Annex 6
Earlier global assessments

FAO was founded on 16 October 1945. At the first session of the Conference of FAO, the need for up-to-date information on the forest resources of the world was highlighted. This reflected concern for a possible future lack of timber, not least due to the needs for reconstruction after the Second World War and for support to development in tropical countries. It was recommended, therefore, that a global forest resources inventory should be undertaken as soon as possible. In May 1946, the Forestry and Forest Products Division was founded and work initiated on FAO's first worldwide assessment of forests, published two years later (FAO, 1948). After reviewing the results of this assessment, the sixth session of the FAO Conference recommended that the Organization "maintain a permanent capability to provide information on the state of forest resources worldwide on a continuing basis" (FAO, 1951). Since that time, regional and global surveys have been conducted every five to ten years. Each has taken a somewhat different form.

Statistics released by FAO on world forest area from 1948 through 1963 were largely collected through questionnaires sent to the countries. The assessments since 1980 have taken a more solid technical form, being based on analysis of country references supported by expert judgements, remote sensing and statistical modelling.

FRA 2000 was based on a range of references and information on forest area, the condition of forests and their management, forest services and NWFPs. FRA 2000 was also notable for applying, for the first time, a single definition of forest at the global level with common minimum thresholds, including a 10 percent crown cover density.

FRA 2005 was the most comprehensive assessment of its time, and encouraged active participation by reporting countries. More than 800 people were involved in the process, including 172 officially nominated country correspondents, together with their national teams, the FRA advisory group, FAO and UNECE staff, consultants and volunteers from all around the world. Information was gathered and analysed for 229 countries at three points in time: 1990, 2000 and 2005. The FAO team, countries and specialists worked together on the design and implementation of FRA 2005, through expert consultations, training courses, regional meetings and ongoing communication. The FRA 2005 process resulted in greater knowledge of forest resources and forestry, facilitated transparent reporting, and enhanced national capacity to collect, analyse and report on more than 40 variables covering the extent, condition, uses and values of forest resources and other wooded land. The findings were presented according to six main themes and aimed at assessing progress towards sustainable forest management.

Statistics from the different assessments do not lend themselves to comparative analysis, owing to changes in baseline information, methods and definitions. However, better correlations can be achieved for time series in many countries for certain assessments, especially with information generated since 1980. Consistent definitions of forests were applied for developing countries for subsequent assessments – and for all countries as of FRA 2000.

FAO'S GLOBAL AND REGIONAL ASSESSMENTS 1946–2001

Forest resources of the world (1948)

For the first global survey, *Forest resources of the world* (FAO, 1948), a questionnaire was sent to all countries, with 101 responding, which represented about 66 percent of

the world's forests. Parameters included were forest area (total and productive), types of forest by accessibility of wood resources, growth and fellings.

One of the noteworthy conclusions of the first report was that:

> *"All these investigations made valuable additions to our knowledge, but all suffered from certain fundamental difficulties. Most important of these were the lack of reliable forest inventory information … and the lack of commonly accepted definitions of some of the more important forestry terms. Hence, to the weakness of some of the quantitative estimates, there was added doubt as to the real meanings of some of the qualitative descriptions" (FAO, 1948).*

While technical and scientific advances have greatly increased the potential to improve the information base in countries, many still lack the training, institutional and financial resources to conduct periodic assessments.

Major findings on forest area and forest area change

- Total forest area (global): 4.0 billion hectares
- Net forest change (global): not reported

World forest inventories (1953, 1958 and 1963)

World forest inventories were carried out on three occasions during the 1950s and 1960s. Lanly (1983) describes these various inventories:

> *...126 countries and territories replied to the 1953 questionnaire representing about 73 percent of the world forest area. The picture was completed by information from the replies to the 1947 questionnaire for 10 other countries (representing 3 percent of the total world forested area) and official statistics for the remaining 57 countries, representing 24 percent of the world forest area. The results were published by FAO in 1955 under the title* World forest resources – results of the inventory undertaken in 1953 by the Forestry Division of FAO.
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> *The 1958 inventory … (*World Forest Inventory 1958 – *the third in the quinquennial series compiled by the Forestry and Forest Products Division of FAO)* [FAO, 1960] *utilized the replies of the 143 countries or territories, representing 88 percent of the world forest area, complemented by the replies to the 1953 questionnaire for 13 countries (2 percent) and to the 1947 questionnaire for 5 countries (3 percent). Necessary changes and precisions introduced in the definition of some concepts, more precise definitions of forests and changes in such concepts as forest-in-use and accessible forests affected comparability with the previous inventories. However, changes in area and other forest characteristics during the 1953-58 period were, for several countries, either reported directly from them or could be derived by comparison of the replies to both questionnaires (changes in area of permanent forests, in management status ... increase in accessible areas and in forest-in-use, afforested area between 1953 and 1957, etc.).*
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> *The* World Forest Inventory 1963 *published by FAO in 1965 witnessed a slightly lower rate of response (105 compared to 130), "at least partly accounted for by temporary strains on administration in countries gaining their independence" as was reported in the document. Again comparability with the former enquiries was limited, and, as pointed out by the authors of the report, "large differences for some countries (between the results of the 1958 and 1963 enquiries) resulted more from better knowledge about the forests, or stricter application of definitions, than from effective changes in the forest resources".*

The main parameters assessed during the *World forest inventory 1963* were forest area (total, productive and protected), ownership, management status, composition (softwoods and hardwoods), growing stock and removals (FAO, 1966).

Major findings on forest area and forest area change (1963)

- Total forest area (global): 3.8 billion hectares
- Net forest change: not reported

Regional forest resources assessments (1970s)

During the 1970s, FAO did not carry out global surveys. Instead, a series of regional assessments were conducted, with the intention that each would be more appropriate and specific to the regions. Beginning in the late 1960s, FAO sent out questionnaires to all industrialized countries. The results were published in 1976 as *Forest resources of the European Region* (FAO, 1976b). Questionnaires were also sent to Asia and Latin America, and the results were published in *Forest resources in the Asia and Far East Region* (FAO, 1976c) and *Appraisal of forest resources of the Latin American Region* (FAO, 1976a). A similar questionnaire was sent to African countries by the Department of Forest Survey of the Swedish Royal College of Forestry and the results published in *Forest resources of Africa – an approach to international forest resources appraisal, Part I: country descriptions* (Persson, 1975) and *Part II: Regional analyses* (Persson, 1977).

According to Lanly (1983), the regional assessments of the developing countries had the following main features in common:

- they were based only in part upon questionnaires, the rest of the information having been collected in another form, in particular through travel to countries of the region concerned;
- they included more qualitative information (description of forest types, indication of species planted, quotation of figures on volumes and other stand characteristics extracted from inventory reports, etc.), while the *World Forest Inventory* assessments were essentially statistical;
- in addition to regional statistical tables, country notes were prepared regrouping the quantitative information selected for each country;
- since the information provided was not limited to the replies to the questionnaires, the draft country notes were sent back to the national forest institutions for their comments and suggested amendments.

Although FAO did not compile the regional findings into a global synthesis, a global survey was done outside FAO and published in *World forest resources – review of the world's forest resources in the early 1970s* (Persson, 1974). Another FAO study, *Attempt at an assessment of the world's tropical moist forests* (Sommer, 1976), provided a summary of findings on the forest situation in all tropical moist forests.

FRA 1980

FRA 1980 covered 97 percent of the land area of developing countries or 76 tropical countries: 37 in Africa, 16 in Asia and 23 in Latin America and the Caribbean. FRA 1980 was distinguished by many features. Its breadth was the greatest up to that time, and in many cases remains unmatched by more recent assessments. It is also notable as the first assessment to use a definition of forests in which measurable parameters were indicated – 10 percent canopy cover density, minimum tree height of 7 m and 10 ha as the minimum area. Previous assessments had relatively broad definitions, which could be interpreted quite differently by different countries. This consistent definition provided parameters useful in adjusting country information to a common standard. An adjustment in time was also made, using expert opinion to project the information to common reference years of 1976, 1980, 1981 and 1985.

FRA 1980 relied extensively on existing documentation from countries to formulate its estimates of forest area (status and change), plantation resources and wood volume.

Existing information from multiple sources in the countries was gathered and analysed. Dialogues with national and international experts on information utility and reliability helped to firm up country estimates. The assessment noted that information was abundant, but that it was hard to locate and synthesize in the coherent manner needed for a consistent global survey.

Extended narratives, explanatory text and qualitative information complemented the statistical data set. During the tenure of FRA 1980, FAO was conducting extensive work on forest inventories in tropical countries. Roughly one project existed for every two to three countries, and FAO experts in the projects provided valuable input to the 1980 assessment results.

In major forested areas for which existing information was lacking, the assessment conducted manual interpretations of satellite imagery (1:1 000 000 scale). This was done for six Latin American countries, two African countries, two Asian countries and portions of two other Asian countries. The interpretations covered about 70–99 percent of these countries, using 55 satellite images.

The final documentation for FRA 1980 included three volumes of country briefs (one for each developing country region) (FAO, 1981a, b and c), three regional summaries and a condensed main report, published as an FAO Forestry Paper (FAO, 1982). While the findings were not global, FRA 1980 was used again in 1988 to make an interim global assessment.

Major findings on forest area and forest area change

- Total forest area (tropical developing countries only) 1980: 2.1 billion hectares (natural forests and plantations)
- Net forest change (tropical developing countries only) 1981–1985: -10.2 million hectares per year
- Net forest change (global): not reported

Interim assessment 1988

The *Interim report on the state of forest resources in the developing countries* (FAO, 1988) provided information on 129 developing countries (53 more than FRA 1980) as well as on industrialized countries. The report provided information on the state of forests in the year 1980 and changes over the period 1981–1985. Definitions varied between the industrialized and developing countries specifically for crown cover thresholds for forests, which were set at 20 percent for industrialized countries and 10 percent for developing ones. Information on the industrialized countries was collected by UNECE in Geneva, which drew on the report *Forest resources of the ECE region (Europe, the USSR, North America)* (UNECE and FAO, 1985). Parameters varied as well for the two groups of countries. Thus a global synthesis of core elements was needed in order to achieve a uniform global data set.

Elements of the global synthesis included forest, operable forest, inoperable forest, other wooded land, broad-leaved forest and coniferous forest.

Major findings on forest area and forest area change

- Total forest area (global) 1980: 3.6 billion hectares
- Net forest change (tropical developing countries) 1981–1985: -11.4 million hectares per year
- Net forest change (global): not reported

FRA 1990

FRA 1990 (FAO, 1995) covered all developing and industrialized countries and was distinguished by two innovations: the development and use of a computerized 'deforestation model', which was applied to the developing country data in order to

project forest area statistics to a common reference year; and an independent, pan-tropical remote sensing survey of forest change based on high-resolution remote sensing data.

FRA 1990 sought to improve estimates by eliminating the bias in expert opinions through a statistical model for predicting forest area loss (and thus deforestation rates). The model was based on forest area change derived from the few comparable multi-date assessments available. Deforestation rates were then regressed against independent variables to determine the rate of forest loss relative to changes in population densities within specific ecological zones. Forest area change rates were obtained by applying the model to available baseline statistics for the countries.

The advantages of the 1990 method were the near-uniformity achieved by applying the model equally to almost all developing countries and the ability to streamline the production of statistics using computer routines.[38] The disadvantages of the 1990 method were the low number of variables used in the deforestation algorithm and the low number of observations used to construct the model, introducing a relatively high random error (i.e. low precision) in country estimates.

Because of the many uncertainties involved in working with existing national data, FRA 1990 implemented a remote sensing survey to provide a quality-controlled set of statistics on forest resources. The use of statistical sampling combined with a uniform data source (satellite imagery) and standard data-collection methods were important tools in providing a set of statistics to compare with the country data.

The survey relied on statistical sampling (10 percent) of the world's tropical forests through 117 sample units distributed throughout the tropics. Based on the sampling, estimates were produced of the status of and changes in tropical forests at regional, ecological and pan-tropical levels (but not at the national level). Each of the sample units consisted of multi-date, Landsat satellite images, which provided the raw material for producing statistics on forest and other land cover changes from 1980 to 1990.

FAO used an interdependent, manual interpretation of satellite scenes at a scale of 1:250 000, conducted by local professionals, where possible, and internationally experienced professionals in other areas. Multi-date image interpretations were manually compared to one another. Ground information was incorporated into about 50 percent of the interpretations. In some areas, ground truthing was not necessary, owing to the large and consistent amount of forest. In other locations, especially where the composition of the landscape was highly differentiated, it was found to be very valuable.

The principal output of the remote sensing survey was a change matrix that illustrated and quantified how the forest and landscape change over time. The forest and land cover classification scheme of the remote sensing survey was linked closely to the FRA classes for global reporting by countries.

Different definitions of forests for developing and industrialized countries limited the utility of the final global synthesis, as did the absence of change information on forests in industrialized countries. Only changes in the area of forest, combined with other wooded land, were assessed (the definition of forest was again set at 20 percent crown cover density for industrialized countries and 10 percent for developing countries).

The assessment covered the parameters of volume, biomass, annual harvesting (tropics) and plantations. Brief summaries were also prepared on conservation, forest

[38] Two different models were used – one for the tropics and one for subtropical areas. Other differences among countries included the lack of: baseline data in some countries, a uniform ecological map and comparable multi-date observations.

management and biological diversity. Unfortunately, the country briefs prominent in FRA 1980 were discontinued.

Major findings on forest area and forest area change

- Total forest area (global) 1990: 3.4 billion hectares
- Net forest change (tropical developing countries) 1980–1990: -13.6 million hectares per year
- Net forest change (global) 1980–1990: -9.9 million hectares per year (forest and other wooded land combined)

Interim 1995 assessment

An interim 1995 assessment was published in *State of the World's Forests 1997* (FAO, 1997). This report published new statistics on forest area status and change for all countries with a reference year of 1995, and a change interval from 1991–1995. The definition of forest set canopy closure thresholds at 20 percent for industrialized countries and 10 percent for developing countries.

The baseline information set was drawn, with a minimum of updating, from FRA 1990 data and had an average reference year of 1983. Although FAO contacted all developing countries and requested their latest inventory reports, updated information was submitted and used only for Bolivia, Brazil, Cambodia, Côte d'Ivoire, Guinea-Bissau, Mexico, Papua New Guinea, the Philippines and Sierra Leone.

The FRA 1990 deforestation model was used to adjust developing country statistics to standard reference years (1991 and 1995). No adjustments to standard reference years were made for industrialized country statistics. Consequently, the industrialized and developing country data were not harmonized in terms of their definitions or reference year.

Major findings on forest area and forest area change

- Total forest area (global) 1995: 3.4 billion hectares
- Net forest change (tropical developing countries) 1990–1995: -12.7 million hectares per year
- Net forest change (global): -11.3 million hectares per year (total forests)

FRA 2000

FRA 2000 improved on previous assessments in several ways. It covered more countries and parameters and used a single global definition of forest. The average national inventory year for information was closer to the global reporting year than in previous assessments. More support than in the past was given to country capacity-building; and new technologies, such as remote sensing, were used extensively. Reliability of the results was thus greatly enhanced, but there were still many information gaps.

In FRA 2000, a uniform definition of forest – 10 percent canopy cover – was used for all regions of the world. Revised estimates were made for the area of temperate and boreal forests in 1990 using the definition and methodology adopted in 2000.

An independent remote sensing survey used the same 117 sample units used in FRA 1990 and added recent Landsat satellite images, which made the production of statistics possible on forest and other land cover changes from 1980 to 2000. The resulting change matrix illustrated and quantified changes in the forest and landscape over time. The survey showed different patterns among regions within the tropics, which may have reflected general land-use patterns and policies. In Latin America, large-scale, direct conversion of forests dominated. Direct conversions also dominated in Africa, but on a smaller scale. In Asia, the area of gradual conversions (intensification of shifting agriculture) was equal to the direct conversions from forests to other land

uses. At the global level, direct conversions dominated the picture, accounting for about three-quarters of the converted area. Most tropical deforestation was thus a result of rapid, planned or large-scale conversion to other land uses, mainly agriculture.

Efforts were made to increase the transparency and availability of background information. Many working papers were published in order to provide details on key countries and topics. Statistics, together with their underlying analyses and assumptions, were published on the FAO website. Countries were officially requested to confirm their key statistics before publication. As a follow-up, a dedicated issue of *Unasylva* (FAO, 2002) reviewed forest resources assessment processes at global and national levels. The Kotka IV expert consultation in 2002 also reviewed the FRA 2000 process and results (Luhtala and Varjo, 2003).

Major findings on forest area and forest area change

- Total forest area (global) 2000: Nearly 3.9 billion hectares, of which 95 percent was natural forest and 5 percent forest plantations
- Net forest change (global) 1990–2000: -9.4 million hectares per year (forest)
- Global deforestation 1990–2000: 14.6 million hectares per year
- Global increase in forest area due to afforestation and natural expansion of forests during the same period: average of 5.2 million hectares per year
- Net forest change (tropical countries) 1990–2000: -12.3 million hectares per year
- Net forest change (non-tropical countries) 1990–2000: +2.9 million hectares per year

FRA 2005

The Global Forest Resources Assessment 2005 (FRA 2005) involved more than 800 people including national correspondents and their teams, an advisory group, international experts, FAO and UNECE staff, consultants and volunteers from around the world.

Information was collected and analysed for 229 countries and areas for three points in time: 1990, 2000 and 2005. FAO worked closely with countries and specialists in the design and implementation of FRA 2005 – through regular contact, expert consultations, training for national correspondents and ten regional and subregional workshops. This process represented a truly global partnership that resulted in improved knowledge of the world's forests and forestry, a more transparent reporting process, and enhanced capacity in data analysis and reporting.

FRA 2005 examined the status and recent trends for more than 40 variables covering the extent, condition, uses and values of forests and other wooded land, with the aim of assessing the benefits derived from forest resources. The results were presented according to six themes representing important elements of sustainable forest management:

- extent of forest resources;
- biological diversity;
- forest health and vitality;
- productive functions of forest resources;
- protective functions of forest resources;
- socio-economic functions.

Major findings on forest area and forest area change

- Total forest area (global) 2005: Just over 3.95 billion hectares, of which primary forest accounted for 36 percent, modified natural forest accounted for 53 percent, semi-natural forest accounted for 7 percent, productive plantations for 3 percent and protective plantations 0.8 percent

- Net forest change (global) 1990–2000: -8.9 million hectares per year (forest)
- Net forest change (global) 2000–2005: -7.3 million hectares per year (forest)
- Global deforestation 1990–2005: 13 million hectares per year with no significant change over time
- Global increase in forest area due to afforestation and natural expansion of forests: an average of 4.1 million hectares per year during 1990–2000 and 5.7 million hectares per year during 2000–2005