IRRATIONAL NUMBERS:

WHY THE FAO'S FOREST ASSESSMENTS ARE MISLEADING

A report by the Rainforest Foundation UK, Norway and US

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EXECUTIVE SUMMARY

Forests are crucially important in reducing poverty and in contributing to the livelihoods of millions of people around the world. The World Bank (2004) has estimated that "over 90% of the 1.2 billion people living in extreme poverty depend on forests for some part of their livelihoods". Furthermore, the Bank suggests that forests contain "at least 80% of the world's remaining terrestrial biodiversity and are a major carbon sink that regulates the global climate". The crucial link between forests and sustainable development has been recognised within the Millennium Development Goals – the area of forest cover is one of the indicators for the 7th Goal, to "ensure environmental sustainability".

Despite their enormous importance, the world's forests have been in steady – in some cases, precipitous – decline. Attempts to curb this process are hampered by the absence of credible data describing the state of forests. The Global Forest Resources Assessments (GFRA) of FAO should be providing this information. However, they are in fact unreliable and highly misleading. Using FAO's definition of forest, monoculture plantations, highly degraded forests and even clear-cut areas "expected" to regenerate, are all counted as forests. Consequently, the FAO data obscure our understanding of the world's forests, and seriously underestimate the extent of their degradation.

The key problems with FAO's approach are:

- The use of the term "net forest change", in which the loss of "natural" forests is cancelled out by the expansion of plantations, is meaningless and serves to hide the true extent of the loss of the world's natural forests.

- The impact of humans on forests is vastly underestimated; key processes of forest degradation and fragmentation are barely taken into account.

- The definition of "forest", including all vegetation types with tree canopy cover over 10%, is too broad, making the data of limited value to scientists, forest managers and policy makers.

- The inclusion of forest plantations within FAO's "total forest" estimates is illogical and misleading, obscuring our understanding of the status and values of both natural forests and of plantations.

- The exclusion of temporarily deforested areas from estimates of deforestation is highly subjective, and underestimates the loss of forest in many parts of the world.

To address these problems, the Rainforest Foundation recommends that FAO makes the following amendments to its GFRA methodology:

- Abandon the calculation of "net forest change". Deforestation estimates should refer to the loss of natural forest.

- Distinguish a number of different categories of forest on the basis of canopy cover.

- Assess all plantations separately from natural forests.

- Abandon the use of the category "temporary deforestation", and count these areas as deforested.

INTRODUCTION

Since 1948, the United Nation's Food and Agriculture Organization (FAO) has been engaged in compiling data on the state of forests on a global scale. These assessments are used as the official statistics on forests within the UN, and so provide the basis for international policy development and decision-making. Furthermore, these data are widely referred to by those outside of the UN system; FAO statistics on forest area and rates of deforestation can be found throughout the scientific and non-scientific literature, as well as more widely in the general media. Indeed, for many parts of the world, it is difficult to find alternative sources of information.

Therefore, it is crucial to ensure that the FAO data are as reliable as possible, and also that they are both clear and transparent. Unfortunately, this is currently not the case: the Global Forest Resources Assessments (GFRAs) do not provide a clear understanding of the state of the world's forests. As will be highlighted in this report, the statistics which are produced, based on a broad definition of forests and the aggregation of statistics on plantations and natural forests, are of little value to anyone: it is not possible to assess threats to biodiversity, the status of forest ecosystems, nor the availability of timber resources and many non-timber forest products. Consequently, they can not be used as a sound basis on which to develop policies which will help to conserve forests and to enhance their role in sustainable development.

THE PROBLEMS WITH FOREST RESOURCES ASSESSMENT DATA

The GFRAs are aimed at providing information that will enable better decision-making (FAO, 2005). However, this is not being achieved. A survey of users of the GFRAs concluded that "current monitoring efforts are not adequately meeting the increasingly pressing needs of policy-makers or scientists for information on the global extent and quality of forest resources." (Matthews & Grainger, 2002) Two key problems can be identified with FAO's data: that they are unreliable, and also misleading.

The unreliability of FAO's data has been noted in several previous studies (Downton, 1995; Matthews, 2001; Matthews & Grainger, 2002; Wunder, 2003). For example, a report for the Intergovernmental Panel on Climate Change (IPCC) suggested that deforestation figures for tropical countries could be in error by as much as 50% (Watson et al., 2000). Such inaccuracy makes the FAO data all but useless for those attempting to analyse the processes of forest change. For example, in his analysis of forest change in five tropical countries, Wunder (2003) states that he "has slightly higher confidence in my own deforestation estimates… than in those in the FRA (2000)."

While the difficulties of monitoring forest resources on a global level are recognised, this raises the question as to where FAO should be focusing its activities in order to ensure that the limited resources available are used to greatest effect, and to ensure that the data it does produce are useful and relevant for policy makers, forest managers and others.

A more fundamental problem with FAO's data is that they are misleading. The definitions used for forests, and the methods used for estimating deforestation – in particular, the calculation of "net forest change" – mean that the picture presented of the state of the world's forests is severely distorted. As the following sections describe, FAO needs to change the way in which its forest estimates are made, to give a truer picture of the state of the world's forests. [1]

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[1] While these arguments are largely made on the basis of data from previous GFRAs, the key findings released by FAO for GFRA 2005 indicate that the same approach has been taken in this assessment. (http://www.fao.org/forestry/foris/webview/forestry2/index.jsp?siteId=101&sitetreeId=1191&langId=1&geoId=0)

1. Net forest change

FAO calculates the "net change" in forest cover, which is based on the area of deforestation, minus the areas of reforestation and afforestation. Consequently, the expansion of plantations cancels out much of the loss of "natural" and old-growth forests. This tends to hugely underestimate the loss of natural forests, and it is highly misleading (Matthews & Grainger, 2002). For example, in GFRA 2000 it was calculated that the rate of forest area change for 90 tropical countries for 1990-2000 was 12.2 million hectares per year. This was 74% of the corresponding estimate for 1980-1990, so suggesting a significant drop in deforestation. However, this apparent "positive development" is accounted for by the expansion of plantations and secondary forests. So, on the basis of FAO's figures gross deforestation, that is the loss of natural forests, fell only slightly from 15.4 million hectares / year in the 1980's to 14.5 million hectares per year in the 1990's (Grainger, 2005) (although this does not take into account any of the other methodological errors noted above).

Furthermore, the emphasis on the global estimates is misleading if the regional or sub-regional picture is not emphasised. Global estimates can hide dramatic differences in the forest situation between regions, countries or ecosystems (Mayaux et al., 2005). For example, FAO suggested that the net rate of global forest loss had declined significantly as of 2000, compared to its previous assessment in 1995. However, if the regional data are compared (as was done by Matthews, 2001), this shows that the apparent improvement in rates of forest loss was due to the expansion of forest area in temperate regions. In tropical Africa there was actually an increase in net deforestation rates, and there was only a slight decline in deforestation rates in tropical Asia and South America.

The figures for net forest change are widely quoted, both in the scientific literature and in the news media. However, in quoting these figures, it is often not made clear how they were calculated, and so it is forgotten that they represent "net forest change" and not the loss of natural forest.

The calculation of net deforestation also encourages the perception that the loss of natural forests can be compensated for by an increase in forest plantations (Matthews & Grainger, 2002). However, as mentioned above, these are very different from "natural" or old-growth forests in ecological, biophysical and economic terms (Achard et al., 2002).

The low priority given to estimates of natural forest loss is reflected in the statistics which FAO provides. Thus, in GFRA 2000, changes in the area of natural forest and plantations were only assessed at the global level, for the tropics and non-tropics, with no such statistics being provided at the regional or national levels. National statistics are only provided for the area of plantations, and so it is left up to readers to calculate the areas of natural forest. Furthermore, no revised estimates of the areas of natural forest and plantations are given for earlier years, and so it is not possible to assess changes in these areas (Matthews & Grainger, 2002).

This approach, in which net forest change is emphasised over natural forest loss, continues. Thus, the press release for GFRA 2005[2] begins with the statement that net forest loss is slowing down. In the key findings presented by FAO, only the figure for global net forest change is compared with previous estimates, and not that of natural forest loss. Further, at the regional level, only net forest change has been calculated. For example, it is reported that in Asia, there was a net gain of forests during the period 2000-2005. While it was noted that this was largely due to large-scale afforestation in China, the amount of natural forest that has been lost was not reported. However, using the national data provided in FAO's global tables, this suggests that over 7 million hectares of "primary forest" has been lost in Asia.

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[2] http://www.fao.org/forestry/foris/webview/forestry2/index.jsp?siteId=101&sitetreeId=1191&langId=1&geoId=0

2. Forest degradation

FAO defines forests as: "Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds *in situ*." As a result of this broad forest definition, deforestation is very narrowly defined. Therefore, even if logging results in the removal of significant canopy cover, if this does not fall below the 10% threshold, the area concerned is not regarded as "deforested". Thus, the canopy cover of a forest may be reduced from 80% to 20%, with devastating impacts on biodiversity levels and ecosystem functions, but it will still be classified as forest. Consequently, the full human impact on forests is underestimated, and the processes of degradation and fragmentation of forests are largely overlooked.

These processes are of profound significance for forest-dependent peoples, since essential forest resources may be severely depleted in such degraded forests. For example, in central Africa, wild game provides nearly all of the animal protein consumed by many forest-dwelling communities. However, in this region "large blocks of the forest have already become 'silent forests,'" the wildlife having become locally extinct or endangered (CARPE, 2005: 1).

Forest degradation is also of relevance for ecologists, climate change scientists and forest managers. Forest that has been thinned has very different ecological characteristics from those of closed forest. Logged over forest may show considerable loss of environmental functions, or forest attributes, such as structure and species composition (Alvarado & Sandberg, 2001; Matricardi et al., 2001; Sunderlin & Resosudarmo, 1996). Logged forest will also have less biomass than intact forest, which is of importance for research into carbon sinks and climate change.

Furthermore, an understanding of these processes is crucial in understanding the underlying causes of deforestation, since degraded and fragmented forests are more susceptible to deforestation (Wunder, 2004). Vast areas of forest are being degraded, as is apparent from the examples below. However, these processes are not adequately monitored or assessed by FAO, making their data all but useless for those seeking to develop forest policy to curb degradation and deforestation.

Little discussion of forest degradation is given in the key findings of GFRA 2005, as released in November 2005. There was some analysis of the processes of deforestation and forest fragmentation in GFRA 2000, with assessments of changes between the categories of closed-canopy forests, open canopy forests, long fallows (forest affected by shifting cultivation), and fragmented forests. However, this was only done at the pantropical level, and the basic data for each of the regions were not presented. Assessment of these different forest types is needed at the national level. This would enable more detailed analysis of the processes of forest degradation and fragmentation, and so a better understanding of the full range of human pressures affecting forests, and the significance of these changes for biodiversity conservation, forest management and climate change.

In central Africa, it has been estimated that 30% of the region's forests have been selectively logged (Laporte et al., 2004), and that a total of 45% of the region lies within forest concessions (Minnemeyer, 2002). Furthermore, it has been estimated that many of the remaining large areas of "low access forests" (these being defined as forest areas of at least 100,000 hectares and at least 2 km from public roads) are at threat from human impact (Minnemeyer, 2002). While about a third of the region's forests were defined as low-access, nearly 60% of this area was found to be within 10 km of a logging road. The degradation of such a large proportion of forests would have a devastating impact on the millions of forest-dependent people in the region as well as on the region's biodiversity. However, these changes will not be apparent from FAO's data.

The significance of forest degradation in many parts of the world has become apparent from satellite monitoring. The TREES project estimated that in the humid tropics, from 1990-97, the annual rate of deforestation was about 5.8 million hectares, and a further 2.3 million hectares per year was visibly degraded (see Table 2). This latter figure was thought to be a conservative estimate, since many areas

subject to selective logging were apparently not distinguishable using their methodology (Achard et al., 2002; Mayaux et al., 2005).[3]

Table 2: Deforestation and forest degradation in the humid tropics (1990-1997) (millions of hectares)

	Latin America	Africa	SE Asia	Pantropical
Forest cover in 1997	653	193	270	1116
Annual deforested area	2.5	0.85	2.5	5.8
Annual degraded area	0.83	0.39	1.1	2.3

Source: Achard et al., 2002

In recent years, a number of research projects have investigated forest degradation in the Amazon basin, and these have revealed that a much larger area has been affected than had previously been recognised.

FOREST DEGRADATION IN BRAZIL

In the past, most land change in Brazil has been in the form of deforestation rather than degradation. However, the areas affected by degradation are becoming increasingly significant, largely due to the expansion of selective logging activities.

Estimates of the area affected by degradation vary widely. Downton (1995) estimated that degradation accounted for 15% of forest change, the remainder being deforestation, while Nepstad et al. (1999) suggested that "present estimates of annual deforestation for Brazilian Amazonia capture less than half of the forest area that is impoverished each year, and even less during years of severe drought.". In this latter study, they estimated that degradation effected as much as 1-1.5 million hectares per year, although this was strongly disputed by the Brazilian government, which estimated the area to be about a tenth of this (Matricardi et al., 2001).

Analysis of satellite data from the late 1990's found that a significant area of forest had been impacted by degradation, although this was much lower than the area being deforested (Matricardi et al., 2001). From 1992-1999, a total of 3.5 million hectares was affected by selective logging in the Brazilian Amazon (an average of 0.5 million hectares per year). In contrast, government data for the same period suggest an average annual deforestation rate of over 1.8 million hectares.[4] Although forest clearing was more important during this period, forest degradation was becoming increasingly significant. The study by Matricardi et al. (2001) found that during 1992-1996 just over 0.9 million hectares of forest had been affected by selective logging, but for the period 1996-1999, an additional area of over 2.3 million hectares had been impacted.

This trend has been confirmed by two recent studies. An analysis of satellite data for the Brazilian Amazon basin estimated that in 2002, 19% (~70 million hectares) of the Brazilian Amazon basin was settled, deforested or fragmented. Further, it was estimated that an additional 28% (over 100 million hectares) of this region was subject to "incipient human pressure". This was classified as the area within a 10 km radius around each deforestation

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[3] The accuracy of the TREES estimates of deforestation have been disputed (Fearnside & Laurance, 2003). In spite of the uncertainty of these figures, they do illustrate the widespread nature of forest degradation and its significance in relation to deforestation.

[4] http://www.obt.inpe.br/

hotspot – small-scale clearings or forest fires identified by satellite (Barreto et al., 2005). This suggests that nearly half of the Amazon basin has been degraded, or is at imminent risk from human impact. In another study, satellite data from 1999-2002 were analysed for the top five timber producing states of the Brazilian Amazon (Asner et al., 2005). This found that the area being deforested each year during this period ranged from 1.6 to 2 million hectares, while the areas affected by selective logging were between 1.2 and 2 million hectares per year. Thus, "selective logging doubles previous estimates of the total amount of forest degraded by human activities".

3. How to define "forest"?

As a result of FAO's broad forest definition, a wide range of forest ecosystems, from dense humid forests, to open woodlands and savannahs, are all included within the category of forest. This broad definition of forest tells us very little, and is of limited value to those concerned either with forest management or policy. This is apparent if we consider some alternative statistics to those of FAO.

In the case of Brazil, FAO (1997) estimated that there was 546,239,000 hectares of forest in 1995. In contrast, UNEP (2001) estimated that there was 361,597,200 hectares of closed forest (with canopy cover >40%) for the same year. The difference in these two estimates, about a third of FAO's total figure, is largely accounted for by *cerrado* vegetation. Brazil's *cerrado* (open savannah-like ecosystems) differs hugely from the tropical rainforests which predominate in the country with respect to the resources which it provides for local people, its ecological values, and also, processes of land cover change, it being particularly susceptible to deforestation (Fearnside & Laurance, 2003).

Data from central Africa also highlight the information which is hidden by FAO's definition of "forest". Table 1 shows estimates for the areas of different vegetation types, based on the interpretation of satellite imagery.

Table 1: Forest area estimates for 2000 (Mayaux et al., 2004)

Country	Dense forest (ha.) (% total)	Mosaic forest (ha.) (% total)	Woodlands (ha.) (% total)	Shrublands (ha.) (% total)	Total (ha.)
Congo	25,914,000 (73%)	1,221,000 (3%)	1,421,000 (4%)	6,773,000 (19%)	35,329,000
DRC	124,566,000 (56%)	22,707,000 (10%)	53,879,000 (24%)	21,454,000 (10%)	222,606,000
Gabon	21,190,000 (90%)	1,006,000 (4%)	219,000 (1%)	1,217,000 (5%)	23,632,000

Dense forest: mostly >70% tree canopy cover (evergreen lowland, montane and swamp forests) & some forests >40% canopy cover (degraded evergreen lowland forest & mangroves)
Mosaic forest: >40% canopy cover (forest and croplands, or forest and savannah)
Woodlands: 15-40% canopy cover (deciduous woodland)
Shrublands: <20% canopy cover

Under FAO's definition, all these vegetation types are categorised as forest. However, such a broad classification is of little use to ecologists or conservationists, since the diverse ecosystems included within it have vastly different biological and ecological values: rainforests are renowned for their high levels of biodiversity, while other ecosystems may support unique fauna and flora. For example, high levels of endemism are found in Brazil's *cerrado*.[5]

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[5] http://www.biodiversityhotspots.org/xp/Hotspots/cerrado/biodiversity.xml

This definition of forest is also not useful to those concerned with managing forests for their timber resources. In those countries with significant areas of dense forest, the assessment of woodlands and other ecosystems with low canopy cover is often regarded as being of little value, because of their low value as a timber resource. Consequently, they are not always included within national forest assessments. For example, *miombo* and *mikwati* woodlands were apparently not included in the Democratic Republic of Congo's national forest estimates for GFRA 2000, even though these fall within FAO's forest definition (Hansen & Defries, 2004).

Nor is this definition of value to those interested in assessing the non-timber values of forests, since these vary greatly between forest types. The non-timber values of forests are particularly important for local communities, many of whom are highly dependent on forest resources both for subsistence and as economic resources. According to the World Bank, forests contribute to the livelihoods of more than 1.6 billion people whilst "about 60 million indigenous people are almost wholly dependent on forests" (World Bank, 2004).

Finally, the FAO's broad definition is of limited value to climate-change scientists, since it does not allow an accurate estimation of forest biomass to be made, and thus, carbon stocks (Houghton, 2003; 2005). The deforestation of intact, old-growth forests will release significantly more carbon than will the deforestation of open woodlands, but this can not be accounted for using FAO's statistics.

Although FAO does distinguish between open and closed forests, these categories have only been used to a limited extent. In GFRA 2000 (FAO, 2001), the latest statistics on these areas were reported for each country. However, only single year estimates were given, and these figures were not adjusted to the reference year of 2000. Consequently, no assessment can be made of changes in these forest areas, and comparisons with future GFRA data will be difficult.

4. Defining plantations

FAO's definition of forests includes both land cover and land use criteria, being determined "both by the presence of trees and the absence of other predominant land uses." (FAO, 2004) Therefore, while plantations primarily used for forestry or protection purposes (timber species, rubber) are included within the category of forest, those for non-forestry purposes are excluded. For example, fruit tree and oil palm plantations are excluded, as are agroforestry systems.

The question of how to define plantations has been the subject of debate within FAO for many years. At a meeting in 1967 on man-made forests, it was highlighted that the distinction between agricultural and forestry tree crops was not logical, and was often obscure (Carle & Holmgren, 2003). In spite of this, this classification has persisted.

The illogical nature of this definition is illustrated by the following examples. In earlier assessments, rubber plantations were classified as non-forest. However, for GFRA 2000 it was decided to classify these as forest plantations, because of their "increasing significance as a supply of fibre to the wood industries sector". Similarly, bamboo and palms are included as "forest", with the exception of some palm plantations established for other purposes than wood (i.e. oil palm and coconut plantations), which are classified as "other land" and "other land with tree cover" as these areas are considered to be under agricultural land use. The exclusion of agroforestry systems seems to be particularly illogical, given that such systems can provide many of the same environmental services as natural forests (Contreras-Hermosilla & Fay, 2005), unlike the monoculture plantations currently included within FAO's "forest" definition.

This distinction between plantations for forestry and non-forestry purposes reflects the continued focus of FAO on the timber values of forests, rather than considering the entirety of the values and

resources provided by forests. However, a more fundamental problem with the FAO definition is that by including some plantations within the category of "total forests" this gives the impression that natural forests and plantations are equivalent to each other. As was highlighted above, this is patently untrue in almost every respect – in terms of ecology, biodiversity, economic values and cultural values.

5. Temporary deforestation

FAO's definition of forest includes: "Areas under reforestation that have not yet but are expected to reach a canopy cover of 10 percent and tree height of 5 m are included, as are temporarily unstocked areas, resulting from human intervention or natural causes that are expected to regenerate." (FAO, 2004)

This makes the definition of deforestation highly subjective, since it depends on distinguishing between those areas that have been "temporarily" deforested from those which are permanently deforested. It is very difficult, if not impossible, to determine whether those areas that are "expected" to regenerate will actually do so, and whether planned replanting will actually be carried out. This is particularly true in the tropics, where land use is highly dynamic (Wunder, 2002). Many cleared areas of forest are never reforested, but are abandoned or converted to agriculture, in spite of a stated intention to reforest them.

> ## PLANTATIONS AND DEFORESTATION IN INDONESIA
> Data from Indonesia illustrate the problems with this definition. For example, WWF Indonesia reports that in the province of Riau in 2003, out of 169 plantation companies 85% were inactive – the land had been cleared, but it had then been abandoned without replanting.[6] Elsewhere it has been reported that between 1990 and 1997, only 23.1% of the total area planned for timber plantations throughout Indonesia was actually planted (Kartodihardjo & Supriono, 2000: 8). A similar figure is given by Forest Watch Indonesia's report (FWI/GFW, 2002) on the state of the country's forests, this stating that 75% of plantations are never planted despite being cleared – of 9 million hectares cleared for industrial timber plantations, only 2 million hectares had actually been planted. Wunder (2004) estimated that some 30 million hectares of land had been deforested between 1980-2000, while for the same period about 22-23 million hectares of land had been converted to other uses, either agriculture or plantations. He suggests that this discrepancy is partly due to errors in the estimates, but may also be due to forest clearing "running ahead" of conversion. In other words, up to 8 million hectares of land may have been deforested, and neither reforested or converted to agricultural use.

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[6] http://www.wwf.or.id/tessonilo/Default.php?ID=871&wwf_lang=1

RECOMMENDATIONS

1. The calculation of "net forest area change" is of no value, and it is in fact misleading. Deforestation should refer simply to the loss of natural forests, and the extent and establishment of plantations should be reported separately.

Natural forests differ profoundly from plantations in their ecological, economic and cultural values. Consequently, separate analysis of natural forests, and their rate of loss, is essential for gaining a full understanding of the state of the world's forests, and thus, for developing sound forest policy.

2. A number of different categories of forest, with different levels of canopy cover, should be distinguished in the FAO's global forest assessments. This has been called for by ecologists and foresters (Matthews & Grainger, 2002; Wunder, 2003) as well as climate-change specialists (Watson et al., 2000), for whom it would provide far more useful data .

It would also enable a more detailed analysis of the processes of forest degradation and fragmentation, and enable the full human impact on forests to be assessed (Lambin, 1999; Matthews, 2001; Sunderlin & Resosudarmo, 1996).

Three categories of forest could be classified according to percentage canopy cover, for example: 10-40% (open forest); 40-70% (closed forest); >70% (dense forest). These thresholds are the most obvious since these are already employed in other forest assessments, for example, those of the Tropical Ecosystem Environment Observations by Satellite (TREES) project (Achard et al., 2002), the United Nations Environment Programme (UNEP, 2001), and the World Conservation Union (IUCN) (Harcourt & Sayer, 1996).

3. Temporarily unstocked areas should be counted as "deforested". This is a far more objective measure of deforestation. It will also give a much more accurate picture of the situation on the ground, particularly in those parts of the world where land use is highly unpredictable, and so plantations are often abandoned or converted to other uses.

4. While an assessment of the world's plantations is clearly of great value, these figures should be kept separate from those on natural forest. In other words, plantations and natural forest should not be included in the category of "total forest". Such a category is highly misleading, and gives a distorted view of the current state of the world's forests.

The assessment of plantations should include all plantation types – those which FAO regards as being for "forestry purposes", as well as those for non-timber purposes and agroforestry systems. This would be more objective, and the data generated would be of much greater value for forest policy – for example, that related to economic issues, rural development or climate change.

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ACRONYMS

FAO – Food and Agriculture Organization
FRA – Forest Resources Assessment
GFRA – Global Forest Resources Assessment
IUCN – The World Conservation Union / International Union for the Conservation of Nature and Natural Resources
TREES – Tropical Ecosystem Environment Observations by Satellite
UN – United Nations
UNEP – United Nations Environment Programme