

UNDERSTANDING THE FRA 2000

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This Briefing Note has been prepared by the World Resources Institute in response to the launch of the Forest Resources Assessment 2000. It comments on the methodology and principal findings of the new FAO report and makes the following observations:

- *Global deforestation is probably not slowing down, even though FAO's results can be interpreted to suggest that it is. The confusion arises because FAO focuses on a net rate of global forest change in which destruction of natural forests is offset by plantation establishment. Natural forest loss in the tropics appears to have accelerated.*
- *Tracking long-term trends in forest cover has been made more difficult because FAO has produced new estimates of global forest cover for 1990 that are much higher than previous estimates made for that year.*
- *The quality of forest data in many developing countries is still too poor to draw firm conclusions. Some developed country data are also unreliable. At the beginning of the 21st century, official intergovernmental processes do not produce consistent and replicable estimates of the world's forested area.*
- *The FAO has made a heroic effort in the face of great technical, institutional, and financial constraints. There is an urgent need for greater efforts at national and international levels to improve the quality and timeliness of information available.*

INTRODUCTION

The United Nations Food and Agriculture Organization (FAO) has produced a new assessment of the world's forests, the latest in a series of 10-yearly reports. The *Forest Resources Assessment 2000*

(FRA 2000) provides estimates of the world's total forest area in 2000 and changes that have occurred since 1990, as well as information on forest ownership, management, and environmental parameters such as forest fires and biomass volumes. No other organization provides such comprehensive information on global forest cover. The data in FAO's report will be used by ecologists and climate change scientists, by policymakers, educators, and environmental activists worldwide for years to come. Clearly, it is important that the report's findings are as accurate as possible. Equally, they should be replicable so that future assessments can be compared to the current report.

The FRA 2000 is the result of a dedicated effort to compile and analyze vast amounts of information, much of which is incomplete, inconsistent, and not comparable over time within or among countries. Regular forest monitoring in most developing countries remains hampered by resource and institutional constraints, and the absence of standardized data collection and recording techniques introduces errors that cannot be quantified. Developed country forest inventories also suffer from inconsistencies in measurement and reporting.

The uneven quality of data, and the ways in which data have been processed and presented, raise a number of important questions about the reliability of the new report's findings. Do we know how much forest the world still has? Is deforestation slowing down or not? It appears from FRA 2000 that these questions still cannot be answered with much confidence. This paper summarizes the findings of FRA 2000, provides some guidelines for interpreting them, and asks what we have really learned from the new study. It concludes with some recommendations for improving global forest monitoring.



SUMMARY OF FRA 2000 FINDINGS

The FAO reports that the world's total forest cover in 2000 was 3.86 billion hectares, of which 44 percent is found in the developed countries, and 56 percent in the developing countries. Total forest cover in 1990 is reported as 3.95 billion hectares. The world's forests thus declined by 90.4 million hectares during the 1990s, a loss of 9 million hectares, or 0.2 per cent, annually. This rate of decline appears slower than that reported for the first half of the decade. In its last report, FAO estimated that net forest loss between 1990 and 1995 was 11 million hectares per year, or 0.3 percent annually. FRA 2000 also reports extensively on various biological parameters and environmental goods and services provided by forests in the temperate and boreal regions; this paper deals only with FAO's new estimates of forest area and deforestation rates.

HOW MUCH FOREST DO WE REALLY HAVE?

Estimates of Total Forest Cover Have Been Revised Upward

The new estimates of global forest cover in 1990 and 2000 are not as straightforward as they first appear. The FAO has revised its previous estimates of global forest cover upward. The higher estimates of forest cover in 1990 and the new estimates for 2000 are based on definitional changes, new information, and changed methodologies. The FRA 2000 should be seen as superseding the FRA 1990 and the revised version of FRA 1990 that was published in *State of the World's Forests 1997* (SOFO 1997). The new assessment is not, therefore, directly comparable with earlier assessments.

The estimate of global forest cover in 1990 – *the baseline from which changes in forest cover are calculated* – has been revised upward, to 3.95 billion hectares from 3.44 billion hectares. This represents an increase of 15 percent over the original estimate made in 1990. The biggest revisions occur in the developed countries – in Australia and the Russian Federation. Major revisions have also been made to forest cover in tropical Africa and temperate Asia. Estimates of total forest cover at the regional and global levels according to FRA 1990 and FRA 2000 are compared in Table 1.

Why Has the Baseline Changed?

In the developed countries, the higher baseline appears to be due in large part to a change in the definition of forest land. In the 1990 assessment, developed country forests were defined as land with tree crown cover of more than about 20 percent of the area. The developing country threshold was 10 percent tree crown cover. In the FRA 2000, the definition has been standardized to 10 percent for all countries. While improving international consistency and comparability, the reduction of the threshold in the developed countries from 20 percent to 10 percent has led to land formerly defined as “other wooded land” now being defined as “forest land”. (A threshold of 10 percent is low enough that it includes land that most nonspecialists would consider to be tundra, wooded grassland or savanna, or scrubland – not forest.)

In the case of Australia, the new definition of forest land has led to a statistical increase in forest area from 40 million hectares in the 1990 assessment to 158 million hectares in the new assessment. The new Australian baseline accounts for over 40 percent of the net increase in forest area reported for the developed countries, with much of the remainder

Region	Total Forest Cover, 1990 Baseline			Total Forest Cover, 2000 FRA 2000
	FRA 1990	FRA 2000	Difference (%)	
Africa	545,085	702,502	29	649,866
Asia	489,530	551,457	13	547,744
Oceania	88,254	201,992	129	201,164
Europe	895,295	1,030,780	15	1,039,514
North America	456,737	466,684	2	470,564
Central America & Caribbean	74,539	88,318	23	78,740
South America	892,930	910,478	2	874,194
World	3,442,370	3,952,211	15	3,861,786

Note: Countries in regional groupings in FRA 1990 have been adjusted to match those of FRA 2000, with one exception. The Caucasian countries of the Former Soviet Union could not be disaggregated from FRA 1990 regional groupings, where they are included in Europe. In FRA 2000, they are included in Asia. Total forest area in these countries in 1990, according to FRA 2000, was less than 20 million hectares.

Sources: *Forest Resources Assessment 1990: Global Synthesis*. FAO Forestry Paper 124, Table 6. *Forest Resources Assessment 2000* (2000). Table 4. Available on-line at: <http://www.fao.org/forestry/fo/fra/index.jsp> Last accessed 6 March, 2001



accounted for by Russia. It is worth noting that some parts of the Australian outback that are officially classified in Australia as “desert” have 10 percent tree crown cover and are now recorded by FAO as “forest”.¹

How Reliable Are Estimates for the Developed Countries?

The FRA 2000 involves two separate studies, each using different methodologies. The developed countries² are surveyed via detailed questionnaires completed by national governments. Information on national forest resources is provided from forest inventories that are built up from field surveys, aerial photography, and satellite imagery. Sampling and statistical analysis have reached a high level of sophistication in most developed countries and the quality of the information is judged to be generally good. However, national data are often not completely comparable with each other because of differences in national forestry definitions and systems of measurement, and the use of different reference periods. Some Central and Eastern European countries had to be assessed on the basis of inventory data from the 1980s and expert judgment. Information from all the developed countries is analyzed and harmonized by the United Nations Economic Commission for Europe (UN/ECE), located in Geneva, then forwarded to FAO, where the results are adjusted further.

More seriously, there are major inconsistencies in the methodologies used to define and measure natural forest area in Russia and Canada. Complex national definitions of Russian forest land have long obscured actual forest cover in that country. Furthermore, the boundary between northern forest and tundra is vague, and the additional forest that should be counted under the new 10 percent threshold proved hard to quantify. Data from Canada are highly aggregated from Provincial sources, and report only on productive forest land. Unproductive forests are classified as “other wooded land” in FRA 2000, even though many of them appear to meet the FAO definition of forest land. This results in underreporting of more than 170 million hectares, or 40 percent of Canadian forest land. ***Because Canada and Russia account for at least 65 percent of all forests in the developed country survey, methodological incon-***

sistencies in their reporting skew the results for the entire temperate and boreal forest region.

How Reliable Are Estimates for the Developing Countries?

The developing countries are directly assessed by FAO, on the basis of national forest inventory data, supplemented by satellite information and expert opinion. FAO acknowledges that forest inventory information remains poor, despite some improvement since 1990. ***More than half the developing country inventories used by FAO were either more than 10 years old or incomplete.*** Of the 137 developing countries surveyed for the 2000 report, only 22 have systems for continuous forest monitoring. Of the remainder, 43 have made single national forest inventories since 1990, and 34 last made national forest inventories before 1990. 33 countries have only a partial forest inventory, and 28 are without any national forest inventory. Even this interpretation of data sources may be optimistic. The source for many tropical country estimates is given simply as “expert estimates” and it is not clear whether the reference years given for the estimates refer to the actual data used to make that estimate or simply to when the estimate was made.

The higher estimates of forest cover in 1990, and the new estimates for 2000, owe much to methodological changes adopted in the new assessment. The FAO no longer uses mathematical models to compensate for poor data on national forest cover in the developing countries. The FRA 1990 used a “deforestation model” to adapt available data to the standard reference years of 1980 and 1990. Forest cover change over time was correlated with variables including population growth and density, initial forest cover, and ecological zone. The model was widely criticized. In the FRA 2000, there is, instead, greater reliance on national statistics, the use of high resolution Landsat TM satellite data, and expert opinion. The FRA 2000 has thus moved back to the expert assessment approach used 20 years ago, but it remains unclear why this change has led to so many upward revisions to estimates of forest area in the tropics. (*See Box 1.*)



Box 1. What's Going On at the Country Level?

Brazil and Indonesia together account for about 35 percent of all tropical forests.³ Both countries also provide forest data of better than average quality. In FRA 2000, the baseline estimate of Indonesia's forest area in 1990 has been revised up slightly, from 116 to 119 million hectares, but Brazil's 1990 forest cover has been revised downward: from 566 million hectares to 555 million hectares. By 2000, Indonesia's forest cover is reported to have fallen to 105 million hectares, while Brazil's fell to 532 million hectares. Thus, the two most important countries for tropical forests appear to have suffered significant losses.

FRA 2000 reports that the great majority of other tropical countries also suffered declines in their total forest cover between 1990 and 2000. However, many of these countries have had their baseline year (1990) estimates of forest cover revised upward, in some cases dramatically. In Africa, for example, forest cover in the Democratic Republic of Congo has been revised upward, from 113 million hectares in FRA 1990 to 141 million hectares in FRA 2000. The estimate of Angola's forest cover in 1990 has been revised up from 23 million hectares to 71 million hectares. Other countries have had their 1990 forest cover revised downward. The aggregate effect of all revisions is that FAO's estimate of total forest cover in all tropical countries in 1990 increased by 189 million hectares between the assessments of 1990 and 2000.

HOW BAD IS DEFORESTATION?

FRA 2000 reports that the net rate of global forest loss in the 1990s averaged 9 million hectares per year, and that the gross rate of deforestation was approximately 12 million hectares per year. These statistics can be difficult to understand because they involve two levels of aggregation. The *net rate* of global forest loss refers to the rate of change in "total forest cover" – a category that aggregates natural forests and plantations in all parts of the world. Net forest loss is therefore calculated as the outcome of deforestation in some regions, partially offset by plantation establishment in other regions. The *gross rate* of global deforestation refers to losses of natural forest, excluding gains in plantation area, but it still aggregates forest losses in different parts of the world.

Disentangling Net and Gross Rates of Change

Interpretation of deforestation trends is made difficult by FAO's use of the category "total forest cover", which aggregates natural forests and plantations.⁴

Although it is helpful in some respects to monitor the change over time in the combined figure, the two types of forest are very different from one another in terms of biodiversity, biomass volumes, productivity (plantations are heavily biased towards wood fiber production), management (clearfelling is common in plantations and rare in closed tropical forests), and amenity value.

FRA 2000 disaggregates natural forest and plantation area to report on changes in natural forest cover at the global level and in the tropical countries as a whole (although not, at the time of writing, at a more disaggregated level). FAO reports that the tropical countries lost an average of 13.5 million hectares of natural forest per year, while natural forest in the temperate regions regrew by 1.5 million hectares per year.

Table 2 (*see end of paper*) presents a more detailed set of natural forest loss rates for the tropical and temperate regions. Because FRA 2000 does not provide plantation area data for 1990, it was not possible to disaggregate natural forest area from total forest cover for that year, using FRA 2000 data only. Natural forest area in 1990 was calculated by subtracting plantation area in 1990, published in the FRA 1990, from total forest cover in 1990, published in FRA 2000. Natural forest area in 2000 was calculated by subtracting plantation area in 2000 from total forest cover in 2000 (all data published in FRA 2000). Rates of natural forest loss were calculated as the difference between natural forest area in 1990 and 2000.

Table 2 shows that adjusting from changes in total forest cover to changes in natural forest cover does not significantly affect tropical Africa, where plantations are of comparatively minor importance. However, rates of natural forest loss appear to be more than twice the rates of total forest loss reported by FAO in tropical Asia. In temperate Asia (especially China), plantation establishment exceeded natural forest loss so, while FRA 2000 reports a positive net change in total forest cover between 1990 and 2000, natural forest was actually lost at a rate of nearly one percent per year. Temperate South America lost natural forests at the rate of nearly one percent per year, while plantation area more than doubled, reducing the net rate of total forest loss to half a percent per year.



In the tropical countries as a whole, FRA 2000 reports a net rate of total forest loss of about 12 million hectares per year, a total of 120 million hectares over the decade. If plantation establishment is excluded, natural forest loss in the tropics is reported to be 13.5 million hectares a year, a total of 135 million hectares over the decade. However, ***WRI calculations indicate that natural forest losses in all tropical countries amounted to nearly 16 million hectares per year, for a total loss of 158 million hectares between 1990 and 2000.*** (See Table 2.) In other words, the rate of natural forest loss in the tropical region appears to be about 17 percent higher than the rate reported by FAO.⁵

IS DEFORESTATION SLOWING DOWN?

Rates of Change in Total Forest Cover

FAO claims that the net rate of global forest loss (that is, deforestation in some areas, partially compensated by planting in other areas) has slowed by 20 percent since its last assessment, from 11 million hectares per year to 9 million hectares per year. This statement derives from a comparison of the global rate of net deforestation reported for the period 1990-2000 (-0.2 percent per annum) with the rate reported for the period 1990-95 (-0.3 percent per annum).⁶ The estimate for this latter period (1990-1995) was published in FAO's *State of the World's Forests 1997* (SOFO 1997), which presented an interim revision of FRA 1990 data. Because FAO has compared net rates of deforestation in FRA 2000 with those published in SOFO 1997,⁷ this paper does the same. Net rates of change in total forest cover are presented in more detail in Table 3. (See end of paper.)

Three objections may be raised to FAO's claim of a slowdown.

Given the different methodologies used in the FRA 1990 and the FRA 2000, and the very different 1990 baselines from which the net rates of forest loss are calculated, the two deforestation estimates should not be compared in this way. The revised definition of forest land in FRA 2000 was applied only to developed country forests, and the substitution of expert assessment for mathematical

modeling was applied only to developing country forests. These regionally applied methodological changes introduce unknown directional bias into the global results.

If this objection is overlooked, it is clear that the net rate of global forest loss is arrived at by aggregating significant gains in forest area in Europe, North America, and Oceania, and significant losses in Africa, Asia, and South America. Within the major continents, net deforestation rates should be further disaggregated into the tropical and temperate zones. Table 3 of this paper provides such a disaggregation and shows that, compared to the rates recorded for the period 1990-95, ***net deforestation rates have increased in tropical Africa, remained constant in Central America, and declined only slightly in tropical Asia and South America.*** While it is legitimate to aggregate net deforestation rates to the global level, the overall message that "deforestation is slowing down" can be misleading if the regional and subregional picture is not emphasized.

Rates of Change in Natural Forest Cover

The FAO claims that there are "strong indications for a slowdown in [natural] deforestation". Tropical deforestation is estimated to be "at least 10 percent less in the past ten years compared to the 1980s".⁸ This statement derives from a comparison of deforestation rates observed from satellite images of the tropical region, recorded between 1980 and 1990 (-15.4 million hectares per year), and again between 1990 and 2000 (-13.5 million hectares per year).⁹

However, this claim does not appear to be borne out if natural forest loss rates in the tropics are compared using FAO's full dataset, not the restricted data sample provided by satellite imagery. Table 4 compares the estimated rate of change in natural forest cover for the 1980s (as reported in FRA 1990) and the 1990s (calculated from FRA 2000). ***If these data can be relied on, they indicate that rates of natural forest loss have worsened in all tropical regions except Latin America. In absolute terms, it appears that more tropical forest was lost in the 1990s than in the 1980s.***



Region	1980 - 1990 (FRA 1990)		1990 - 2000 (FRA 2000)	
	Av. Ann. Change (000 ha)	Av. Ann. Change Rate (%)	Av. Ann. Change (000 ha)	Av. Ann. Change Rate (%)
Tropical Africa	-4,101	-0.7	-5,524	-0.8
Tropical Asia	-3,791	-1.2	-5,637	-1.9
Tropical Oceania	-131	-0.3	-133	-0.4
Tropical Latin America (inc. Caribbean)	-7,407	-0.7	-4,546	-0.5
Total Tropical Countries	-15,430	-0.8	-15,840	-0.8

Sources: Change rates for 1980-90 from *Forest Resources Assessment 1990: Global Synthesis*. FAO Forestry Paper 124, Table 4. Annual change and change rates for 1990-2000 from Table 2, this paper. See note in Table 2 for an explanation of how natural forest loss rates were calculated.

How Reliable are Deforestation Estimates?

FAO has produced two kinds of deforestation estimates for the FRA 2000. The first kind involves country level estimates, based on estimates of national total forest cover in 1990 and 2000 and the difference between the two. These numbers underlie the net deforestation rate estimates at national, continental, and global levels. The second involves pantropical estimates based on a remote sensing survey of 10 percent of tropical forests. These numbers underlie the gross deforestation rate estimated *for the tropical region only*.

Forest Cover Differences

It is important to understand that the latest national statistics on forest cover in 1990 and 2000 in most developing countries are based not on measurement but on a variety of estimation techniques. Faced with inadequate inventory data and limited satellite data, FAO was obliged to adjust national forest surveys dating from very different years to the reference years 1990 and 2000 by a combination of linear projections and expert assessment. The latter drew on the advice of multiple experts, whose differing views were reconciled by a combination of the Delphi Technique and the Convergence of Evidence Technique.¹⁰ Virtually every national estimate had to be corrected in this way and, particularly in the case of

tropical Africa, the corrections made by multiple experts were, in fact, often based on an assessment made by a single expert. The margins of error are, at this stage, unknown. In the case of the developed countries, the change in definition of forest land introduces some uncertainty into the retrospective estimates of forest cover in 1990. However, area difference estimates for most countries between 1990 and 2000 appear plausible.

Remote Sensing Survey

Satellite imagery is capable of providing valuable information, but it is subject to misinterpretation if, for example, the forest area sampled is too small to provide an accurate representation of the situation on the ground. FAO has limited resources and, as in the 1990 survey, has relied on a sample of satellite images that cover only 10 percent of total tropical forest area, rather than undertaking a more extensive survey as recommended by an expert advisory group.¹¹ The satellite survey commissioned by FAO for the FRA 2000 revisited the same 117 sites that were sampled for the FRA 1990, to provide a comparable time series for 1980, 1990, and 2000. On the basis of this survey, FAO produced land and forest cover change matrices at the local, regional, and pantropical levels. These matrices provide valuable insights into change processes at the local level. However, it is arguable that the information obtained from this survey is not statistically significant and should not be generalized to the tropical zone. The FAO's 117 sampling sites are distributed randomly across Asia, Africa, and Latin America and it has been demonstrated that, *because deforestation is not a randomly distributed phenomenon, a 10 percent sampling rate is not sufficient to identify with acceptable accuracy how much forest survives intact and how much is being lost*. Analysts have determined that, in order to achieve a Landsat-derived estimate accurate within +/- 20 percent of actual deforestation 90 percent of the time, a sampling rate of between 80 and 90 percent is required.¹²

DO WE REALLY KNOW WHAT IS HAPPENING TO TROPICAL FORESTS?

The FRA 1990 was criticized by some analysts for lack of comparability with the 1980 assessment.¹³



The classification of various tropical forest types was altered, which made it difficult to track changes in area of specific types such as tropical moist forest. And modeling techniques replaced expert opinion as the preferred means of compensating for poor or missing data in tropical countries. The 1990 assessment might or might not have been an improvement over the 1980 report, but the two could not easily be compared.

The same difficulties apply to the new FRA 2000 and, unfortunately, the data still cannot be relied upon. Forest monitoring has improved in Asia and Latin America since the 1990 assessment but data quality for Africa remains very poor. ***Most forests in the tropical world are simply not monitored frequently enough for rates of change to be measured consistently over time.*** Decadal rates of change are often projected from single inventories, some of them so old that they date from before the decade in question. The uncertainties involved in estimating long-term trends in tropical forest cover are well illustrated by the case of Africa. FAO's baseline estimates of natural forest cover in tropical Africa since 1980 have changed in successive assessments (FRA 1980, FRA 1990, FRA 2000) by more than the estimated forest loss within each assessment period. ***This means that, over the past 20 years, increases or decreases in tropical forest cover in Africa that have resulted from changes in assessment methodology are greater than the changes estimated to have taken place on the ground.***

To SUM UP

- The results of the FRA 2000 are not what they seem to be. Changes in assessment methodologies explain much of what appears, at first, to be real change.
- Forest data for many countries, in both the developed and developing world, are weak, or reported in odd ways that undermine their credibility.
- Deforestation data are presented in ways that can be misleading if the differences between net and gross rates of change are not thoroughly understood. Comparisons of global net deforesta-

tion rates in the 1990s with those reported for the first half of the decade are not valid, because the data are based on different methodologies and different baselines.

- The new assessment falls short of what is required. The extent and rate of change of the world's forests are still unclear, especially at the national level, and long-term trends are distorted by changing baseline data. Accurate global forest monitoring is critical at a time when natural forests are rapidly disappearing, flora and fauna are at risk of extinction, and a wealth of environmental goods and services is being lost.

WHERE DO WE GO FROM HERE?

There is a clear need for more timely and accurate global forest monitoring. Intervals of 10 years are too long given today's rapid pace of change. In addition, decadal trend data miss important year-to-year variability in forest condition. We suggest three major steps that could be implemented in the short- to medium term.

1. ***With respect to forest cover, FAO should focus on regular collection of a limited set of core data variables, which provide the foundation for integration of additional information, modeling and analysis by other groups.***

We need global information on how forests are changing, and how these changes affect products and key ecosystem goods and services (including conservation values) derived from forests. FAO cannot be expected to address all of these information needs, given the limited resources at hand. Other organizations are well positioned to help (*see below*). Rather, FAO should focus on providing quality baseline data on forest cover and change. This information should:

- (i) Be provided *spatially*, to allow integration of additional datasets, and to permit analysis at the national, ecoregion, and subnational level.
- (ii) Distinguish various cut-offs in canopy cover (for example, 10-20%, 20-50%) to overcome differences in how "forest cover" is defined, and



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- to address the fact that closed and open canopy forests are affected by very different change mechanisms.
- (iii) At a minimum, global forest cover information should distinguish between the following categories: forests (with various canopy-cover cut-offs), and young/regenerating forests (for example, less than 10 years old). These categories can generally be determined through comparison of high-resolution imagery for two or more time periods, and the latter category is important for distinguishing disturbance (fires, clearcutting) not currently captured by the FAO definition of “deforestation.” In addition, country-level inventory data should be used to distinguish the following sub-categories: plantation forests, and intensively managed natural and seminatural forest.

This information should be regularly updated, given rapid degradation and change of forests around the world. The points above suggest a monitoring approach based on acquisition of a global, wall-to-wall high-resolution imagery dataset at least every 10 years, where country-level inventory data are used to interpret and augment results. In addition, coarse resolution imagery should be used in the interim, to determine rapid-change areas. These areas should additionally be assessed every 2-3 years using high-resolution imagery and inventory data.

2. *There is an urgent need to establish standardized baseline information on forest cover and change.*

The FRA assessment process has failed to establish standardized baseline information. Ongoing work by Earthsat will provide baseline land cover data based on high-resolution imagery for the early 1990s. NASA (and possibly others) should provide a similar coverage for the late 1990s/early 2000 based on Landsat 7. Such coverage would provide the basic data needed to establish baseline forest cover data for circa 1990

and circa 2000.

Images from such an effort would be useful to countries seeking to improve national-level inventories. FAO, with assistance from others, should strive to provide a new forest cover and change analysis for the 1990s based on this information, within the next two years.

3. *We need a consortium of data providers working together to address key global forest information needs.*

In addition to FAO, various organizations including the Global Observation of Forest Cover (GOFC), the International Geosphere-Biosphere Programme (IGBP), the World Conservation Monitoring Centre (UNEP-WCMC), the U.S. National Aeronautics and Space Administration (NASA), the European Space Agency (ESA), the European Joint Research Centre (JRC), the Millennium Ecosystem Assessment, and many other universities, research institutes, and nongovernmental organizations (NGOs), either have or are collecting and analyzing information on forest and land cover at regional and global levels. Their initiatives offer additional resources to fill critical information gaps, and can help provide data in user-friendly formats.

Repeated efforts to develop new institutions or projects to address current forest monitoring deficiencies single-handedly have failed for lack of resources and inability to win the cooperation of key players in these efforts. Rather than rely on one entity to fill all information needs, a more appropriate structure should be developed from collaboration among key players, taking maximum advantage of the resources these groups can provide.

These efforts might be harmonized around a commonly agreed *global forest information agenda*, that establishes key information needs for the coming decade (and beyond), based on an analysis of user needs, and the degree to which needs are being filled by existing efforts. Donors and governments might use this information agenda to prioritize and support data collection efforts that address these needs and fill these gaps.



NOTES

¹ Curiously, the Australian Country Profile in FRA 2000 (Internet version) states that a 20 percent canopy cover threshold was used to determine forest cover, not the 10 percent threshold used for all other countries. This implies that the threshold used for Australia in the 1990 assessment was even higher than the 20 percent used in other developed countries at that time (the higher the threshold, the more forest land that is excluded).

² North America, Europe (including Russia), Scandinavia, Israel, Turkey, Japan, Australia and New Zealand.

³ For purposes of comparison with 1990 data, forest area in the newly independent East Timor has been added to Indonesian forest area in 2000.

⁴ The category Total Forest Cover did not feature prominently in FRA 1990, and was adopted only in 1997, with publication of the *State of the World's Forests 1997* (SOFO 1997).

⁵ It should be noted that this conclusion depends critically on the accuracy of data for plantation area in 1990. This paper uses plantation area data from *Forest Resources Assessment 1990: Global Synthesis*. FAO Forestry Paper 124. Rome: FAO, 1995. This is the final summary report of the FRA 1990 and plantation area data reported for the tropical countries are significantly smaller than those reported in the earlier FAO Forestry Paper 112 (1993). If the later, smaller plantation area data are an underestimate, then this paper exaggerates the extent of natural forest loss by an equivalent amount.

⁶ The FAO makes a further comparison, between the net deforestation rate of 9 million hectares per year in the 1990s, and the 13 million hectares per year reported for the period 1980-90. The latter number was reported in the FRA 1990, but it applied only to the developing countries, not to the world.

⁷ FAO Forestry News. *Net Loss of 9 Million Hectares of Forests Per Year Despite Increases in Plantations*. Rome, 22 January, 2001.

⁸ FAO Forestry News. *Strong Indications for Slow Down in Deforestation*. Rome, 8 August 2000. The text is not explicit, but appears to refer to gross rates of natural deforestation, not net rates of change including plantation establishment.

⁹ Changes in natural forest cover during the 1980s were reported in the FRA 1990, but the statistic was not recorded in the SOFO 1997. FAO is thus comparing FRA 2000

with SOFO 1997 to comment on *net* rates of change, and comparing FRA 2000 with FRA 1990 to comment on *gross* rates of change.

¹⁰ *FRA 2000 Assessing State and Change in Global Forest Cover: 2000 and Beyond*. Forest Resources Assessment Programme. Working Paper 31:10-11. Rome: FAO.

¹¹ *FRA 2000 Expert Consultation Review of the FRA 2000 Methodology for Regional and Global Forest Change Assessment*. Forest Resources Assessment Programme. Working Paper 42, p. 21. Rome: FAO.

¹² C.J. Tucker and J.R.G. Townshend (2000). "Strategies for Monitoring Tropical Deforestation Using Satellite Data." *International Journal of Remote Sensing* 21 (6): 1461-1472.

ACKNOWLEDGMENTS

The author would like to thank the individuals who agreed to review this Briefing Note, or otherwise contributed their time and expertise: Nigel Dudley (Equilibrium Consultants), Andrew Gillespie (U.S. Department of Agriculture, Forest Service), Peter Holmgren (FAO), Denise Ingram (U.S. Department of Agriculture, Forest Service), Val Kapos (UNEP-WCMC), Gyde Lund (Forest Information Services), Anatoly Shvidenko (International Institute for Applied Systems Analysis), Karndeo Singh (Harvard University), and John Townshend (University of Maryland). Within WRI, thanks are due to Dirk Bryant, Tony Janetos, Nels Johnson, Lars Laestadius, and Dan Tunstall for their constructive criticism, Hyacinth Billings and Susan Buzby for help with editing and design, Tyson Walker for map production, and Jillian Salvatore for calm and efficient administrative support. The author is particularly grateful to Alan Grainger (Leeds University, U.K.) for his thoughtful input and for sharing an early draft of his own paper on the *Forest Resources Assessment 2000*.



Table 2. Gross Deforestation: Rates of Change in Natural Forest Cover and Plantation Area, FRA 2000 Estimates

Region	1990		2000		Average Annual Change	Average Annual Change Rate
	Natural Forest (000 ha)	Plantations (000 ha)	Natural Forest (000 ha)	Plantations (000 ha)	Natural Forest Area (000 ha)	Natural Forest (%)
Tropical Africa	684,772	2,120	629,536	4,615	-5,524	-0.8
Nontropical Africa	13,110	2,295	12,292	3,423	-65	-0.5
Africa	697,882	4,415	641,828	8,038	-5,589	-0.8
Tropical Asia	289,820	22,486	233,448	54,624	-5,637	-1.9
Temperate Asia	205,520	33,631	197,974	61,249	-755	-0.4
Asia	495,340	56,117	431,422	115,873	-6,392	-1.3
Tropical Oceania	36,201	149	34,869	263	-133	-0.4
Central America	82,544	194	72,300	729	-1,025	-1.2
Caribbean	5,289	291	5,144	566	-15	-0.3
Tropical South America	850,888	5,561	815,828	6,890	-3,506	-0.4
Temperate South America	52,311	1,718	47,911	3,565	-440	-0.8
South America	903,199	7,279	888,127	10,455	-3,946	-0.4
All Tropical Countries	1,949,514	30,801	1,791,125	67,687	-15,840	-0.8

Notes: Natural Forest Cover 1990 is calculated by subtracting Plantation Area in 1990 (FRA 1990, Table 4) from Total Forest Cover in 1990 (FRA 2000, Table 4). Natural Forest Cover 2000 is calculated by subtracting Plantation Area in 2000 (FRA 2000, Table 6) from Total Forest Cover in 2000 (FRA 2000, Table 4). Plantation data for 1990 in the tropical countries are less complete than for 2000; where plantation data were missing for individual countries, natural forest cover was assumed to be equivalent to total forest cover. Plantation data for 1990 in the developed countries are not available. It should be borne in mind that plantation data for 1990 and 2000 are not very reliable.

Sources: *Forest Resources Assessment 1990: Global Synthesis*. FAO Forestry Paper 124. *Forest Resources Assessment 2000*. Available online at: <http://www.fao.org/forestry/fo/fra/index.jsp> Last accessed 6 March, 2001.



Table 3. Net Deforestation: Rates of Change in Total Forest Cover: SOFO 1997 and FRA 2000 Estimate Compared						
Regions	SOFO 1997 ¹			FRA 2000 ²		
	Total Forest Cover 1990 (000 ha)	Av. Ann. Change, 1990 - 1995 (000 ha)	Annual Change Rate (%)	Total Forest Cover 1990 (000 ha)	Av. Ann. Change, 1990 - 2000 (000 ha)	Annual Change Rate (%)
Tropical Africa	523,376	-3,695	-0.7	687,097	-5,295	-0.8
Nontropical Africa	15,602	-53	-0.3	15,405	31	0.2
Africa	538,978	-3,748	-0.7	705,502	-5,264	-0.7
Tropical Asia	295,041	-3,055	-1.1	312,306	-2,423	-0.8
Temperate Asia	222,464	154	0	239,151	2,052	0.9
Asia	517,505	-2,901	-0.6	551,457	-371	-0.1
Tropical Oceania	42,659	-151	-0.4	36,356	-122	-0.3
Australia & N.Z.	48,490	60	0.1	165,636	39	n.s.
Oceania	91,149	-91	-0.1	201,992	-83	n.s.
Northern Europe	52,498	8	n.s.	57,566	40	0.07
Western Europe	57,688	358	0.6	64,713	311	0.5
Eastern Europe	820,546	153	0	908,501	522	0.06
Europe	930,732	519	0	1,030,780	873	0.08
U.S. and Canada	453,270	763	0.2	466,684	388	0.08
Central America	79,812	-959	-1.2	82,738	-971	-1.2
Caribbean	4,816	-78	-1.7	5,580	14	0.3
North & Central America	537,898	-274	-0.1	555,002	-569	-0.1
Tropical South America	851,223	-4,655	-0.6	856,449	-3,373	-0.4
Temperate South America	43,243	-119	-0.3	54,029	-255	-0.5
South America	894,466	-4,774	-0.5	910,478	-3,628	-0.4
All Tropical Countries	1,796,927	-12,593	-0.7	1,980,526	-12,170	-0.6
World	3,510,728	-11,269	-0.32	3,952,053	-9,045	-0.23

Notes: This table follows FAO in comparing 1990-2000 data (FRA 2000) with 1990-95 data (SOFO 1997), rather than with data from FRA 1990. FRA 1990 did not aggregate natural forest and plantation area to "total forest cover" and did not calculate the net rate of forest loss. The "total forest" category was first introduced in the SOFO 1997.

Eastern Europe includes Russian Federation.

n.s. = not significant, indicating a very small value.

Sources: ¹ *State of the World's Forests, 1997*. Rome: FAO, 1997, Table 3, pp. 186-189. ² *Forest Resources Assessment 2000*. Table 4. Available online at: <http://www.fao.org/forestry/fo/fra/index.jsp> Last accessed 6 March, 2001.



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