THE GLOBAL ENVIRONMENT MONITORING SYSTEM

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UNEP/FAO TROPICAL FOREST ASSESSMENT

INTRODUCTION

Growing world concern over the state and rate of removal of tropical forests has led in recent years to the production of a number of publications giving widely differing estimates of the present extent of that resource and its current rate of change. In order to resolve this question by providing as objective an assessment as possible UNEP and FAO undertook a co-operative study as part of the Global Environment Monitoring System (GEMS). The results of this three year investigation were published in 1981 and 1982 as the UNEP/FAO Tropical Forest Resources Assessment.

This assessment represents the first attempt to gather together the wealth of information on tropical forest resources that is scattered throughout the world literature, together with the mass of unpublished data held in national agencies and at international centres.

All this information has been compiled into a report according to a single, uniform tropical forest resource classification system developed specifically for this assessment. This is the first time that this has been attempted and is a major reason for considering the UNEP/FAO Tropical Forest Resources Assessment to be the best and most reliable so far produced. It will serve as a baseline against which future tropical forest changes may be measured. The data are to be continually up-dated with the aim of publishing new more comprehensive global tropical forest resource assessments every five years.

THE ASSESSMENT APPROACH

The assessment was carried out on a national basis since this seemed the most reasonable way of presenting the data at this stage. National information was then used to compile regional syntheses (Africa, Asia, Latin America) and these in turn to derive a global assessment.

Forest extent was estimated for each of the 76 countries covered by the assessment using the best available sources of existing information. These included surveys based upon satellite image interpretation (18 countries), together with forest maps, inventories and geographical studies which had been prepared or carried out over the past 25 years. Throughout the survey a dialogue was maintained with the forest services of the countries concerned and in three cases the assessment was carried out by the countries themselves. Rates of forest removal were either taken from existing documents or derived from assumptions based, for example, on the degree of shifting cultivation or upon agricultural statistics. These rates were used to extrapolate forest extent to a common baseline of December 1980. Satellite image interpretation was used to verify estimates where necessary, to correct conflicting figures, and for 13 countries for which no data were available, to derive the primary estimates.

Since national data sets varied greatly in form it was necessary to approach each individually in order to recast it into a common analytical format. The quality of the estimates is, therefore, a function of the quality of the data and the reasonableness of the assumptions used in their compilation.

As a result of these differences in information quality, estimates of forest cover and deforestation rates are judged to be very reliable in only 15 out of the 76 countries surveyed. In terms of total area of closed forests, however, this represents 40 percent of the forest extent data, largely because Brazil, with 30 percent of the world's closed forests, is in the very reliable group. A further 38 countries (covering 40 percent of the total closed forests) have very good baseline information on forest cover. In the remaining 23 countries both baseline data and deforestation rate estimates are considered to be of medium to poor quality. This latter group, however, contains only some 20 percent of the total world closed forests and 29 percent of the total world open forests.

Projections into the near future have assumed constant rates of deforestation based on those determined for each country, but it must be stressed that these national deforestation rates could increase or get less in years to come. Given these constraints, the quality of the data, and the necessary number of assumptions the projections can only be broadly indicative of trends and future states and should, therefore, be viewed with caution.

TROPICAL FOREST CLASSIFICATION

In order to make an assessment of the extent of tropical forests and the rate at which they are changing, it is first necessary to define exactly what is meant by the term 'tropical forest' and to decide on definitions for both the various forest associations that make up a tropical forest and the derivative associations that result when tropical forest is removed. Many of the conflicting statements on the extent of tropical forests and their removal rates have arisen because authors have not always included the same range of forest formations in their consideration of tropical forests. Exclusion of even a few formations between consecutive assessments can lead to big differences in estimates of forest extent and, unless carefully examined, can lead to the derivation of forest removal rates far different from those intended by the authors. In order for the UNEP/FAO assessment to be meaningful, therefore, it was first necessary to create a simple but universally applicable classification that took into account all the main tropical forest formations that have arisen due to differences in botanical composition, ecological and climatological setting, and, most importantly, from a history of encounters with man.

Although a large number of tropical forest classifications exist, it was decided to make the present assessment classification compatible wherever possible with that used by UNESCO* but with particular emphasis upon management. Only those vegetation types whose woody elements have canopies covering more than ten percent of the ground are included. Figure 1 shows the different classes of woody vegetation used in the assessment.

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*UNESCO classification of vegetation prepared by the UNESCO Standing Committee on Classification and Mapping of Vegetation on a World Basis. August 1969.

There are two main forest types that have to be assessed separately:

1. Closed forests: Have an interlocking, continuous canopy, many layers, and, usually, abundant undergrowth. They do not have a continuous dense grass layer which would allow grazing and the spread of fires. Closed forests are either broadleaved, coniferous, bamboo or mangrove, and they occur in areas with high rainfall or locally abundant ground water. The term 'tropical forest' has come to mean in popular understanding the moist tropical rainforest which here can be equated with tropical broadleaved closed forests, and it is about this particular forest type that most world concern has been expressed.

2. Open forests: Are mixed broadleaved forest and grassland formations usually without an extensive continuous canopy but with a continuous grass layer under a tree canopy that covers more than ten percent of the ground (e.g. Cerrado in Brazil, and the wooded grasslands of Africa). Such formations, in general, occur in regions that are drier than those supporting closed forests.

There are also a third major tropical forest type, though its extent is much less than the two main types.

3. Shrubland: Are characterised by a predominance of woody plants between 0.5 and 7 metres in height.

The remaining major classification units relate to what is found in formerly forested areas after the forest has been cleared - in other words, replacement vegetation.

4. Closed forest fallow: Are derived from the clearing of broadleaved and coniferous forests for shifting cultivation and are typically a mosaic of various woody regeneration stages. Patches of uncleared forest and agricultural fields which occur within extensive areas of shifting cultivation are often included within the estimates because it is difficult to separate such complex formations into their component elements.

5. Open forest fallows: Are open forests in various re-growth stages after the original forest has been cleared for agricultural purposes.

6. Plantations: Are afforested stands established on land which has not carried forest within the last 50 years. Stands which have been established through artificial regeneration but which are essentially similar to those they are replacing are not included. Also excluded are rubber, coconut, cacoa and other plantation tree crops, and plantations established for shade.

Tropical forests in the broadest sense today cover some 2970 million hectares which represents 20 percent of the land surface of the globe. Of this area 40 percent is covered by closed broadleaved forest, 25 percent by open forest types, one percent by coniferous forests and 21 percent by shrubland. Also in this area are included closed forest fallow (8 percent), open forest fallow (6 percent) and plantation (0.5 percent). Figure 2 shows this in diagramatic form while full regional details are given in Table 1.

The bulk of the closed forest occurs in tropical America where the 23 countries of the region possess between them 57 percent of the world total. Africa, on the other hand, is the continent of savanna and shrubland containing 66 percent of the world's open broadleaved forests and 71 percent of its shrublands.

Forest areas are, however, not distributed proportionally among countries within regions. As is shown in Table 2, for example, three countries (Brazil, Indonesia, Zaire) together contain 48 percent of the world's total tropical broadleaved closed forest. Angola, Brazil and Zaire hold 38 percent of the global tropical open broadleaved forest while Brazil alone has almost 30 percent of the tropical broadleaved closed forests of the world and 21 percent of the open.

TROPICAL FOREST CHANGE

General causes

Tropical forests are altered in two ways: through deforestation where all the trees in a particular area are cut and removed, the land then being used for non-forestry, mainly agricultural purposes; and through felling where either an area is logged whereby selected trees are removed for industrial use (most commonly in moist closed broadleaved forests) or trees are felled for fuelwood or conversion to charcoal (mainly in the drier open forest formations). It is usual, however, that logged over forests are eventually deforested so that for long term practical purposes deforestation can be considered the major factor altering the state and extent of tropical closed broadleaved forest.

Deforestation

The most important single cause of deforestation is shifting cultivation which is estimated to account for 70 percent, 50 percent and 35 percent of the total areas deforested in Africa, Asia and the Americas respectively. Shifting cultivators clear forest in patches and, if fallow periods are long enough, a forest mosaic of primary forest, secondary growth and traditional agriculture results.

Other significant causes of deforestation are extensive clearing, particularly of open forests, to create grazing lands, and settlement along logging tracks with subsequent expansion into the forest. The former is a particularly significant deforestation cause in the Americas while the latter is most important in Asia and Africa.

Logging

Logging for industrial purposes, even if done carefully and conscientiously, can also lead to forest damage since the felling of a big tree nearly always damages those around it while the tracks necessary for the movement of heavy machinery and the extraction of logs make further inroads into forest that would otherwise not be touched.

These paths are often used subsequently by human settlers with consequent further forest degradation. This is most apparent in Africa and Asia where 70 percent of the deforestation occurs in areas of closed forests that have previously been logged. In the Americas, however, the comparable figure is only 44 percent because most logs are transported by rivers or along existing roads so that logging operations do not create as many new access roads for agriculturalists to exploit.

In addition logging in pure, or nearly pure closed forest stands such as are found in southeast Asia, may be very intensive with as much as 90 cubic metres per hectare being extracted and this may lead to rapid degradation of the closed forest. In the Americas and Africa where no more than 5-20 cubic metres per hectare of wood are extracted, logging is not thought to be directly responsible for impoverishment of the forests.

Fuelwood and charcoal

Wood for fuel and charcoal is mainly obtained from open forests and shrub formations in the drier parts of the tropics. In the 76 countries covered by the assessment the average yearly total production of fuelwood and charcoal was estimated to be 1,100 million cubic metres during the period 1976-79. This represents 0.6 cubic metres per inhabitant per year and is some eight times the production of wood logged for industrial purposes. In many areas due to the almost total dependence of the rural population upon wood as fuel, especially in Asia and Africa, the natural woody vegetation is being removed at a very rapid rate, or has already disappeared. Current annual wood production for energy production is estimated to be 736 million m^3 in Asia, 314 million m^3 in Africa and 210 million m^3 in tropical America.

Plantations

Plantations do not replace indigenous undisturbed forest but by providing an additional source of wood for industrial and energy purposes, they alleviate the exploitation pressure on these forests. The importance of this can be seen, for example, in Brazil where 11 million of the 38 million m^3 of wood used annually for charcoal production and fuel are obtained from Eucalyptus plantation, with the remainder coming from closed forest (6 million m^3) and the drier open forest (21 million m^3). Without the plantations, the degradation of the natural forests would be much greater