening of public awareness about the importance of forests, and it has also influenced investments by both the public and private sectors in forestry. Although public interest has focused mainly on deforestation, many of the world's forests have changed in other important ways that are less visible. FRA has been monitoring these less visible changes by providing statistics on forest characteristics, stocking density, health and vitality, ownership and management rights, and social and economic aspects of forests. Over the years, progress towards SFM has benefitted from having reliable information with which to monitor the extent of forest resources, their characteristics and changes through time.

The warning messages sent by an earlier FRA about the rapid conversion of tropical forest into agricultural land helped to highlight the global significance of deforestation. FRA results have also provided an objective basis for increased investments to improve forest management in the tropics, by governments, companies, individuals, donor agencies and civil society groups. These investments have, in turn, contributed to the reduction in the rate of tropical forest loss. Forest area and growing stock changes detected through the FRA have also contributed to improved understanding of forests in the global carbon balance and of their role in

climate change mitigation. Forest stock losses arising from long-term land-use change, especially in the tropics, are an important contributor to net greenhouse gas emissions. Data from FRA continue to be important references for the IPCC and for global estimates of emissions from land use and land-use change.

FRA is a main reference for the land-use statistics in FAOSTAT, which is one of the main FAO databases on food and agriculture-related data. Data from FRA have also supported decision-making by various international bodies; for example, by providing data for the Aichi Biodiversity Targets of the CBD, the Global Objectives on Forests of the UNFF and the UNEP Global Environment Outlook. FRA statistics have also been used to inform the development of, and the monitoring of progress towards, the MDGs and the SDGs. Meanwhile, development of the CFRQ helped to strengthen links with criteria and indicator processes such as the Montreal Process and FOREST EUROPE.

The recently developed global core set (GCS) of forest related indicators⁴ has also positioned FRA as one of the main information providers for measuring progress towards SFM.

On the other hand, FRA has also faced criticism. As a country-driven process, FRA depends on the capacity of countries to collect and analyse data and provide reliable estimates of their forest resources. While there have been many significant technical and scientific advances in forest resource assessment

4 Global core set (GCS) of forest-related indicators: Following a number of informal meetings, an international Expert Workshop in Ottawa and an organization-led initiative in Rome, a task force under the CPF has drawn up a proposal for a GCS of forest-related indicators. The aim of the GCS is to simplify and harmonize concepts and terminology, and to simplify and streamline monitoring, while respecting the needs of all potential users. The ultimate outcome of this work should be a clearer, more comprehensive picture of global trends and a significant reduction in reporting burden. The core set aims to bring together existing indicators to harmonize terminology, streamline reporting and prioritize data collection. The GCS is not a new set of criteria and indicators with its own conceptual framework: that framework is provided by high-level policy commitments, including the 2030 Agenda for Sustainable Development with its SDGs, the United Nations Strategic Plan for Forests and the commitments of the Rio Conventions. Many of the relevant data for the indicator set are already collected, or will be collected, through FRA.

during the past 70 years, some countries still lack the capacity (including the training, institutional and financial resources) necessary to conduct periodic assessments and provide reliable data for FRA. However, in many countries good progress has been made in generating new and more reliable data through identifying gaps in knowledge on forest resources, and through capacity development and the strengthening of national stakeholder networks. This has, in turn, resulted in improved FRA estimates.

At the same time, the remote sensing component of FRA has been important. Because of concern that FRA data were less suitable than remote sensing data for monitoring and measuring forest in a dynamic and objective way, remote sensing has been used since 1980. The results from remote sensing have been used to produce an independent reference against which to compare the data reported by the countries, and to help with analysis at the regional and global levels. National experts have made an important contribution to this work.

Comparisons between FRA data and estimates produced through remote sensing techniques have sometimes caused confusion. This confusion has resulted mainly from the difference between figures relating to status and changes in tree cover, and figures relating to forest land use. Under the FRA forest definition, a forest area that is temporarily unstocked due to recent tree-cutting or natural disturbance is still defined as forest, but a remote sensing-based analysis may identify these temporarily unstocked areas as “non-forest” due to the temporary absence of tree cover.

FRA is, and must continue to be, a country-driven process. Future assessments will have to be able to maintain and strengthen collaboration with countries, ensuring that there

is a solid institutional basis for continuous forest reporting capacity; this is likely to be increasingly important with emerging requests for more frequent reporting on key variables and indicators. The establishment and consolidation of an online platform represents a good opportunity for FRA to promote the benefits of collaboration as it will facilitate and streamline reporting to other international reporting processes. It will also serve as a national forest information system for countries that are lacking in the resources and capacities required to establish their own.

Another important challenge facing future assessments will be the need to integrate FRA forestry data with other land use and socio-economic data. The value of forest resource information will be even greater if it is analysed alongside information from outside the forestry sector, such as that relating to the needs of rural and urban populations, grazing intensity and other agricultural requirements, energy demands, biodiversity conservation and water resources, at different levels. Much of this information is already available within FAO, and the opportunities for developing this more integrated approach should be carefully investigated for future FRA.

REFERENCES AND BIBLIOGRAPHY

- de Foresta, H., Somarriba, E., Temu, A., Boulanger, D., Feuilly, H. & Gauthier, M. 2013. *Towards the assessment of trees outside forests: a thematic report prepared in the framework of the Global Forest Resources Assessment*. Forest Resources Assessment Working Paper 183. Rome, FAO. (also available at www.fao.org/docrep/017/aq071e/aq071e01.pdf).
- Del Lungo, A., Ball, J. & Carle, J., 2006. *Global planted forests thematic study. Results and analysis*. Planted Forest and Trees Working Paper 38. Rome, FAO. (also available at www.fao.org/forestry/12139-03441d093f070ea7d7c4e3ec3f306507.pdf).
- FAO. 1948. Forest resources of the world. *Unasylva*, 2(4). Washington, DC. (also available at www.fao.org/docrep/x5345e/x5345e00.htm).
- FAO. 1951. *Resolutions of the sixth session of the Conference* (Rome, 19 November – 6 December 1951). Rome. (also available at www.fao.org/unfao/govbodies/gsbhome/conference/resolutions/1951/en/).
- FAO. 1957. *World forest resources – results of the inventory undertaken in 1953 by the Forestry Division of FAO*. Rome.
- FAO. 1960. *World forest inventory 1958*. Rome. (also available at www.fao.org/docrep/007/ad906t/ad906t00.htm).
- FAO. 1965. *World forest inventory 1963*. Rome. (also available at <http://www.fao.org/3/a-ad907t.pdf>).
- FAO. 1976a. *Forest resources in the European region*. Rome. (also available at <http://www.fao.org/docrep/013/am006e/am006e00.pdf>).
- FAO. 1976b. *Forest resources in the Asia and Far East region*. Rome. (also available at <http://www.fao.org/docrep/013/h6226e/h6226e00.pdf>).
- FAO. 1976c. *Appraisal of the forest resources in the Latin American region*. Document presented at the 12th session of the Latin American Forestry Commission, Havana, Cuba, February 1976.
- FAO. 1981a. *Forest resources of tropical Asia*. Rome. (also available at www.fao.org/docrep/007/ad908e/ad908e00.htm).
- FAO. 1981b. *Los recursos forestales de la América tropical*. Rome. (also available at www.fao.org/docrep/007/ag293s/ag293s00.htm).
- FAO. 1981c. *Forest resources of tropical Africa. Part I: regional synthesis*. Rome (also available at www.fao.org/docrep/007/ad909e/ad909e00.htm).
- FAO. 1981d. *Forest resources of tropical Africa. Part II: country briefs*. Rome. (also available at www.fao.org/docrep/007/ad910e/ad910e00.htm).
- FAO. 1988. *An interim report on the state of forest resources in the developing countries*. Rome.
- FAO. 1993. *Forest resources assessment 1990 - Tropical countries*. FAO Forestry Paper No. 112. Rome. (also available at www.fao.org/docrep/007/t0830e/t0830e00.htm).
- FAO. 1994. *Forest resources assessment 1990: non-tropical developing countries Mediterranean region*. Rome. (also available at www.fao.org/docrep/007/t3910e/t3910e00.htm).

- FAO. 1995a. *Forest resources assessment 1990 - global synthesis*. FAO Forestry Paper No. 124. Rome. (also available at www.fao.org/docrep/007/v5695e/v5695e00.htm).
- FAO. 1995b. *Forest resources assessment 1990: tropical forest plantation resources*. FAO Forestry Paper No. 128. Rome. (also available at www.fao.org/docrep/007/v8330e/v8330e00.htm).
- FAO. 1995c. *Forest resources assessment 1990: non-tropical developing countries*. Rome. (also available at www.fao.org/docrep/007/v8050e/v8050e00.htm).
- FAO. 1996. *Forest resources assessment 1990: survey of tropical forest cover and study of change processes*. FAO Forestry Paper 130. Rome. (also available at www.fao.org/docrep/007/w0015e/w0015e00.htm).
- FAO. 1997. *State of the world's forests 1997*. Rome. (also available at <http://www.fao.org/docrep/w4345e/w4345e00.htm>).
- FAO. 2001. *FRA 2000 main report*. FAO Forestry Paper 140. Rome. (also available at www.fao.org/docrep/004/y1997e/y1997e00.htm).
- FAO. 2003. *FAO yearbook of forest products*. Rome.
- FAO. 2004a. *Specifications of national reporting tables for FRA 2005*. Forest Resources Assessment Programme Working Paper 81. Rome. (also available at <ftp://ftp.fao.org/docrep/fao/007/ad681e/ad681e00.pdf>).
- FAO. 2004b. *Guidelines for country reporting to FRA 2005*. Forest Resources Assessment Programme Working Paper 82. Rome. (also available at www.fao.org/forestry/6564-05f9a765776f4354282e1f8e1d53220a9.pdf).
- FAO. 2004c. *Global Forest Resources Assessment update 2005. Terms and definitions*. Forest Resources Assessment Programme Working Paper 83. Rome. (also available at www.fao.org/docrep/007/ae156e/ae156e00.htm).
- FAO. 2006a. *Global Forest Resources Assessment 2005, main report. Progress towards sustainable forest management*. FAO Forestry paper 147. Rome, Italy (also available at www.fao.org/docrep/008/a0400e/a0400e00.htm).
- FAO. 2006b. *Understanding forest tenure in South and Southeast Asia*. Forestry Policy and Institutions Working Paper 14. Rome. (also available at www.fao.org/3/a-i0440s/j8167e01.pdf).
- FAO. 2007a. *Global Forest Resources Assessment 2010. Specification of national reporting tables for FRA 2010*. Forest Resources Assessment Programme Working Paper 135. Rome. (also available at www.fao.org/forestry/14241-0d7b74f45b0d2cfef31599cc17e4c28cd.pdf).
- FAO. 2007b. *The world's mangroves 1980-2005*. FAO Forestry Paper 153. Rome. (also available at www.fao.org/docrep/010/a1427e/a1427e00.htm).
- FAO. 2007c. *Fire management global assessment 2006*. FAO Forestry Paper 151. Rome. (also available at www.fao.org/3/a-a0969e/index.html).
- FAO. 2008a. *Guidelines for country reporting to FRA 2010*. Forest Resources Assessment Programme Working Paper 143. Rome. (also available at [ftp.fao.org/docrep/fao/012/ak312e/ak312e00.pdf](ftp://ftp.fao.org/docrep/fao/012/ak312e/ak312e00.pdf)).
- FAO. 2008b. *Terms and definitions for country reporting to FRA 2010*. Forest Resources Assessment Programme Working Paper 144/E. Rome.

- FAO. 2009. *Global review of forest pests and diseases*. FAO Forestry Paper 156. Rome. (also available at www.fao.org/3/contents/004f6748-1c62-536a-9954-9c14c721e1ae/i0640e00.htm).
- FAO. 2010. *Global forest resources assessment 2010. Main report*. FAO Forestry Paper 163. Rome. (also available at www.fao.org/docrep/013/i1757e/i1757e.pdf).
- FAO. 2011. *Assessing forest degradation - Towards the development of globally applicable guidelines*. Forest Resources Assessment Working Paper 177. Rome. (also available at www.fao.org/docrep/015/i2479e/i2479e00.pdf).
- FAO. 2012a. *FRA 2015 Terms and definitions*. Forest Resources Assessment Working Paper 180. Rome. (also available at www.fao.org/docrep/017/ap862e/ap862e00.pdf).
- FAO. 2012b. *FRA 2015 Guide for country reporting for FRA 2015*. Forest Resources Assessment Working Paper 184. Rome. (also available at www.fao.org/3/a-au190e.pdf).
- FAO. 2015a. *FRA 2015 country reports*. Rome. (also available at www.fao.org/forest-resources-assessment/current-assessment/country-reports/en/).
- FAO. 2015b. *Global Forest Resources Assessment 2015, desk reference*. Rome. (also available: <http://www.fao.org/3/a-i4808e.pdf>).
- FAO. 2016. *Global Forest Resources Assessment 2015. How are the world's forests changing? Second edition*. Rome. (also available at www.fao.org/3/a-i4793e.pdf).
- FINNIDA. 1987. *Proceedings of Ad hoc FAO/ECE/FINNIDA Meeting of Experts on Global Forest Resources Assessment, Kotka, Finland, 26–30 October 1987*. Bulletin 284 of the Finnish Forest Research Institute. Helsinki.
- FINNIDA. 1993. *Proceedings of FAO/ECE Meeting of Experts on Global Forest Resources Assessment in cooperation with UNEP and with the support of FINNIDA (Kotka II)*, Kotka, Finland, 3–7 May 1993. Research Paper 469 of the Finnish Forest Research Institute. Helsinki.
- Hamilton, L.S., FAO. 2008. *Forests and water: a thematic study prepared in the framework of the Global Forest Resources Assessment 2005*. FAO Forestry Paper 155. Rome. (also available at www.fao.org/3/a-i0410e/index.html).
- IPCC. 2006. *2006 Guidelines for national greenhouse gas inventories. Volume 4. Agriculture, forestry and other land use*. Geneva. (also available at www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html).
- IUCN. 2000. *2000 IUCN Red List of Threatened Species*. Hilton-Taylor, C. (Compiler), Gland, Switzerland and Cambridge, UK.
- Keenan, R.J., Reams, G.A., Achard, F., de Freitas, J.V., Graingers, A. & Lindquist, E. 2015. Dynamics of global forest area: results from the FAO global forest resources assessment 2015. *Forest ecology and management*, 352: 9–20. (also available at www.sciencedirect.com/science/article/pii/S0378112715003400).
- Lanly, J.P. 1982. *Tropical forest resources*. FAO Forestry Paper No. 30. Rome.
- Lanly, J.P. 1983. Assessment of forest resources of the tropics. *Commonwealth Forestry Review, Forestry abstracts*, 44(6): 287–318.

- Lindquist, E.J., D'Annunzio, R., Gerrand, A., MacDicken, K., Achard, F., Beuchle, R., Brink, A., Eva, H.D., Mayaux, P., San-Miguel-Ayanz, J. & Stibig, H-J.** 2012. *Global forest land-use change 1990–2005*. FAO Forestry Paper 169. Rome, FAO and JRC. (also available at www.fao.org/docrep/017/i3110e/i3110e.pdf).
- Lobovikov, M., Paudel, S., Piazza, M., Ren, H., & Wu, J.** 2007. *World bamboo resources, a thematic study prepared in the framework of the Global Forest Resources Assessment 2005*. Non-wood forest products 18. Rome, FAO. (available at www.fao.org/3/a-a1243e.pdf).
- MacDicken K.**, ed. 2015. *Changes in global forest resources from 1990 to 2015*. *Forest Ecology and Management*. 352: 1–146.
- METLA.** 1996. *Proceedings of FAO/ECE Expert Consultation on Global Forest Resources Assessment 2000 in cooperation with ECE and UNEP with the support of the Government of Finland (Kotka III), Kotka, Finland, 10–14 June 1996*. Research Paper 620. Finnish Forest Research Institute. Helsinki.
- METLA.** 2002. *Proceedings of FAO/ECE Expert Consultation on Global Forest Resources Assessment 2005 (Kotka IV), Kotka, Finland, 1–5 July 2002*. Research Paper 889. Helsinki, Finnish Forest Research Institute.
- METLA.** 2007. *Kotka I-V 20 years of expert consultations on Global Forest Resources Assessments*. METLA, FAO and UNECE. Helsinki, Finnish Forest Research Institute.
- Palo, M. & Uusivuori, J., eds.** 1999. *World forests, society and environment*. *World forests*, Volume I, 404 pp. Springer Netherlands.
- Persson, R.** 1974. *World forest resources - review of the world's forest resources in the early 1970s*. Department of Forest Survey, Reports and Dissertations No. 17. Stockholm, Royal College of Forestry. (also available at: <http://foris.fao.org/static/data/fra2010/WorldForestResources.pdf>).
- Persson, R.** 1975. *Forest resources of Africa – an approach to international forest resources appraisal, Part I: country descriptions*. Department of Forest Survey, Reports and Dissertations No. 18. Stockholm, Royal College of Forestry. (also available at: http://foris.fao.org/static/data/fra2010/ForestResourcesofAfrica_Part1.pdf).
- Persson, R.** 1977. *Forest Resources of Africa. Part II: regional analyses*. Department of Forest Survey, Reports and Dissertations No. 22. Stockholm, Royal College of Forestry. (also available at: http://foris.fao.org/static/data/fra2010/ForestResourcesofAfrica_Part2.pdf).
- Phillips, R.** 1981. *FAO: its origin, formation and evolution 1948–1981*. Rome, FAO. (also available at www.fao.org/3/a-p4228e.pdf).
- Singh, K.D.** 1993. The 1990 tropical forest resources assessment. *Unasylva*, 44(3): 10–19. (also available at www.fao.org/docrep/v0290e/v0290e00.htm#Contents).
- Sommer, A.** 1976. Attempt at an assessment of the world's tropical moist forests. *Unasylva*, 28: 5–25, Rome, FAO. (also available at www.fao.org/docrep/k0050e/k0050e03.htm).
- UNECE & FAO.** 1985. *The forest resources of the ECE region: Europe, the USSR, North America*. Geneva.
- UNECE & FAO.** 1992. *The forest resources of the temperate zones: main findings of the UN-ECE/FAO 1990 forest resource assessment*. 33 pp. (ECE/TIM/60) United Nations, New York.

UNESCO. 1973. International classification and mapping of vegetation. *Ecology and Conservation*, No. 6. Paris.

United Nations. 2008a. *Official list of MDG indicators*. United Nations Statistics Division, New York, USA. (also available at unstats.un.org/unsd/mdg/Resources/Attach/Indicators/OfficialList2008.pdf).

United Nations. 2008b. *Resolution adopted by the General Assembly on the report of the Second Committee (A/62/419 (Part 1)) 62/98. Non-legally Binding Instruments on All Types of Forests. A/RES/62/98.* (also available at www.fao.org/forestry/14717-03d86aa8c1a7426cf69bf9e2f5023bb12.pdf).

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