



# **Forestry Department**

**Food and Agriculture Organization of the United Nations**

## **Definitions Related to Planted Forests**

**By**

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## The Forest Resources Assessment Programme

Forests are crucial for the well-being of humanity. They provide foundations for life on earth through ecological functions, by regulating the climate and water resources, and by serving as habitats for plants and animals. Forests also furnish a wide range of essential goods such as wood, food, fodder and medicines, in addition to opportunities for recreation, spiritual renewal and other services.

Today, forests are under pressure from expanding human populations, which frequently leads to the conversion or degradation of forests into unsustainable forms of land use. When forests are lost or severely degraded, their capacity to function as regulators of the environment is also lost, increasing flood and erosion hazards, reducing soil fertility, and contributing to the loss of plant and animal life. As a result, the sustainable provision of goods and services from forests is jeopardized.

FAO, at the request of the member nations and the world community, regularly monitors the world's forests through the Forest Resources Assessment Programme. The next report, the Global Forest Resources Assessment 2000 (FRA 2000), will review the forest situation by the end of the millennium. FRA 2000 will include country-level information based on existing forest inventory data, regional investigations of land-cover change processes, and a number of global studies focusing on the interaction between people and forests. The FRA 2000 report will be made public and distributed on the world wide web in the year 2000.

The Forest Resources Assessment Programme is organized under the Forest Resources Division (FOR) at FAO headquarters in Rome. Contact persons are:

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## **Abstract**

This paper details the difficulties in definitions related to planted forests over recent decades, highlights trends in use of key definitions, recognizes processes underway to harmonize forest related definitions and points to the emerging way forward.

Planted forests can resemble natural ecological processes to a greater or lesser extent. Increasingly planted forests of exotic species are referred to as plantation forests (with single or few species, even age class, uniform planting density). Planted forests of indigenous species are increasingly referred to as forms of semi-natural forest or modified natural forest (depending on degree of naturalness, including mixed species and age classes and variable planting density).

Planted forests are often intensively managed for production purposes, but can also be established for protection, conservation or socio-economic purposes in which case the management may be less intensive. This distinction is important in global assessments that attempt to capture the extent of productive, protective, conservation of biological diversity, and socio-economic functions of forests, which are key criteria for sustainable forest management.

The complementary global forest resources assessment process coordinated by FAO in collaboration with UNEP and UNECE under the guidance of an advisory group; and the harmonization of forestry related definitions process coordinated by FAO in collaboration with the IPCC, CIFOR, IUFRO and UNEP have gathered momentum and strong endorsement from a wide stakeholder base of country experts, academics, scientists, intergovernmental and international non-governmental organizations. There is a determination to resolve the difficulties in forest related definitions related to modified natural forests, semi-natural forests, planted forests and plantation forests that have hindered policy and decision-makers, planners and foresters for decades. However, it is recognized that harmonization does not mean standardization but includes adjustments for improved compatibility, consistency, comparability, linkages and hierarchies between terms and documentation of similarities and differences.

## Definitions Related to Planted Forests

### 1.0 Introduction

#### 1.1 Difficulty in Definition

Planted forests are generally defined according to the extent of human intervention in the forest's establishment and/or management, which depends, to a large extent, on the purpose of growing the forest. In many instances, because there is an extensive range of silvicultural practices applied in varying levels of forest management to achieve different objectives, the difference between a semi-natural forest and planted forests is essentially arbitrary – it is in the eye of the classifier (FAO, 2000a).

There is a need to recognize semi-natural forests which are neither strictly natural forests with minimal management nor planted forests with intensive management, but which provide critical wood and non-wood forest product supplies and valuable social, cultural, environmental and economic values. Semi-natural forests may be selectively harvested for wood and non-wood forest products, receive enrichment planting and/or seeding or have silvicultural treatments to enhance growth and yield. A wider planted forest classification can potentially include indigenous species, particularly in Europe and North America that have been reported as natural forests in FAO Global Forest Resources Assessments in the past, including the Global Forest Resources Assessment 2000.

#### 1.2 Emerging Logic

The broad agreement from recent definitions processes is that “Forests” are tree covered areas not predominantly used for purposes other than forestry.

“Forests” regenerated naturally without human intervention, are referred to as “Natural Forests”.

“*Forests*” also include those planted or seeded with human intervention, where the main land use is for production (wood and fibre), protection (soil, water and other environmental values), conservation of biological diversity (*ex situ*), socio-economic (recreation, amenity, cultural) or combinations of these. These forests are referred to as “Planted Forests”.

“*Forests*” (and thus “Planted Forests”) exclude those trees planted or seeded with human intervention where the main land use is for agricultural production, e.g. fruits, saps or for other non-forest land uses. These trees are referred to as “Trees Outside Forests”.

“*Planted Forests*” can resemble natural ecological processes to a greater or lesser extent. This distinction is important in global assessments that attempt to capture environmental functions of forests. Therefore there is a need to distinguish between “Planted Forests” consisting of indigenous species from those consisting of exotic species. There is a trend towards referring to Planted Forests of exotic species as “Plantation Forests” (with single or few species, even age class, uniform planting density). “Planted Forests” of indigenous species are forms of “Semi-natural Forests” or “Modified Natural Forests” (depending on degree of naturalness, including mixed species and age classes and variable planting density).

“*Planted Forests*” are often intensively managed for production purposes, but can also be established for protection, conservation or socio-economic purposes in which case the management may be less intensive. This distinction is important in global assessments that attempt to capture the extent of both productive and environmental functions of forests.

### **1.3 Scale of Plantation Forest Resources**

According to the Global Forest Resources Assessment 2000 (FAO, 2001a), the area of plantation forests was 187 million hectares, a significant increase over the 1995 estimate of 124 million hectares. Asia accounted for 62 percent. The largest plantation forest resources were found in China (24 percent) and India (18 percent). Annual new planting was 4.5 million hectares globally, with Asia and South America accounting for 91 percent. The predominant genera were *Pinus* (20 percent) and *Eucalyptus* (10 percent); however, the species groups varied markedly among geographic regions. Globally, 48 percent of the plantation forest estate was for industrial (or production use), 26 percent for non-industrial (or protection) use (fuelwood, soil and water protection other environmental values) and 26 percent was not specified.

Reported plantation forests accounted for less than 5 percent of global forest cover, of which, those planted for industrial purposes made up 3 percent of global forest cover. However, industrial plantation forests have been variously estimated to account for 22 percent of global roundwood supplies to industry in 2000 (FAO, 2000a) up to 35 percent in 2000, 44 percent in 2020 and 46 percent in 2040 (FAO, 1999); (ABARE et al, 1999); (Carle et al, 2002).

Plantation forests will have an increasing role as a sustainable, energy efficient and environmentally and socially friendly source of world roundwood, fibre, fuelwood, non-wood forest products and other social and environmental values. This is particularly so as natural forest areas decrease owing to deforestation (largely in developing countries in the tropics and subtropics) or are designated as protected areas (largely in developed, temperate countries).

## **2.0 Trends Over Recent Decades**

### **2.1 FAO World Symposium on Man-made Forests**

At the World Symposium on Man-made Forests and their Industrial Importance, Canberra, Australia, 1967 the issues relating to definition of man made forests essentially addressed similar issues that we are grappling with today – the degree of naturalness and intensity of management (FAO, 1967). A selection of planted forest related definitions at that time are listed below:

“*Man-made Forest*”: A forest crop raised artificially, either by sowing or planting.

“*Forest*”: A width of 100 metres minimum was considered necessary to qualify as a forest, rather than as shelterbelts, avenues, line plantings etc. The latter were considered as plantings outside the forest (windbreaks, roadside plantings agroforestry etc). Minimum stocking at that time was 1,000 stems/hectare or 75 percent of the trees planted whichever was the lesser. Young plantation forests with 25-75 percent stocking were considered “partially stocked” and those with less than 25 percent stocking were considered poorly stocked.

*“Agricultural vs Forestry Crops”*: It was considered that the distinction between agricultural and forestry tree crops was not logical, often obscure, however, for reporting purposes it was considered critical to have consistent reporting between countries. (e.g. Cashew, Rubber, Oil Palm, Coconut Palm etc).

*“Afforestation”*: Forests established artificially by afforestation on land which previously did not carry forest within living memory where there were no records, or within 50 years if records existed. Clearly a man-made forest.

*“Reforestation”*: Forests established artificially by reforestation on land that carried forest within the previous 50 years or within living memory, and involved the replacement of a previous crop by a new and essentially different crop. The frequent changes included different species or superior genotypes. Clearly a man-made forest.

*“Artificial Regeneration”*: Forests established by artificial regeneration on land that carried forest within the previous 50 years or within living memory, and involved the renewal of what was essentially the same crop as before. As the new crop was essentially the same as its predecessor, this was deemed a forest remade by man. Not clearly a man-made forest.

*“Natural regeneration (with assistance)”*: Forests established by natural regeneration, with deliberate silvicultural assistance from man. The source of seed or vegetative reproduction is natural so this is a natural forest assisted by man. Not clearly a man-made or natural forest.

*“Natural regeneration (without assistance)”*: Forests established by natural regeneration without deliberate assistance from man. These included virgin forests and those regenerated by natural means. Clearly a natural forest.

*“Mixed Regeneration Systems”*: When both natural and artificial regeneration were carried out in the same area, if over 50 percent of the intended final crop was regenerated artificially, then the forest was considered man-made. Not clearly man-made or natural forest.

*“Naturalization”*: Plantation forests of exotics were man made, however, if subsequent rotations regenerated naturally it was debatable whether the forests were man made or natural. It was generally agreed that naturally regenerated crops of exotics be considered man made forests up to 250 years from the date of original introduction. Beyond 250 years, the forest was considered naturalized. Not clearly man made or natural forest.

A classification of man made forests was also considered at that time to be based upon intensity of management and the effectiveness of stocking, however there was no clear statement of objective(s) of management (FAO, 1967).

## **2.2 International Expert Consultation, Santiago, Chile**

The international expert consultation on the role of planted forests in sustainable forest management, Santiago, Chile, 1999 recognized that planted forests provided a diverse range of goods and services, including industrial wood, fuelwood, non-wood forest goods (eg. animal fodder, apiculture, essential oils, tan bark, cork, latex, food), and conservation, carbon sequestration, recreation (eg. hunting, fishing, hiking), erosion control and rehabilitation of degraded lands, including landscape and amenity enhancement. Several functions could occur simultaneously. At the same time, circumstances of each country varied with differing economic, social, cultural and other critical aspects that impacted upon forestry.

Different management objectives and practices were used to deliver the variety of goods and services required. The management objectives of a forest planted with wood production as a primary goal differed substantially from a planted forest that had erosion control as its principal objective. With sound planning, silvicultural practices, complemented by monitoring and research and effective bio-security, planted forests were considered to contribute to ecological stability, transitional rehabilitation of degraded lands and increase of forest cover, particularly in countries with low forest cover.

The meeting concluded that traditionally, forests had been defined as either natural or planted depending on a number of factors including method of establishment, management intensity and nature of the species used. With the inclusion of non-wood forest product values to the management objectives of many planted forests and with the initiation of management practices in many of the natural forests, the distinction between natural and planted forests was more difficult to make. It was recognized that a continuum existed from highly protected natural forests, with minimal management, for primarily environmental purposes; to planted forests, intensively managed for production purposes; with the boundary between planted and natural forests being indistinct. This prevented a highly prescriptive definition of planted forests from being used.

The meeting recommended that when considering the definition of planted forests, the international community, especially FAO, and individual countries should take into account the need to reflect the differing intensity of management as well as the different purposes for growing planted forests.

## **2.3 Forest Resources Assessments 1980, 1990 and 2000**

Although the Forest Resources Assessments (FRA) are coordinated and reported by FAO, they are the culmination of expert consultative group and advisory group meetings and collaboration with each country through regional and national focal points. Expert consultations on Forest Resources Assessment were held in Kotka, Finland in 1986, 1993, 1996 and 2002 to review the performance, lessons learned and derive the conceptual framework for subsequent FRA exercises (FAO, 2001b); (FAO, UNEP, UNECE, 2002). A summary is given in Table 1.

**Table 1 Kotka Expert Consultations for Forest Resources Assessment**

Meeting/Date	Sponsors	Participants	Purpose
Kotka I 1987	FINNIDA, FAO-ECE	50 experts from a wide range of stakeholders including international agencies, countries and other institutions (academic, research etc)	Review FRA 1980 and derive conceptual framework for FRA 1990 for Tropical Developing Countries
Kotka II May 1993	FINNIDA, FAO-ECE	58 experts including 49 nominated from countries and 9 from international agency or NGO	Review FRA 1990 and derive conceptual framework for FRA 2000, expanded from Tropical Developing Countries to a Global Forest Resources Assessment. Concept and definitions of plantations forests recognized as a difficulty
Kotka III 10-14 June 1996	FINNIDA, FAO-ECE	32 country experts and major international agencies and NGOs	Derivation of a Strategic Plan and conceptual framework for FRA 2000, endorsed by the FAO Committee on Forestry (COFO), 1997
Kotka IV 1-5 July 2002	FINNIDA, FAO-ECE	57 experts – 32 nominated countries, 10 intergovernmental organizations and 15 other organizations including NGOs	18 background papers and derivation of the rationale, scope, medium term objectives and priority actions, including a multi-disciplinary and informal Advisory Group for balanced representation regarding the next Global FRA

A comparison between FRA 1980, 1990 and 2000 definitions used for forest plantation resources assessment purposes is given in Table 2 for ease of comparison (FAO, 2001b).

In the temperate and boreal component of FRA 2000, the following clause was added to the general terms and definitions of plantation forests used for all other countries:

*“excludes: stands which were established as plantations but which have been without intensive management for a significant period of time. These should be considered semi-natural.”*

**Table 2: Definitions used in FRA 1980, 1990 and 2000 to Describe Forest Status**

Definition	FRA 1980	FRA 1990	FRA 2000
<b>Forest</b>	Stands with a crown density of at least 10 percent or, at least 7 metres height	Stands with a crown density of at least 10 percent or, at least 5 metres height	Land with tree crown cover (or equivalent stocking level) of more than 10 percent and area of more than 0.5 hectares (ha). The trees should be able to reach a minimum height of 5 meters (m) at maturity <i>in situ</i> .
<b>Plantation Forest</b>	Forest stands established artificially by afforestation on land which previously did not carry forest; and forest stands established artificially by reforestation on land which carried forest within the previous 50 years or within living memory and involving the replacement of the previous crop by a new and essentially different crop	Forest stands established artificially by afforestation on land which previously did not carry forest; and forest stands established artificially by reforestation on land which carried forest within the previous 50 years or within living memory and involving the replacement of the previous crop by a new and essentially different crop	Forest stands established by planting or/and seeding in the process of afforestation or reforestation. They are either of introduced species (all planted stands), or intensively managed stands of indigenous species, which meet all the following criteria: one or two species at planting, even age class, regular spacing.  New plantation forests were defined as afforestation for artificial establishment of forest on lands which previously did not carry forest within living memory or the past 10 years; and reforestation for artificial establishment of forest on lands which carried forest before.
<b>Classifications</b>	Hardwoods, Softwoods Industrial <sup>1</sup> , Non industrial <sup>2</sup>	Industrial, Non-industrial	Broadleaves, Softwoods Industrial, Non-industrial Public, Private, Other Ownership
<b>Trees Outside Forests</b>			Trees outside forests are trees and tree environments on land not defined as forest or other wooded land
<b>Exclusions</b>	Rubber, palm oil and coconut plantations	Rubber, palm oil and coconut plantations	
<b>Inclusions</b>			Rubber and cork oak included as plantation forests and oil palm and coconut included as non-forest plantations

<sup>1</sup> Industrial plantations were defined as those for production of wood for industry (saw-logs, veneer-logs pulpwood and pit props).

<sup>2</sup> Non-industrial plantation were grown for fuelwood, charcoal, domestic consumption, non-wood forest products and soil and water protection, including those for production of gum Arabic.

European countries which reported high percentages of their forests as plantation forests in FRA 2000 included Ireland and Malta, with 100 percent; Denmark, 92 percent; United Kingdom, 57 percent and Belgium, 46 percent. In contrast, Finland, Austria, Germany, Czech Republic, Liechtenstien and Canada, reported having no plantation forests. Presumably, significant areas of forests in these countries were considered semi-natural forests and thus, not reported as plantation forests. Conversely, neighbouring countries with seemingly similar forestry practices and philosophies reported significant plantation forest areas (FAO, 2000a).

Another example, in FRA 2000, Sweden reported 550,000 ha of *Pinus contorta* planted from the early-1970s of a total plantation forest area of 572,000 hectares. It was assumed that most plantation forests earlier recorded, prior to 1970, were reclassified as semi-natural forests (FAO, 2000a).

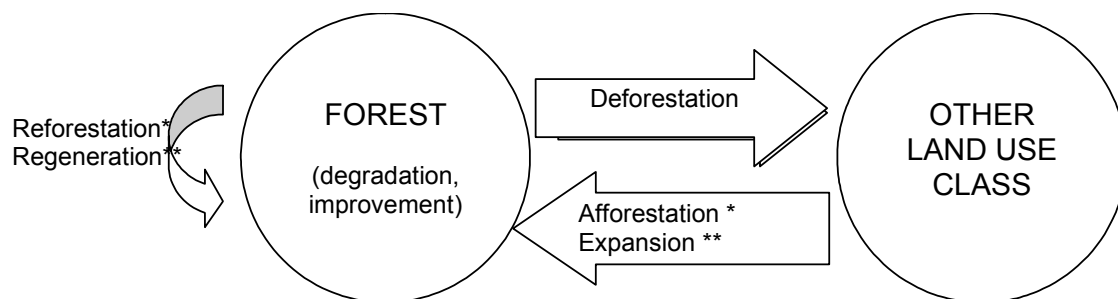
Definitions are also necessary to describe changes (losses, gains and quality) of forests (FAO,1998); (FAO, 2000b); and (FAO, 2001a).

**Table 3: Definitions, FRA 2000 to Describe Forest Change**

Change Term	Definitions used in FRA 2000
Deforestation	Conversion of forest to another land use <i>or</i> the long term reduction of tree canopy cover below the 10 percent threshold
Forest Degradation	Reduction of the canopy cover or stocking within a forest
Afforestation	Conversion from other land uses into forest, <i>or</i> the increase of canopy cover to above the 10 percent threshold
Reforestation	Re-establishment of forest formations after a temporary condition (less than 10 years) with less than 10 percent canopy cover due to human induced or natural perturbations

FRA 2000 recognized seven basic change processes with forest or between forests and other land uses (FRA, 2001a). These are detailed in Figure 1.

**Figure 1: Change Processes for Forests**



\* Planted Forests

\*\* Natural Forests

### **3.0 Harmonization of Forestry Related Definitions**

#### **3.1 Background**

Two expert meetings on harmonizing of forest-related definitions for use by various stakeholders<sup>3</sup> recommended options for harmonizing forest-related definitions; made proposals for the implementation of these options; and established a commonly agreed future agenda. It was recognized that harmonization did not mean standardization but included adjustments for improved compatibility, consistency, comparability, linkages and hierarchies between terms and documentation of similarities and differences (FAO, 2003).

On-going processes connected with this meeting, included:

- Kotka Process to improve the Global Forest Resources Assessment led by FAO (FAO, UNEP, UNECE, 2002);
- UNFCCC/SBSTA Process to develop definitions for afforestation and reforestation under Article 12 of the Kyoto Protocol (KP) referring to the Clean Development Mechanism (CDM);
- IPCC, development of Good Practice Guidance for Land Use, Land-use Change and Forestry (LULUCF) (task 1);
- IPCC, development of definitions for human-induced ‘degradation’ of forests and ‘devegetation’ of other vegetation types and methodological options for inventory and reporting on emissions resulting from these activities (task 2);
- Collaborative Partnerships on Forests’ (CPF) Task Force, on harmonizing and streamlining forest-related reporting under the United Nations Forum on Forests (UNFF);
- IUFRO, forest terminology, e.g. urban forestry, electronic discussion groups on key terms, and terminological awareness;
- UNEP/IUFRO, definitions on low forest cover countries
- CIFOR/World Wildlife Fund (WWF) and World Conservation Union (IUCN), on plantation typology.

#### **3.2 Needs and Tools for Harmonization**

It was recognized that each international convention or process was context-specific and applied its own definitions of forest-related terms. However, the use of these terms and the way they were defined should be as consistent as possible. It was recognized that before adopting new definitions for widely used terms, consistency with current uses in other fora needed to be considered.

A comparative analytical framework of forest-related definitions between international processes was prepared to compare definitions, improve communication and clarify the need and feasibility of developing new ones.

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<sup>3</sup> Expert meetings jointly organized by FAO and IPCC, in collaboration with CIFOR, IUFRO, UNEP, Rome, 19-23 January and 11-13 September, 2002, attended by 67 experts (international processes, international agencies, academics, scientists, IGOs and NGOs,

The harmonization process to foster a common understanding of concepts, terminology and definitions will be reported by the Collaborative Partnership on Forests (CPF) to the third session of the United Nations Forum on Forests (UNFF-3, May 2003).

### **3.3 Status of Harmonization**

The two expert meetings concluded that differences were minor in the definitions of the terms: forest, forest land, forested land, other wooded land, non-forest, reforestation, forest degradation and forest improvement.

Terms used primarily in a regional rather than a global context with differing meanings from region to region, related to old-growth forest, and semi-natural forest.

Inconsistencies that required new formulations or adaptations included: other land (other than forest and other wooded land), afforestation, deforestation, planted forest, forest rehabilitation, forest restoration, forest fragmentation, secondary forest, trees outside forests; and low forest cover.

“Supporting” terms on condition or quality of forests that required further work in cooperation with the processes included: plantation forest, natural forest, naturalness of forest and other forest conditions, managed and unmanaged forest, consideration of quality of forest management and, in particular, sustainable forest management in different contexts.

### **3.4 Managed and Unmanaged Forests, Forest Condition**

The expert consultation reached preliminary conclusions on some definitions related to planted forests (FAO, 2003).

*“Forest management”*: the process of planning and implementing practices for stewardship and use of the forest aimed at fulfilling relevant ecological, economic and social functions of the forest.

*“Unmanaged forest”*: neither any management decision nor any management planning or management interventions had been implemented. Lack of formal management did not necessarily mean that a forest was unmanaged or dealt with in an unsustainable manner.

*“Natural forests”*: forests composed of indigenous trees regenerated naturally. This can include both spontaneous and assisted natural regeneration.

*“Primary forest”*: as a subset of “natural forest” is a forest undisturbed (directly) by humans.

*“Old-growth forest”*: is a subset of primary forest. Whether old-growth is limited to primary forest or would be relevant to secondary or semi-natural forests merits further consideration.

*“Secondary forest”*: is a forest regenerated naturally, or through assisted regeneration, on land that had been previously subject to land-use change, or to partial destruction by other causes, e.g. fire.

*“Semi-natural forest”*: a managed natural forest which, over time, has taken on a number of natural characteristics (such as layered canopy, enriched species diversity, random spacing, etc.) or planted forests which acquire more natural characteristics over time (e.g. abandoned plantation forests that diversify with age and natural regeneration of indigenous species).

*“Planted forests”*: are forests in which trees have been established through planting or seeding by human intervention. Plantation forests are a subset of planted forests.

*“Plantation forests”*: are planted forests that have been established and are (intensively) managed for commercial production of wood and non-wood forest products, or to provide a specific environmental service (e.g. erosion control, landslide stabilization, windbreaks, etc.). Planted forests established for conservation, watershed or soil protection may be subject to little human intervention after their establishment. Changes may occur in purpose, degree of management intensity, time scale and potential reversibility (to other land uses). The Meeting considered the FRA definition of plantation forest to be precise and recommended it for consideration by other organizations, fora and processes.

## **4.0 The Way Forward**

### **4.1 Basis for Future Global Forest Resources Assessment**

Since Kotka IV, July 2002, FAO have established a multi-disciplinary and informal advisory group with a balanced representation of experts, FRA national correspondents, representatives from relevant international bodies, and other stakeholders. Meetings of the advisory group were held in Nairobi, Kenya, 16-18 October, 2002 and 13-15 March, 2003, to advise FAO and its partners on the implementation of the Global Forest Resources Assessment and including its concepts, classifications, definitions, methods, organisation, timing and communication of results.

As outlined in this paper, the variables describing “naturalness” and “management” of forests have caused problems for the FRA process because it is difficult to find globally consistent definitions for these parameters, but also because the nature of existing data may vary considerably between countries and regions. There are also value-laden opinions that are expressed differently by different stakeholders.

In the past “naturalness” at the global level has been classified according to whether natural forest or plantation forest. However, the above distinction has not been considered sufficient in temperate and boreal regions where semi-natural forests classification is used to describe modified forests with native species so new classifications need to better reflect “naturalness” and “forest management”.

## 4.2 Designation of Forest Management Objective

Based on the Expert Consultation on harmonizing forest-related definitions (FAO 2003), it is proposed to adopt their definition of forest management:

Since it has been strongly recommended that FRA be based around the principles and criteria of sustainable forest management, the variables used should, to the extent possible, be useful to monitor and assess the state of forests against each of the criteria. It is therefore logical to create a forest management classification that takes the primary criteria into account including: for biological diversity; production; protection; and socio-economic (FAO, UNEP, UNECE, 2002); (Govil, 2002); and (Holmgren, 2002).

The proposed designated forest management objectives of forest and other wooded land areas proposed in Table 4 are not mutually exclusive (Holmgren, 2002).

**Table 4: Descriptions According to Primary Forest Management Objective**

<b>Designated Forest Management Objective:</b>	<b>Description</b>
Production	Forests where the extraction of forest products, usually wood and fibre are the predominant management objective.
Protection	Forests where soil and water protection, shade, shelter or other protective functions constitute the predominant management objective. Corresponds to IUCN categories.
Conserving biological diversity	Forests where the predominant management objective is to conserve biological diversity. In most cases extensively managed, but some intensively managed areas (high level of inputs) may be included. Corresponds to IUCN categories.
Socio-economic services	Forests with predominant management objective to provide social services, e.g. recreation, spiritual and cultural functions. Corresponds to IUCN categories.
Production in combination with other function(s)	Forests where the management objective is explicitly defined as a combination of productive functions and one or more other functions.

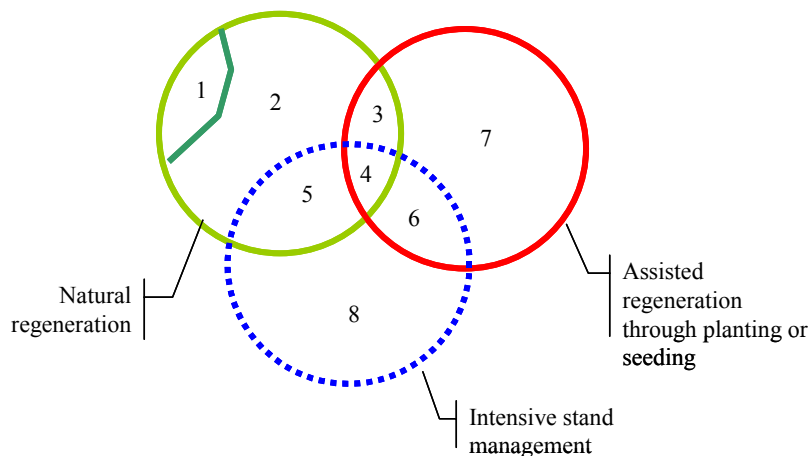
## 4.3 Forest Characteristics

It is proposed that variables on naturalness and management intensity broadly describe the extent that natural ecological processes are present in forests, and the level that management is applied to achieve the designated management objective(s) by modifying the forest (tree) structure. Four principal variables are proposed for naturalness building on descriptors and classification currently used in FRA, including whether the forest has:

- maintained its natural ecological processes
- been established through natural regeneration;
- been regenerated/established through planting or seeding by human intervention;
- intensive stand management, in addition to planting/seeding by human intervention, has been applied that has or may modify the forest structure and/or composition in order to achieve management objectives

Considering that these modifiers are not mutually exclusive, the following Figure 2 and Table 5 illustrate the possible combinations (Holmgren, 2002).

**Figure 2: Representation of Forest Characteristics of Naturalness and Intensity of Management**



**Table 5: Descriptions of Forest Characteristics of Naturalness and Intensity of Management**

Number	Proposed forest naturalness class	Explanation
1	Primary forest	Forests that regenerate naturally, where the natural set of ecological processes are undisturbed by humans.
2	Modified natural forest (1)	Forests of native species that regenerate naturally where the natural set of ecological processes has been modified or disturbed but where intensive stand management is not practised.
3	Modified natural forest (2)	Forests of native species, established either through assisted or natural regeneration, or a mix of these, under non-intensive management. Example: soil protection areas where enrichment planting has been made.
4	Semi-natural forest (1)	Forests of native species, established either through assisted or natural regeneration, or a mix of these under intensive stand management (Includes forests in which assisted regeneration carried out with same species and similar species composition as in the natural forests in the area.) Example: many production forests in Europe, some teak plantations.
5	Semi-natural forest (2)	Forests of native species that have regenerated naturally and are under intensive stand management. Example: pine forests in boreal areas.
6	Production plantation forest	Forests of exotic species that have been planted or seeded by human intervention and that are under intensive stand management, fast growing, short rotation. Example: <i>Poplar</i> , <i>Acacia</i> or <i>Eucalyptus</i> plantations.
7	Protection (and other environmental) plantation forest	Forests of exotic species that have been planted or seeded by human intervention and that are not under intensive management. Example: tree plantings for soil and water conservation purposes and ecological rehabilitation.
8	Not applicable	

The challenge is how to combine the designated forest management objective with intensity of forest management and forest characteristics for reporting purposes for natural

forests, modified natural forests, semi-natural forests, planted forests and plantation forests for the future. The existing concepts in FRA will need to be re-cast and conceptualized in a way that make them more useful for purposes of the next Global Forest Resources Assessment, proposed in 2005.

#### **4.4 Support for the Approach**

The Committee on Forestry (COFO), the governing body of FAO<sup>4</sup> endorsed the recommendations of Kotka IV and advisory group meetings on global forest resources and recommended that the harmonization of forest-related definitions process be continued in collaboration with other organizations to address critical issues that are not yet resolved. FAO, which is mandated to undertake these processes in collaboration with a wide range of collaborative partners, welcome dialogue and feedback to refine the definitions to be useful for not only forest resources assessment purposes, but a wider group of stakeholders and users.

#### **5.0 Conclusions**

Consistent definitions and reliable data have proven problematic in quantifying plantation forests or planted forest resources in both industrialized and developing countries. It has not always been possible to distinguish plantation forests from natural forests in those countries where natural species were grown on long rotation, mixed-species, mixed age plantings in temperate and boreal regions. The distinction between natural forests and plantation forests has been more clear-cut in plantings of single species, uniform planting densities, even age classes, shorter rotation, intensively managed, as often found in tropical and sub-tropical regions. Additionally incomplete, inconsistent and unreliable data on gross/net areas of planted forests by species, purpose, ownership, age class distribution, intensity of management, growth, rotation, harvest yield and forest products output have proven significant impediments to analyzing status and trends for outlook studies, policy-making and planning the extent of planted forests and their impacts on raw materials supplies and other social, environmental and economic values.

There is a need to recognize semi-natural forests which are neither strictly natural forests with minimal management nor planted forests with intensive management, but which provide critical wood and non-wood forest product supplies and valuable social, cultural, environmental and economic values.

The complementary global forest resources assessment and the harmonization of forestry related definitions processes coordinated by FAO, have gathered momentum and strong support from a wide range of collaborators and stakeholders. The intention is to resolve the difficulties in forest related definitions that have hindered foresters and planners for decades, including those related to modified natural forests, modified natural forests, semi-natural forests, planted forests and plantation forests.

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<sup>4</sup> 16<sup>th</sup> Session, COFO, 10-14 March, attended by 113 member countries, 1 UN Member State, the Holy See, 8 UN Agencies and Programmes, 23 Intergovernmental and International NGOs

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