


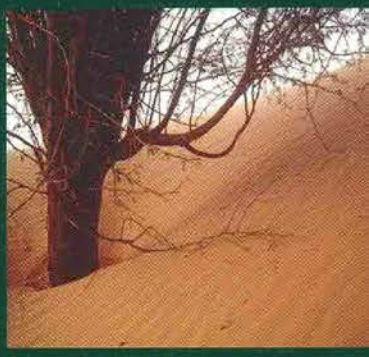

PROCEEDINGS

SECOND EXPERT MEETING ON HARMONIZING FOREST-RELATED DEFINITIONS FOR USE BY VARIOUS STAKEHOLDERS

Rome, 11–13 SEPTEMBER 2002

WMO

INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC)

UNEP

FAO

CIFOR
CENTRE FOR INTERNATIONAL FORESTRY RESEARCH

IUFRO

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

Rome, 2002

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FOREWORD

Barely nine months ago, FAO, IPCC, IUFRO and CIFOR convened the first Expert Meeting on Harmonizing Forest-related Definitions for Use by Various Stakeholders. The objective of the process then started was to harmonize forest-related definitions taking into consideration not only the viewpoints of climate change and forest resources assessments, but also those of biodiversity conservation and forest management. It was hoped that harmonization would contribute to improved communication and facilitate data exchange on forest-related issues between countries and organizations, on one hand, and help reduce the reporting burden on countries, on the other.

In spite of this seemingly impossible undertaking, the participants realized during the first meeting that reaching a common understanding on some forest-related definitions and harmonizing others was not only feasible and highly useful, but also that they had barely been able to scratch the surface. Further painstaking work would be required in order to tackle the problems created by inconsistent definitions of terms and concepts, which are bound to multiply commensurate with the increased global role of forests (e.g. carbon-related terminology).

This effort of harmonizing forest-related definitions does not stand alone. It complements other related activities undertaken by varied organizations and bodies. Participation in this meeting of a number of experts from the other processes will strengthen the synergies between processes and help avoid overlapping.

After the first meeting, the United Nations Environment Programme joined as a partner organization, which is evidence of the growing recognition the process has gained. Also, reference to it was made in the recommendations of the SBSTA 16 of UNFCCC and UNFF 2.

Based on the results of the first expert meeting, an analytical framework was drafted and pre-screened by a small task group. During the second meeting this framework, with its definitions for forest-related core and supporting terms, was discussed and further elaborated.

The excellent and close collaboration between the convening organizations – FAO, IPCC, IUFRO, CIFOR and UNEP – was highly appreciated, as was the collaboration with the secretariats of UNFCCC, CBD and other organizations. FAO and its partner organizations are grateful for the experts' contributions and their continuing commitment.

Well aware of its technical nature, the Meeting undertook to suggest a number of recommendations to different organizations and bodies. These "clients" of the process will decide on the next steps.

Wulf Killmann
Chairperson, Interdepartmental Working Group on Climate Change
Director, Forest Products Division

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ACRONYMNS AND ABBREVIATIONS

%	percent
a	acre
AHTEG	Ad Hoc Technical Expert Group on Forest Biological Diversity
AOSIS	Alliance of Small Island States
ARD	afforestation, reforestation, deforestation
C	carbon
C&I	Criteria and Indicators
CBD	Convention on Biological Diversity
CDM	Clean Development Mechanism
CIFOR	Centre for International Forestry Research
CMSF	Controlled Managed Secondary Forest
CO_2	carbon dioxide
COFO	Committee on Forestry
COP	Conference of the Parties
CP	Conference Paper
CPF	Collaborative Partnership on Forests
CSCE	Commission on Security and Cooperation in Europe
dbh	diameter at breast height
DG	Directorate General
ECE	Economic Commission for Europe
EFTA	European Free Trade Association
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FMU	Forest Management Unit
FRA	Forest Resources Assessment
GEZ	global ecological zone/zoning
GIS	geographical information system
GPG	Good Practice Guidance
h	height
ha	hectare
IFF	Intergovernmental Forum on Forests
ILO	International Labour Organization
IPCC	Intergovernmental Panel on Climate Change
IPF	Intergovernmental Panel on Forests
ITTA	International Timber Trade Agreement
ITTC	International Tropical Timber Council
ITTO	International Tropical Timber Organization
IUCN	World Conservation Union
IUFRO	International Union of Forestry Research Organizations
km^2	square kilometres
KP	Kyoto Protocol
LFC	Low Forest Cover
LFCC	Low Forest Cover Countries
LCCS	Land Cover Classification System

LULUCF	Land Use, Land Use Change and Forestry
m	metre
MA	Marrakesh Accord
NTFP	non-timber forest products
NWFP	non-wood forest products
SADC	Southern African Development Community
SBSTA	Subsidiary Body for Scientific and Technical Advice
SBSTTA	Subsidiary Body for Scientific, Technical and Technological Advice
SFM	sustainable forest management
TBFRA	Temperate and Boreal Forest Resources Assessment
ToF	Trees outside forests
ToR	Terms of reference
UMSF	Uncontrolled Managed Secondary Forest
US	United States
UN	United Nations
UNCCD	United Nations Convention of Combating Desertification
UNCED	United Nations Conference on Environment and Development
UN-ECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific, and Cultural Organization
UNFCCC	United Nations Framework Convention for Climate Change
UNFF	United Nations Forum on Forests
USDA	United States Department of Agriculture
USFS	United States Forest Service
WB	World Bank
WCMC	World Conservation Monitoring Centre
WFC	World Forestry Congress
WWF	World Wildlife Fund

INTRODUCTION

The Second Expert Meeting on Harmonizing Forest-related Definitions for Use by Various Stakeholders was jointly organized by the Food and Agriculture Organization of the United Nations (FAO) and the Intergovernmental Panel on Climate Change (IPCC), in collaboration with the Centre for International Forestry Research (CIFOR), the International Union of Forest Research Organizations (IUFRO) and the United Nations Environment Programme (UNEP) at FAO Headquarters, in Rome, from 11 to 13 September 2002.

The meeting was a follow-up to the first Expert Meeting, organized by the same bodies in Rome from 19 to 23 January 2002, which recommended, *inter alia*, establishing a Task Group; preparing a comprehensive analytical framework; and organizing another expert meeting to review the framework and decide on further action.

Objective

The objectives of the meeting were to (i) recommend options for harmonizing forest-related definitions, (ii) make proposals for the implementation of these options, and (iii) establish a commonly agreed upon future agenda. It was expected to thus contribute towards improving efficiency of processes in different international policies related to forests.

It was clearly stated that harmonization does not mean standardization. Harmonization can include adjustments for improved compatibility and consistency, establishing comparability, linkages and hierarchies between terms, but also documenting differences.

Other Processes

A number of other on-going processes are connected with this meeting, such as:

- the Kotka process related to the improvement of the Global Forest Resources Assessment led by FAO;
- the 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);
- the IPCC work to develop Good Practice Guidance for Land Use, Land-use Change and Forestry (LULUCF) (task 1);
- the IPCC work on developing 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);
- the work of the Collaborative Partnerships on Forests' (CPF) Task Force on harmonizing and streamlining forest-related reporting under the United Nations Forum on Forests (UNFF);
- IUFRO's recent work on forest terminology, e.g. urban forestry, electronic discussion groups on key terms, and terminological awareness;
- UNEP's work on Low Forest Cover
- the plantation typology undertaken by CIFOR, World Wildlife Fund (WWF), World Conservation Union (IUCN) and others.

The background document "Analytical Framework on Forest-related Definitions" was prepared and shared with the participants before the meeting.

The participants (Annex I) included a total of 54 experts, resource people and observers invited by the Director-General of FAO. The experts were selected on the basis of their specialized knowledge and familiarity with the ongoing work on forest-related definitions in various international forums, including UNFCCC, CBD, UNCCD and UNFF. Participants served in their personal capacity and not as representatives of their governments or organizations. In addition, resource people from each of the co-sponsoring and collaborating agencies attended the meeting.

The Meeting agenda is shown as Annex II.

Opening Ceremony

The meeting was opened by Mr M. Hosny El-Lakany, Assistant Director-General of the FAO Forestry Department. Mr Geoff Love, Secretary of IPCC; Mr Heinrich Schmutzenhofer, Executive Secretary of IUFRO; Mr Jens Mackensen, representative of UNEP and Mr Robert Nasi, representative of CIFOR, made statements for the co-organizing Organizations on the relevance of the Meeting's work to their organizations.

Mr Dennis Tirpak, Coordinator, Science and Technology, UNFCCC, gave an account of the current process under the UNFCCC on land use and land-use change and forestry (LULUCF) related activities which would benefit from the results of the meeting.

Organization of Work

The meeting was chaired by Mr Wulf Killmann, Director of the FAO Forest Products Division, and moderated by Mr Markku Simula, Indufor OY. Most of the meeting was conducted in the form of group sessions. Three groups focused their work on the ways and means to harmonize different groups of core and supporting definitions. The first group, which dealt with issues related to definitions of forest and change processes between forest and other land classes, was chaired by Mr Ian Noble and its reporter was Mr Brian Haddon. The second group, which explored definitions of change processes within the forest, focusing its work on forest degradation, was chaired by Mr Jens Mackensen with Mr Robert Nasi acting as reporter. The third group worked on forest management and forest conditions under the leadership of Mr Jürgen Blaser, with Ms Andrea Tuttle as reporter. The fourth group dealt with the issue of forest classifications and the issue whether differentiated definitions should be applied under various processes and instruments. The group was chaired by Mr Jean-Paul Lanly and its reporter was Ms Eveline Trines. A fifth group was formed to study the definition of Low Forest Cover, and it was chaired by Mr Tage Michaelsen with Mr Allali Abdelkader as reporter.

During the first plenary session, after the introductory remarks by Mr Killmann, Mr Dieter Schoene summarized the latest developments under related international processes including the on-going work by IPCC, UNFCCC, IUFRO, UNEP, the Collaborative Partnership on Forests (CPF) and CIFOR. Mr Peter Holmgren briefed the participants on the results of the Kotka IV meeting held in August 2002 on the further development of the Global Forest Resources Assessment (FRA). The moderator then presented the highlights of the background paper. The work was broken down into groups and a plenary session was held during the second day to take stock of the progress. The groups interacted through direct contacts during the course of work.

The presentations made in the workshop are reproduced in Annex IV and the reports of Group Work in Annex VI.

CONCLUSIONS

Need and Tools for Harmonization

The Meeting reiterated the need for a common understanding of, and harmonization between, forest-related definitions of core terms used by different international processes and instruments to reduce errors in employing terms; the reporting burden on countries and related costs; and the confusion in communicating with the media and the public at large.

Harmonization in this context means improved comparability, compatibility and consistency between definitions; establishment of linkages; and description of relationships between terms. The process of harmonization involves documentation of similarities and differences between definitions, for which analytical tools can be used.

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. As an example, when COP7 of UNFCCC used "degradation" in its mandate to IPCC, it actually intended to focus on a human-induced reduction of carbon stock in the forest, whereas under other processes it was related to any change in the forest condition, leading to a reduced overall capacity to supply goods and services from the forest[1].

The Meeting emphasized the need of accuracy in the definition of terms that were used for different purposes under various processes. Before adopting new definitions for widely used terms, consistency with their current use in other fora should be considered.

Whilst the Meeting recognized that a comprehensive definition of forests requires the inclusion of social considerations, the group agreed that, for the purposes of this process, it was not appropriate to further incorporate these into the core definition of forest. They should be included instead in the further characterization of forest. This should be explored in the appropriate arenas and through mechanisms such as the international frameworks for criteria & indicators for Sustainable Forest Management.

The comparative analytical framework of forest-related definitions between international processes should be widely disseminated, used and developed. Such a framework, drawing on comparative matrices and set concepts, identifies (i) the presence or absence of various elements or parameters contained in the respective definition (binary concept, e.g. minimum crown cover) and (ii) quantified threshold parameters (e.g. 10%). The framework can be used effectively to compare definitions, thereby improving communication and clarifying the need and feasibility of developing new ones.

It was anticipated that the outputs of this harmonization process would form part of the expected report by the Collaborative Partnership on Forests (CPF) to the third session of the United Nations Forum on Forests (UNFF-3) on progress made in fostering a common understanding of concepts, terminology and definitions.

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[1] UNFCCC and IPCC work on this term continues.

Status of Harmonization

The two expert meetings concluded that differences were minor in the definitions of the terms listed below. The meetings identified ways in which the definitions could be further harmonized or the differences which could be dealt with:

- forest
- forest land
- forested land
- other wooded land
- non-forest
- reforestation
- forest degradation
- forest improvement

The Meeting identified other terms that were used primarily in a regional rather than a global context, and with differing meaning from region to region, such as:

- old-growth forest
- semi-natural forest

Since the current definitions of the terms indicated below had certain inconsistencies, the expert meeting made proposals for new formulations or adaptations. However, it was recognized that some further work may be required to finalize this task through a cooperative effort between the relevant bodies and in cooperation with countries. The terms in question were:

- 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

A number of "supporting" terms, referring to the condition or quality of forests would still benefit from an effort towards coining common, broadly accepted definitions. This follow-up work could take place in cooperation with the processes and bodies that have a mandate to, or an interest in, using them. These terms include, *inter alia*:

- forest plantation
- 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.

Forest and Change Processes between Forest and Other Land Classes

The three international processes that have defined "forest" deal with the concept from different viewpoints:

- FRA deals with trees as a resource in the following categories: forest (including forest plantations); other wooded land; and other land with trees outside of forests.
- The Marrakech Accord (MA) of the Kyoto Protocol (KP) is mainly concerned with the measuring and accounting of carbon and carbon stock changes and defines as forest all areas containing trees within country-defined structural parameters.
- CBD is concerned primarily with biodiversity issues and appears to follow the FRA definition of forest with the exception that temporarily unstocked areas are not explicitly included.

However, all the definitions include threshold parameters covering minimum area, minimum height and crown cover. As the processes have different purposes, their parameters have been defined differently: in the case of the KP, each of the threshold parameters has a range of optional values within which parties must choose a specific value; the other two processes specify the same fixed values for them. In addition, the FRA specifies a minimum strip (stand) width and defines a maximum period for which a forest may remain temporarily unstocked.

Threshold parameters for defining forest under KP are flexible within a fixed range. Reporting burden could be reduced if countries applied the same threshold parameters for UNFCCC/KP and FRA reporting. The values chosen might actually differ from the definitions they employ nationally. The Marrakech Accord provides strong incentives for Annex I Parties to provide data based on forest area delineation consistent with the information that has historically been reported to FAO or other international bodies. In fact, in many instances, countries did not report to FAO data that were based on their respective national definitions, but rather data that were adjusted to the commonly agreed FRA definition.

In the future, there may be a need to add new parameters for the subclassification of forest, such as level of stocking in relation to potential (e.g., unstocked/understocked/ stocked forest); tree; and potential of land for trees.

Including "temporarily unstocked areas" in the CBD definition of forest would make it essentially the same as the FRA definition. The UNFCCC/KP rules require parties to provide information on how they distinguish temporarily unstocked forests after harvesting from deforestation. This is compatible with the FRA 10-year default for the temporary period.

The FRA and CBD definitions of forest include a land-use component. Lands where non-forestry uses predominate are not classified as forest, even where the tree cover exceeds the threshold values of the other parameters. In FRA, these areas are instead covered under "trees outside of forests" and "other wooded land". The UNFCCC/KP does not make this distinction. The impact is illustrated in Figure 1.

There is a need to clarify the related term "predominantly forestry" in the FRA definition. Its current wording refers to land use, or forests that are used for purposes of producing wood and non-wood forest products; for protection, multiple use or conservation (i.e. forests in national parks, nature reserves and other protected areas); as well as forest stands on agricultural lands (that is, windbreaks and shelterbelts of trees with a width of more than

20 m, rubberwood plantations and cork-oak stands). It is also used for forests which are not used at all due to inaccessibility or other reasons. However, stands of trees established explicitly for agricultural production and agroforestry systems are excluded. UNFCCC does not have any land-use requirements in its definition of forests, but does face the same overlap problems when it comes to forest management activities.

FRA already collects data on forest plantations and categorizes plantations managed for wood or fibre production, protection, etc., as forest. Plantations managed for tree crops are non-forests. UNFCCC/KP defines all plantations as forest (including those that are the result of afforestation and reforestation).

There is a need of further harmonizing the terms afforestation and deforestation in future provisions of UNFCCC/KP with the FRA definitions. UNFCCC may also want to consider removing the requirement for a 50-year non-forest use prior to afforestation and combining the terms afforestation and reforestation, using only the former. This would ease reporting and remove a major inconsistency with FRA.

It was recognized that permanent forest loss was almost always human induced and rarely a natural occurrence. The definitions of deforestation are specific to the purposes of the two processes; however, compatibility cannot be achieved because the FRA and UNFCCC/KP definitions of forest are different. As a result, figures reported by the two processes on changes between forest and other land classes are not likely to be comparable.

The UNFCCC/KP terms "forested land" and "forest land" can be considered synonymous of "forest" and, therefore, it is recommended that the use of the term "forest" be preferred in all contexts.

There is a need to clarify the method of classifying lands with a combined land use under the UNFCCC definitions and assess whether the UNFCCC approach can be aligned with the FRA classification by, e.g., dividing the FRA land class "other land" into subclasses. This could take into consideration the categories used in the IPCC Good Practice Guidance preparation process and subsequent discussions in the SBSTA/COP of the UNFCCC/KP.

Forest Degradation and Change Processes within the Forest

Definitions of forest degradation developed by FRA, CBD, ITTO and IPCC LULUCF Task II in a preliminary draft were analysed in a comparative matrix (Table 1) regarding occurrence and quantification of elements such as structure, function (provision of goods and services), site, reference state, spatial and temporal scale, resilience and cause.

- Three clusters of shared elements emerged, related to "structure", "functions, goods and services" and "site-specific reference state".
- Using these shared elements, a core definition for forest degradation was derived: "Forest degradation is the reduction of the capacity of a forest to produce goods and services." The term "capacity" refers to the time scale and the reference state of any given forest. Although this core definition is not considered to serve as a substitute for existing definitions, it is offered to clarify the common ground between them.
- The definitions of FRA 2000, CBD and ITTO are comparable with respect to the main clusters. The meeting believed that the definition of forest degradation should not use long-term reduction of tree crown cover as a proxy for degradation, which, anyhow, could only be assessed *ex post* over several commitment periods.

- The lower threshold for crown cover provided in the FRA2000 and IPCC LULUCF Task II definitions makes a distinction between degradation and deforestation[2]; however, neither quantifies a differential necessary for justifying the use of the term degradation.
- From the context of COP Decision 11/CP.7, the Meeting considered that the mandate to IPCC to develop a definition for direct human-induced "degradation" (sic) of forests might refer less to the long-term impairment of the capacity of a forest to produce goods and services, but rather to methodologies of accounting for emissions from *short-term carbon stock decreases in a Party's managed forest over the first commitment period.* On the other hand, the draft definition currently considered within IPCC LULUCF Task II appears to allude to the *long-term aspect* of degradation. Any short-term reduction of timber and carbon stocks may not represent degradation in the common sense at all, and may even reflect forest improvement, e.g. a silvicultural tending operation or a reduction of overmature or overly dense timber. Therefore, another term, such as "stock reduction", may be preferable to "degradation" in the context of carbon monitoring.
- Resilience is an important concept linked to degradation. It is an implicit element of most definitions, but articulated only by ITTO as "altered beyond the normal effects of natural processes". Resilience remains a mainly scientific concept, which is not yet operationally measurable. Certain components of resilience, however, may be assessed (e.g. soil buffering capacity). Moreover, in cases of heavy damage to a forest stand, it might be possible to conclude that resilience of the ecosystem and its capacity to revert to its prior condition even in the long term have been impaired. Tallying forest areas with such heavy damages, e.g. soil compaction from machinery, emission-induced element toxicities, topsoil erosion, as a separate category might be the only feasible approach to capture this element of degradation in a short-run assessment.
- The choice of spatial scale of the degradation process is related to the objectives of the assessment and the parameter considered. Forest degradation will usually be determined for the stand but, in many circumstances (e.g. fragmented forests, water catchment runoff), it can only be assessed at the forest management unit, watershed or landscape level. It might also be legitimate to accept certain tradeoffs at the stand level, as long as a proper level of goods and services is maintained at the landscape level.
- Forest naturalness appears inadequate as a reference point for forest degradation, due to possible past human influence and natural shifts in the ecosystems and to the fact that there is no intrinsic attribute (besides "naturalness") which is linked exclusively to natural forests.

The CBD and ITTO definitions consider only "human-induced" forest degradation, whereas FRA does not differentiate forest degradation by cause. Truly natural forest degradation might be rare, but large areas could be involved. However, the reduction of a forest area's capacity to provide goods and services which is triggered by natural events, such as landslides or volcanic eruptions, may not constitute long-term degradation but rather a natural ecosystem shift. The IPCC is expected to develop definitions for direct human-induced degradation of forests and methodological options to inventory and reporting by the end of 2003.

Developing a composite index for degradation incorporating various attributes, such as productivity or biodiversity, in one single measure is a research challenge, which is likely to involve value judgement. Where data on the elements of a composite index are available, these could be directly used to measure different aspects of degradation.

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[2] Forest degradation can occur below this threshold for crown cover, e.g. as site degradation in temporarily unstocked stands.

The Meeting settled on the following core definition of forest degradation:

> *Forest degradation is the reduction of the capacity of a forest to provide goods and services.*
>
> Explanatory note: Capacity includes maintenance of ecosystem structure and functions.

Supporting terms are forest improvement with its subsets forest rehabilitation and forest restoration (Figure 2). The latter two were identified from the literature, but not discussed in detail.

> *Forest improvement is the process which increases the capacity of a forest to provide goods and services.*
>
> Explanatory note: In this sense, forest improvement is the opposite of forest degradation, as defined in the core definition above. Forest improvement is not synonymous to reversal of "stock reduction" as defined above, as improvements may even entail reduced stocks in the short term.
>
> *Forest rehabilitation is the process of restoring the capacity of a forest to provide goods and services again, where the state of the rehabilitated forest is not identical to its state before degradation.*
>
> *Forest restoration is the process of restoring a forest to its original state before degradation (same functions, same structure, same composition).*
>
> *Forest fragmentation is the process that results in the conversion of formerly continuous forest into patches of forest separated by non-forest.*
>
> Explanatory note: This definition, offered by CBD, is the only international definition for this term and, as such, should serve as a default for other processes. Further discussion is suggested to cover certain aspects, such as habitat and ownership fragmentation; patch size; edge effects; distance; corridors; connectivity; existence and migration barriers and their impacts.

Managed and Unmanaged Forests, Forest Condition

Forest management is a concept that can be applied to planning, implementation, monitoring and control at the national, subnational, forest management unit and stand levels. Related concepts, approaches and even terms used may differ in different parts of the world. They also depend on the management objective(s), such as wood products, non-wood products, watershed protection, soil stabilization, recreation and conservation. A management plan is often a basic tool in managed forests, and it can be formal or informal. Even in the absence of a management plan, management can be implemented through established traditional practices.

The UNFCCC definition of forest management provides a useful basis for characterizing this term in its modern context.

"Forest management" is a system of practices for stewardship and use of forest land aimed at fulfilling relevant ecological (including biological diversity), economic and social functions of the forest in a sustainable manner.

The Meeting proposed a slight modification to the UNFCCC wording (for UNFCCC only for later commitment periods) in order to be applicable by all processes.

Forest management is 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.

The term unmanaged forest can have different meanings, but generally relates to the concept that neither any management decision nor any management planning or management interventions have been implemented, etc. The term "unmanaged" may not be needed at all, since it has been argued that there are hardly any forests left that are not affected in one way or another by human intervention or where humans have made a deliberate decision not to intervene with natural processes, except in some remote, inaccessible areas. Lack of formal management does not necessarily mean that a forest is unmanaged or dealt with in an unsustainable manner.

Forest condition can be characterized, *inter alia*, by the following terms: natural forest, undisturbed forest, primary forest, old-growth forest, secondary forest, semi-natural forest, degraded forest, forest plantation. A key aspect is the different degrees of naturalness that are implied by these terms. Their interrelationships are depicted in Figure 3.

The Meeting reached preliminary conclusions on the definitions of some of these terms:

Natural forests

Natural forests are forests composed of indigenous trees regenerated naturally. This can include both spontaneous and assisted natural regeneration.

Explanatory note: Both spontaneous and assisted regeneration are included as natural. Indigenous refers to the FRA definition. Further consideration of the term is required to clarify (i) whether the attribute "indigenous" is necessary; (ii) whether the term "native" (CBD) is fully consistent with the term "indigenous" (FRA); and (iii) whether the definition should include a reference to forest stand rather than forest.

Primary forest

Primary forest as a subset of "natural forest" is a forest undisturbed (directly) by humans.

Explanatory note: The term "primary forest" (as used by CBD) is fully consistent with the term "undisturbed forest" (as used by FRA).

Clarification is needed on the following points:

- Does "undisturbed" exclude any disturbance by man, even if it happened long ago in historic time? If so, what would the time frame be?
- Should the disturbance by non-native animals be explicitly addressed?

Old-growth forest is a subset of primary forest. The CBD definition of old-growth forest is considered adequate. Whether old-growth is limited to primary forest or would be relevant to secondary or semi-natural forests merits further consideration. It is an important concept in several countries.

The CBD definition of secondary forest is broader than that developed by ITTO, as it includes both degraded (primary) and secondary forests. However, it was considered insufficient to describe the concept of secondary forests. Degraded (primary) forest describes a forest beyond the elastic capacity (recovery) of the forest ecosystem. This raises the issue of whether modified and degraded forests should be considered separately. The Meeting considered secondary forest to be 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. Degraded forest may be identified as a subcategory of natural forests, secondary forests and planted forests.

Semi-natural forest is a term that has particular importance in parts of Europe, but with different meanings in various countries and organizations and even within the FRA 2000 process. Semi-naturalness is sometimes difficult to identify at the field level if related to the method of regeneration (planted or natural). The initial FRA definition of semi-natural forest did not refer to species composition (indigenous/native), whereas the present one does by considering it to be a subset of natural forest. Semi-natural forest often implies 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.) . Planted (plantation) forests which acquire more natural characteristics over time (e.g. abandoned forest plantations that diversify with age and natural regeneration of indigenous species) could also fall into this category.

Planted forests are forests in which trees have been established through planting or human seeding. Plantations are a subset of planted forests.

Forest plantations are covered by various definitions, and parallel terms are also used, such as plantation forest. "Planted forests" serve a broad range of objectives, including protection, conservation and commercial production. Forest plantation or plantation forest is understood to be 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), which also merit consideration. The Meeting considered the FRA definition of forest plantation to be precise and recommended it for consideration by other organizations, fora and processes.

The meeting concluded that there was possibly a need for appropriate subclasses of planted forests to capture their diversity[3].

Figure 4 illustrates an option for the grouping of different types of managed and unmanaged forests.

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[3] Further clarification on this is expected from the work on "Typology of Planted Forests", carried out by CIFOR in collaboration with WWF, IUCN and others. (http://www.cifor.cgiar.org/publications/pdf_files/typology/john-typology.pdf)

Forest Classification and the International Processes

There are a great variety of forests worldwide. In order to study, assess or manage them, many classifications have been, and continue to be, developed. These classifications depend on the objectives and geographic levels (from global to local) of the study, assessment and management, and sometimes also on the tools being used (e.g. remote sensing).

The Meeting recognized that original country data were highly useful in all international analyses and reporting. For the sake of reporting consistency among countries and over time, and to facilitate data compilation, there should be, in general, one global definition for each core term, but countries should be free to report on more disaggregated levels.

Differentiated definitions of the core forest-related terms were not recommended. However, in addition to a global definition, different processes may need qualifiers to describe specific aspects of forests related to their objectives. These qualifiers could sometimes be expressed in the form of classification with respective definitions, as explanatory notes, instructions for reporting or other modalities. Specific forest types (e.g. mangroves) would possibly also deserve that their own definitions be applied at an international level.

It was noted that some of the international processes used forest classification systems in their work, and it was pointed out that *all* processes could probably benefit from their use. The following conclusions were reached on how classification systems could be used effectively within a harmonized framework:

1. All the international processes could use, as a first order classification, the FAO global ecological zoning, which is based on the high hierarchical level of domains (i.e. tropical, subtropical, temperate, boreal, polar).
2. A further breakdown into forest types may be desirable for some of the processes but may not be necessary for others.
3. Additional levels of classification could be introduced, as needed, based on the forest function, e.g. production, protection, ecological services, social, historic, spiritual.

In choosing between internationally applicable classification systems and respective definitions, the feasibility for countries to collect and analyse the data required should be taken into account.

Special Needs and Requirements of Countries with Low Forest Cover and Unique Types of Forest (LFCCs)[4]

General forest definitions, agreed upon as applicable to all countries and types of forest, will also apply to LFCCs and countries with low forest cover conditions.

Classifying a country as a low forest cover country may have political implications that cannot be identified at present. For example, if a country is categorized as LFCC, it is unclear whether this would imply restrictions to the export of forest products, including non-wood forest products (NWFPs), or whether it could provide access to increased financial or technical assistance from GEF, multilateral development financing institutions, the Clean Development Mechanism (CDM) of the KP, bilateral agencies, etc.

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[4] Term defined under the Tehran Process and the Tehran Declaration, Tehran, October 1999.

Until the intended use of such classification is clarified, a "working definition" of LFCC could be a country where forest – as defined by FRA – covers less than 10 percent of its territory. It should also be recognized that many countries have large areas with low forest cover, although they as national entities would not fall under the LFCC group as a nation.

Trees outside forests play a large and significant role in low forest cover conditions. Therefore, special attention should be given to the inclusion of Trees outside Forest (TOF) in national forest assessments in LFCCs and countries that have significant areas of land with low forest cover conditions. Failing to do so would give an incomplete picture of the importance of woody vegetation in terms of energy, biological diversity, carbon sequestration, contribution to sustainable livelihoods, etc.

Forest classifications according to Ecological Domain, Ecological Zones and Forest Types are valid also for LFCCs. However, because in many cases there will be very little forest left to actually manage, data should also be collected on the cause of the change process from forest to other land classes, e.g., desertification (due to human impact or climate change); urbanization; overuse (overgrazing, overcutting, etc.); regeneration; migration; etc. In addition, there is a special need to consider fragile ecosystems (arid lands, mountains) and unique types of forests found in LFCCs.

RECOMMENDATIONS FOR FURTHER WORK

The recommendations directly referring to definitions are subsumed in Table 2.

Countries Reporting to International Processes

1. Parties to the UNFCCC might consider adopting, as far as feasible, the same threshold parameters for the definition of "forest" as the ones used for adjusting their figures to the commonly agreed FRA definition.

2. Parties to the international processes, through their own appropriate communication channels, should ensure good coordination between stakeholders of all the international processes at the national level.

3. Countries should be encouraged to report to the international processes at more disaggregated levels than may be required by international definitions or classifications, using their national classification systems, while ensuring compatibility and consistency with the international requirements. Original country data sources and definitions should be made available to illustrate where the processed data originate and to facilitate their interpretation.

International Processes and Organizations

4. CBD, FAO, UNCCD, UNFCCC, UNFF and others (e.g. the Teheran process) could jointly explore the possibility of adopting one common first order forest classification system as the basis for reporting, by considering contributions from other international/regional organizations and/or bodies such as IPCC, IUFRO, etc.

5. All processes and organizations might consider using the term "forest" instead of "forest land" or "forested land".

6. CBD, FRA, and ITTO could consider adopting the proposed core definition of "forest degradation" and the proposed definition for the supporting term "forest improvement".

7. CBD, FRA, and ITTO might consider the inclusion of planted forest as a separate category of forest so that changes in biodiversity associated with the transformation of other forests to plantations can be duly monitored.

8. Biomass- and carbon-related definitions need harmonization and could be developed under a focused process involving the relevant international processes and organizations, together with other stakeholders.

9. CPF could consider reviewing the reporting requirements by countries under various international processes and make recommendations for further useful streamlining and harmonization.

10. The international processes should use original country data as the basis for analyses, adjustments as required, and reporting.

***CBD** might consider*

11. discarding the attribute "secondary" in their definition of plantation forest in order to avoid possible confusion with spontaneous regeneration after disturbance;

12. including, in their definition of primary forest, disturbance by non-native animals and adopting ITTO's definition of primary forest;

13. including the attribute "temporarily unstocked" in their definition of forest.

***FAO** should*

14. together with the other organizers and participants of the Meeting, communicate the outcome of the harmonization process of forest-related definitions to the various international processes, also by organizing side events in connection with negotiation sessions and other official meetings;

15. as secretariat of the harmonization process, consult regularly with the various processes, and report back to the Meeting participants on follow-up action to the recommendations made in this document.

***FAO/FRA** might consider*

16. expanding the definition of afforestation to include assisted regeneration not involving direct seeding or planting;

17. reporting separately areas that are "temporarily unstocked" which are now included in the area statistics for different land categories, as such areas can be significant;

18. developing a typology for management objectives as a basis for reporting on the status of areas under different intensities or levels of forest management;

19. adopting a definition of forest management slightly modified with respect to that of UNFCCC/KP/MA (2001); this would provide for inclusion of a wide range of forest uses and management objectives, e.g. the provision of wood and non-wood forest products, biodiversity conservation, soil conservation or watershed protection;

20. referring, in its definition of natural forests, to their natural regeneration, removing the wording "not planted";

21. investigating, through collaboration with relevant bodies, the possibility of dividing non-forest land into subclasses, which would address the various purposes for which trees and woody vegetation on these lands need to be assessed;

22. taking the leadership, jointly with other organizations, in compiling the various definitions into a compendium where the forest-related terms and definitions used by the various international conventions and processes would be clearly referenced, explained and described, and making this information available in the official languages of the Organization;

23. clarifying the term "predominantly forestry".

***ITTO** might consider*

24. including in its future definitions a reference to an established definition of "forest", making minor adjustments to increase compatibility with the FRA and UNFCCC definitions;

25. adding a definition of natural expansion of forest in its set of definitions and making the necessary adjustments to increase compatibility with the FRA, UNFCCC/KP and CBD definitions;

26. modifying their definition of secondary forest as "woody vegetation regenerated naturally on land that was totally cleared of its previous forest vegetation", as the appropriateness of the concepts of woody vegetation and total clearance merit further consideration; the first concept could also mean shrubs below the forest threshold, and the latter is difficult to measure; none of the proposed ITTO definitions include the notion of forest condition resulting from suppression of natural fire regime, which merits further consideration;

27. adjusting their definition of planted forest to "forest that has been established by planting or seeding"; whether the qualification "artificial" should be added or not merits further consideration;

28. deleting in its definition of degraded primary forest references to primary, old-growth.

Tehran Process

29. The Tehran Process, supported by UNEP as Lead Agency within the CPF, might consider continuing its work on forest definitions in relation to LFC countries and conditions, clarifying possible implications for countries in using such definitions in the international contexts.

UNFCCC/IPCC[5] *might consider*

30. removing the requirement of a 50-year non-forest condition for afforestation in the UNFCCC definition to be applied from the second and subsequent commitment periods. In many countries records are insufficient to document long-term prior use of lands subject to afforestation. Furthermore, afforestation and reforestation could be treated equivalently within the UNFCCC/KP; a separate term "reforestation" would no longer be required and could be discarded;

31. distinguishing the term/concept "stock reduction", as short-term reduction in carbon stock, from "forest degradation";

32. supporting participation of a wider range of forest experts in the combined governments/experts review of the drafts of the Good Practice Guidance and Inventory Guidelines to ensure that their final output would contribute to the harmonization of forest-related definitions.

[5] UNFCCC may want to consider some of the recommendations for the next commitment period

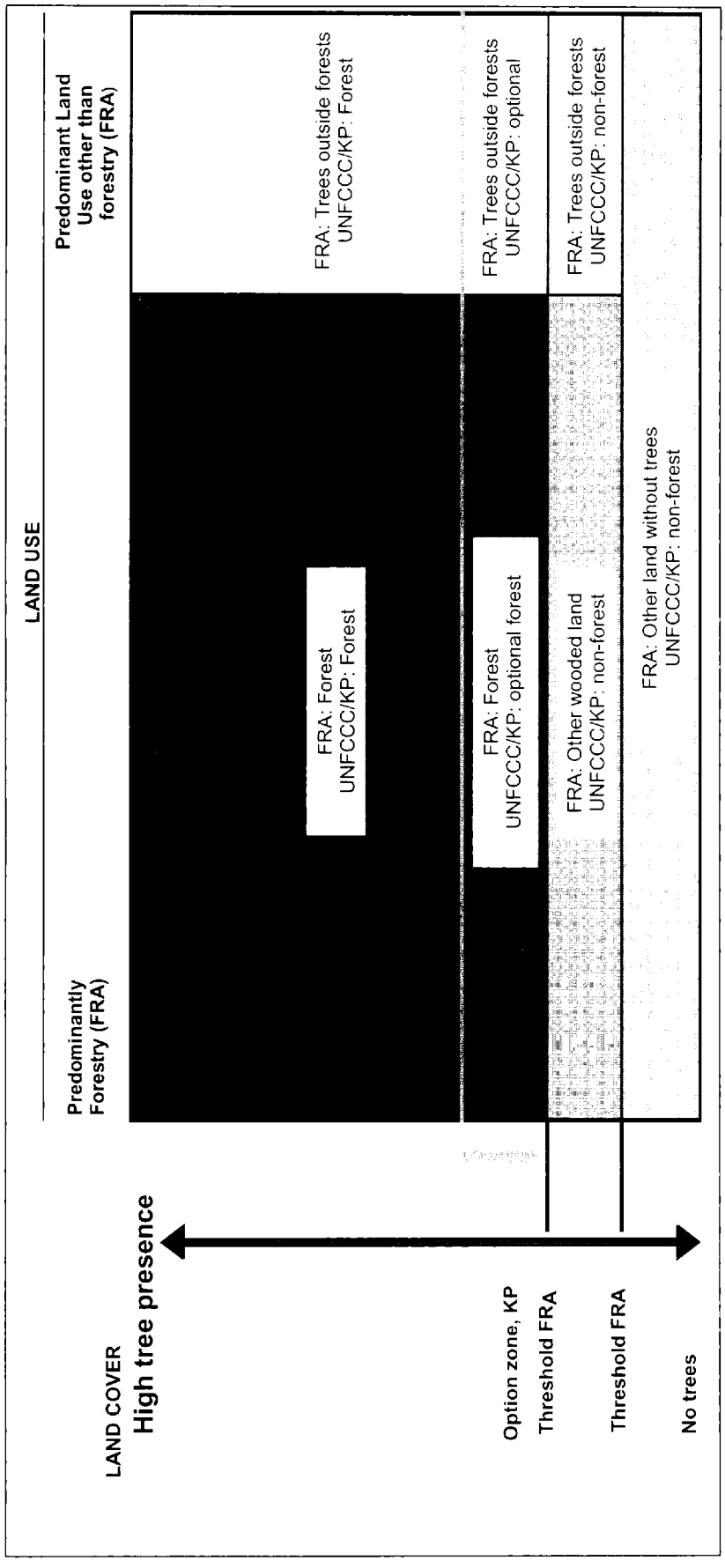

Figure 1: Land Use–Land Cover Relationship

Table 1: Matrix for Forest Degradation

Element	Sub-element	IPCC LULUCF Task II	FRA2000	CBD	ITTO
Structure	Canopy cover	■			
	Stocking				
	General		■	■	■
Resilience	Ecosystem processes				■
	Severe damages				
Functions	Goods		■	■	■
	Services		■	■	■
	Other functions		■	■	■
Time scale	Short term				
	Long term	■			
Cause	Human			■	■
	Natural				
	Indeterminate				
Reference state	Natural			■	■
	Site		■	■	■
Change	Differential				

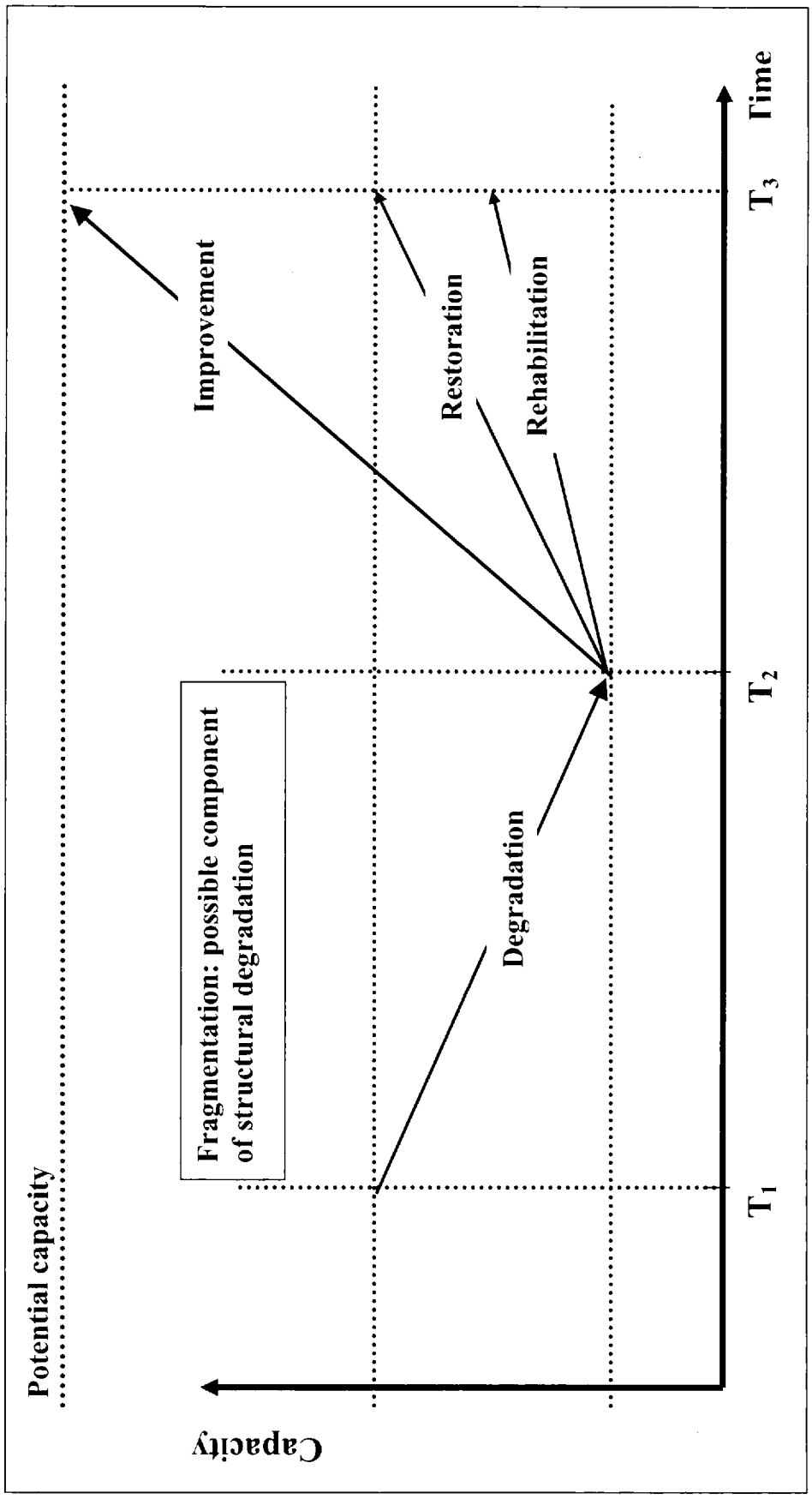

Figure 2: Forest Degradation and supporting terms

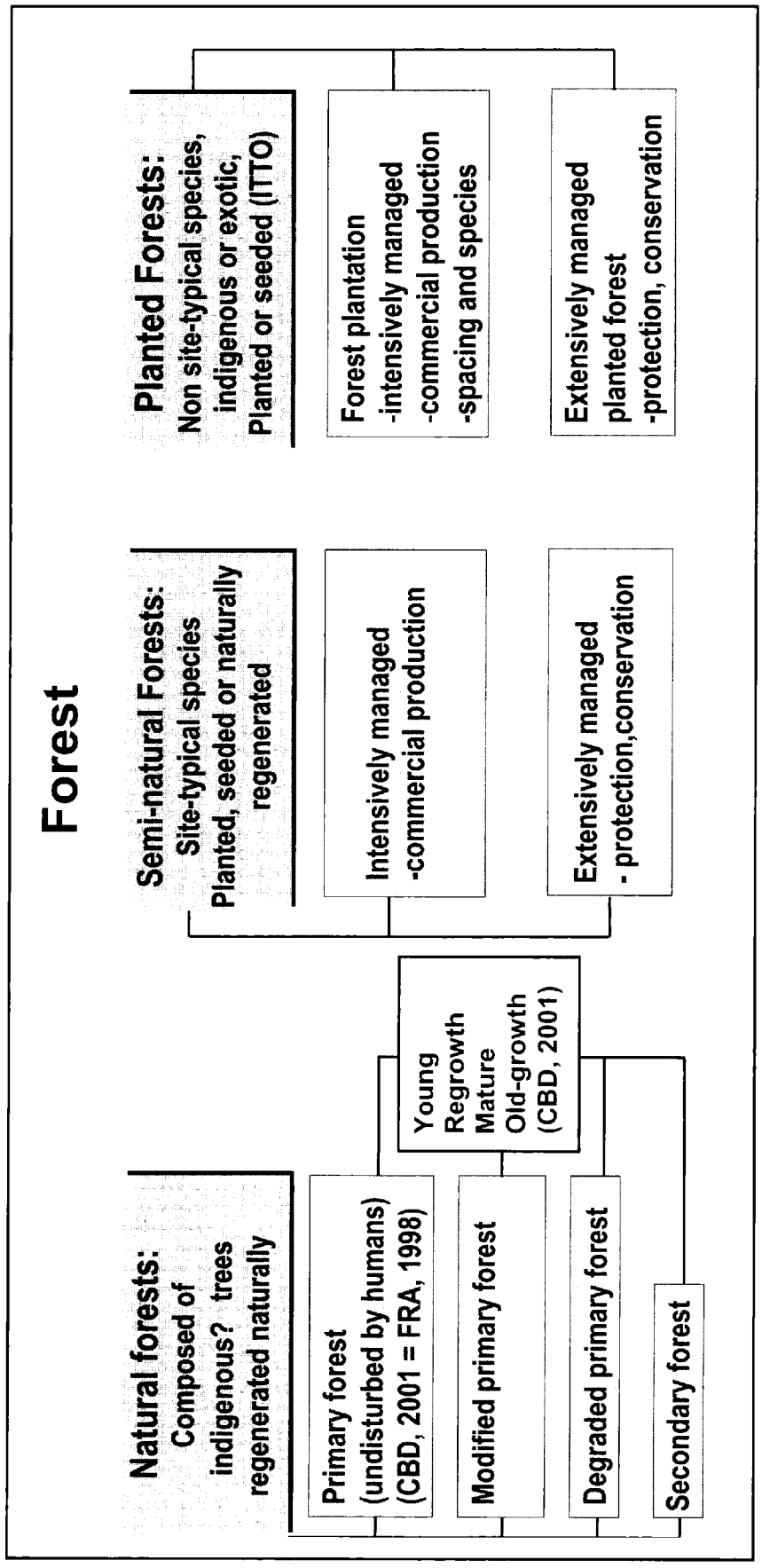

Figure 3: Forest Typology

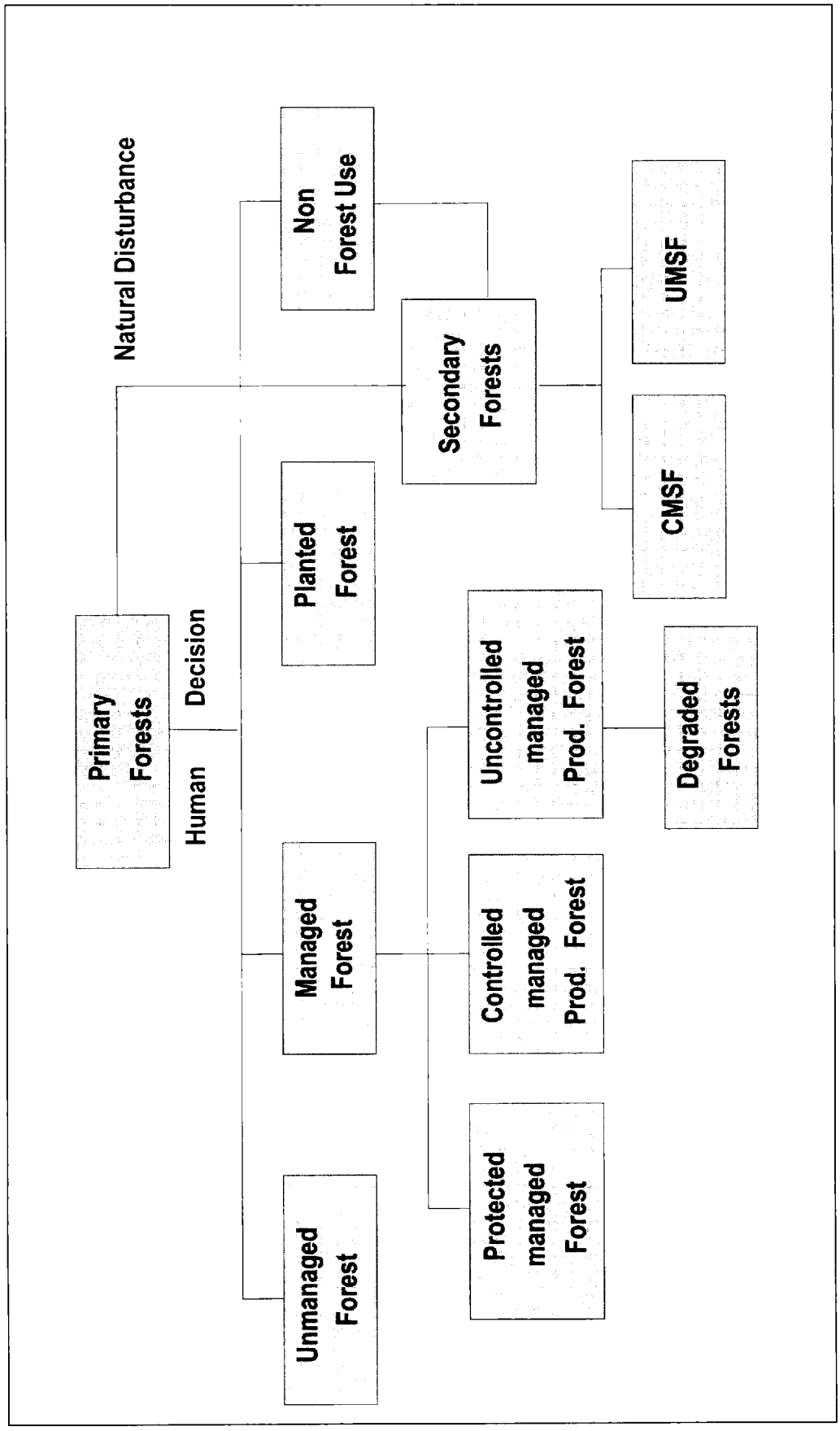

Figure 4: Managed and Unmanaged Forest

Table 2: Comparative Matrix of Recommendations

CONVENTIONS, BODIES AND PROCESSES MAY TAKE INTO CONSIDERATION THE FOLLOWING OPTIONS SUGGESTED FOR HARMONIZATION						
TERM	**CBD**	**FRA/ FAO**	**ITTO**	**UNFCCC/IPCC**	**COUNTRIES**	**ALL**
Forest	include "temporarily unstocked" areas (13)	clarify term "predominantly forestry" (24)	include reference to an established definition of forest (24)		adopt same threshold parameters for UNFCCC/KP and FRA reporting (1)	explore need to add additional parameters, supporting terms
		report separately areas that are "temporarily unstocked" (17)				replace in all contexts the terms "forest land" and "forested land"
Non-forest Land		discuss with other bodies possible introduction of subclasses				replace through the term "non-forest"
Other Land		clarify method of land classification with combined land uses clarify possible subdivision of term in subclasses				
Afforestation		further harmonization between UNFCCC and FAO required include assisted generation not involving direct seeding or planting (16)		remove the requirement for 50- year non-forest condition from second commitment period onwards (30) further harmonization between UNFCCC and FAO required		
Reforestation				discard the term reforestation (30)		
Deforestation		further harmonization between UNFCCC and FAO required		further harmonization between UNFCCC and FAO required		

CONVENTIONS, BODIES AND PROCESSES MAY TAKE INTO CONSIDERATION THE FOLLOWING OPTIONS SUGGESTED FOR HARMONIZATION						
TERM	**CBD**	**FRA/ FAO**	**ITTO**	**UNFCCC/IPCC**	**COUNTRIES**	**ALL**
Natural Expansion			add definition of natural expansion to set of definitions (25)			
Forest Improvement						**Adopt definition:** The process of increasing the capacity of forest to provide goods and services (opposite to forest degradation) (3)
Forest Degradation	**Adopt definition:** Forest degradation is the reduction of the capacity of a forest to provide goods and services (6); clarify, if this and the related definitions need qualifiers: ECOSYSTEM FUNCTION	**Adopt definition:** Forest degradation is the reduction of the capacity of a forest to provide goods and services (6) clarify, if qualifiers are needed	**Adopt definition**: Forest degradation is the reduction of the capacity of a forest to provide goods and services (6)	**Exchange terms:** distinguish "stock reduction" from "forest degradation". It is still possible to use the same generic definition for degradation and to add qualifiers for monitoring purposes (31)		
Forest Fragmentation	clarify if certain aspects like habitat fragmentation are adequately covered					**Adopt CBD definition**: Forest fragmentation refers to any process that results in the conversion of formerly continuous forest into patches of forest separated by non-forest (lands).
Forest Management		**Adopt definition:** FM is the process of planning and implementing practices for stewardship and use of the forest aimed at fulfilling ecological, economic and social functions of forest (19) develop a typology for management objectives (18)				clarify, if term unmanaged is not superfluous, since there are hardly any unmanaged forests

CONVENTIONS, BODIES AND PROCESSES MAY TAKE INTO CONSIDERATION THE FOLLOWING OPTIONS SUGGESTED FOR HARMONIZATION						
TERM	**CBD**	**FRA/ FAO**	**ITTO**	**UNFCCC/IPCC**	**COUNTRIES**	**ALL**
Natural Forest	clarify, whether attribute "indigenous" is necessary, whether "native" (CBD) is fully consistent with term "indigenous" (FRA), and whether the definition should rather refer to "forest stand" than to "forest".	clarify, whether "native" (CBD) is fully consistent with term "indigenous"(FRA), and whether the definition should rather refer to "forest stand" than to "forest" refer to the natural regeneration of forests and discard the wording "not planted"(20)	clarify, whether "native" (CBD) is fully consistent with term "indigenous"(FRA), and whether the definition should rather refer to "forest stand" than to "forest"			
Primary Forest	consider ITTO's definition of "primary forest" (12) clarify, whether the disturbance by non-native animals should be explicitly addressed		delete in definition of "degraded primary forest" references to primary, old-growth (28)			
Old-growth Forest	clarify if only limited to primary forest, or includes also secondary and semi-natural forest	clarify if only limited to primary forest, or includes also secondary and semi-natural forest	clarify if only limited to primary forest, or includes also secondary and semi-natural forest		clarify if only limited to primary forest, or includes also secondary and semi- natural forest	
Secondary Forest	clarify if definition should refer to species composition		develop ITTO definition further: "Woody vegetation regenerated naturally on land that was cleared of its previous forest vegetation" (26)			clarify if definition should include notion of forest condition resulting from suppression of natural fire regime;
Planted Forest	include "planted forest" as a separate category (7) discard the attribute secondary in "plantation forest" (11)	include "planted forest" as a separate category (7) clarify if subclasses are needed to reflect the management objectives and/or whether the species planted occur naturally on the site	include "planted forest" as a separate category (7) adjust definition to "forest that has been established by planting or seeding" (27)			

DEVELOPMENT OF COMMON FRAMEWORK FOR FOREST-RELATED DEFINITIONS

Discussion Paper

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with inputs from the Task Group

Helsinki
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Introduction

Forest-related definitions are used nationally and internationally and they are currently developed under various international conventions and fora. These encompass, *inter alia*, UNFCCC, CBD, UNCCD, UNFF and various other bodies to which countries have reporting obligations or commitments, including FAO and the International Tropical Timber Organization (ITTO). Reporting requirements to these bodies, fora and conventions represent a considerable burden for the countries, and particularly developing countries have difficulties to meet them. Differing definitions for the same term aggravate this burden.

National reporting is indispensable for most purposes. Thus, the link to national resource assessments is an essential feature of any global monitoring system. In spite of rapid development in remote sensing and related data transfer and processing technologies, global systems will have to draw on nationally produced information and analyses. For instance, changes are generally more precisely estimated using the original national inventory data than direct observations of global systems. It is therefore of high international interest to facilitate data flow between national and global levels (FAO 2002). However, diverging definitions make data integration difficult at the global level.

To assist in coping with these problems, the Expert Meeting on Harmonizing Forest-related Definitions for Use by Various Stakeholders (hereafter referred to as the Expert Meeting) was initiated by the Food and Agriculture Organization of the United Nations (FAO) and, in collaboration with the Intergovernmental Panel on Climate Change (IPCC), the Centre for International Forestry Research (CIFOR) and the International Union of Forest Research Organizations (IUFRO), at FAO Headquarters, in Rome, from 23 to 25 January 2002. The Expert Meeting noted, *inter alia*, four key points (Proceedings 2002):

(i) More universally accepted and harmonized forest-related definitions might facilitate coordination between international conventions, processes and negotiations, and consequently might help to reduce the reporting burden and respective costs for countries;
(ii) Existing definitions should be adopted (wherever possible) or improved (where necessary), before developing new ones;
(iii) The current definitions used in the context of Article 3.3 of the Kyoto Protocol and FAO's Forest Resources Assessment 2000 are largely compatible, with the exception of differing interpretations of the term 'reforestation', as evidenced in past climate change negotiations;
(iv) The biome-specific approach suggested for some definitions is not necessarily compatible with the actual land use or the state of forests. The biome is probably a less important driver than the forest type.

The Expert Meeting also agreed on a number of criteria for the follow-up harmonization process and made detailed recommendations on how to deal with state and change processes; forest as a land use; forest functions; and the different definitions for afforestation, reforestation, deforestation and degradation.

The Expert Meeting recommended that follow-up action be taken urgently under the umbrella of the Collaborative Partnership on Forests (CPF), with FAO acting as the Secretariat. Furthermore, other stakeholders should be invited to participate in the process. As part of the implementation of the

recommendations, a Task Force was established under FAO's leadership to plan and implement the follow-up action.

This report is the outcome of the implementation of the Expert Meeting's recommendation to "*prepare a comprehensive analytical framework, including compilation and analysis of similarities and differences between definitions and clarification of their relationships, in order to facilitate follow-up process*". The analytical framework will be discussed by the Experts in the second meeting, to be organized in Rome, September 11 - 13, 2002.

The process on harmonizing forest-related definitions at international level is a response to a global call. The issue is high on the international agenda, and the need for further elaboration of forest-related definitions, particularly with regard to their possible harmonization, has been recently signaled as a priority issue by several international fora and bodies including:

- The sixth meeting of the Conference of the Parties to the Convention on Biological Diversity (COP 6), the Hague, the Netherlands, from 7 to 19 April 2002
- Twenty-Sixth FAO Regional Conference for the Near East, Tehran, Islamic Republic of Iran, 9 to13 March 2002 (hosting the Tehran Process for Low Forest Cover Countries)
- The second session of the United Nations Forum on Forests (UNFF), New York, 4 to 15 March, 2002
- UNFCCC: 16th Session of the Subsidiary Bodies (SB16), Bonn, Germany, 5 to 14 June, 2002. [6] [7]

The follow-up work needs to be undertaken cognizant of, and drawing on the following activities:

- SBSTA of the UNFCCC considering to apply biome-specific forest definitions, and developing forest-related definitions for the afforestation and reforestation under the CDM (Article 12 of the KP);
- IPCC developing definitions for degradation and devegetation;
- ITTO working on defining degraded and secondary forests;
- The World Conservation Union (IUCN), the World Wildlife Fund (WWF) and CIFOR developing a typology of plantations;
- IUFRO working on terminology (Dobbertin & Prüller 2002);
- UNEP and IUFRO working on how low-forest cover should be defined
- Previous work on definitions by FAO, e.g. in the context of FRA and the Kotka process.

It is expected that conclusions and proposals resulting from the process on forest-related definitions will be submitted to the IPCC, the Subsidiary Body for Scientific and Technological Advice (SBSTA) of the UNFCCC, the Subsidiary Body for Scientific, Technical and Technological Advice (SBSTTA) of the CBD and the Committee on Science and Technology of the UN Convention on Combating Desertification (CCD), the Member Countries of the UNFF for their consideration, as well as to the participants in the so-called Kotka Process preparing the next FRA.

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[6] Extract from para 29 b): "The SBSTA also noted with appreciation the statement made by the representative of the FAO in relation to the process of harmonizing forest-related definitions, and acknowledged the importance of this initiative for the UNFCCC." (UNFCCC/SBSTA 2002)... It encouraged the IPCC to continue to work with FAO, and invited the IPCC to take into account the output from this process when developing definitions for forest degradation and devegetation of other vegetation types.

[7] The ToR for work to developing definitions for afforestation and reforestation under the CDM mandates that SBSTA use as relevant information the reports prepared by the FAO on forest-related definitions.

Objectives

The objective of the process is to harmonize forest-related definitions and thus improve efficiency of processes in different international policy fora related to forests.

The objective of this report is to provide an analytical comparative framework for analyzing forest-related definitions and identification of inconsistencies and conflicts among them. The report focuses on a series of core terms for which alternative existing definitions are reviewed. Based on the comparative analysis, options for improving comparability are identified.

Approach

Methodology

In this report, analytical framework is understood to mean the various methods of analyzing and highlighting relevant features of forest-related definitions as well as their similarities and differences. An essential element of the framework is that the key elements are visualized, or presented in a tabular form to facilitate understanding of differences and shared features between definitions. In the tables where binary presentation is applied, '1' indicates that the instrument in question makes a reference to the concept, and '0' means that the concept is not explicitly mentioned.

The aim of the analysis is not to propose detailed formulations, but to point out optional approaches towards harmonized or more compatible formulations that would be practical and acceptable for use by various stakeholders. Harmonization relates, above all, to the process of making various definitions comparable and consistent with each other (see Box 1.1).

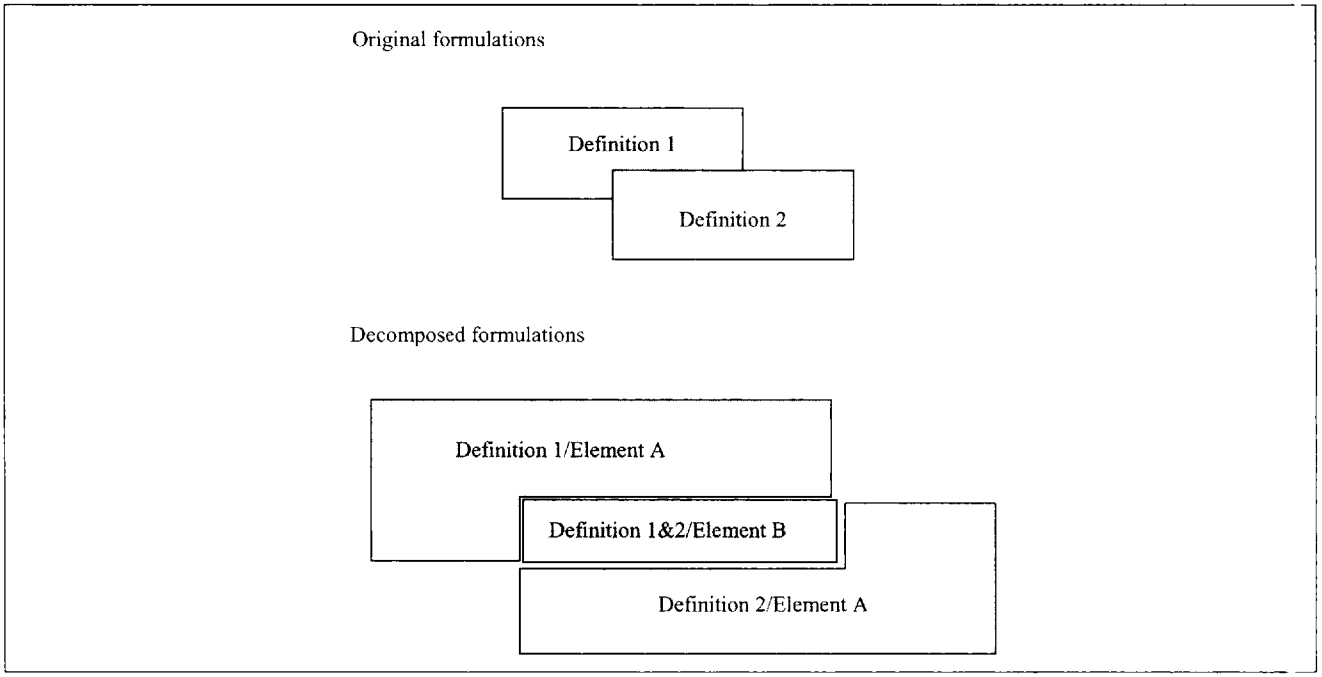
One of the principal approaches to harmonization is adjustment of data. In other words, data collected under one definition framework is adapted to the needs of another by applying conversions. These conversions may be a result of set logic, supplementary studies, scientific literature, statistics, or expert judgment. The method has been successfully applied e.g. in the context of FRA when data from national level is adjusted to global needs and vice versa. The same approach can be applied to harmonizing global definitions.

Box 1.1 Key Terminology (Countercheck with Oxford Dictionary)

In this report, the following definitions are used for key generic concepts related to harmonization. They are derived from the approach proposed in TBFRA 2000 (cf. Koehl, 2000)	
Harmonization	Making existing definitions, which denote the same or closely related concepts, comparable and consistent.
Comparability of definitions	Definitions are set so that their possible differences can be identified and data based on one definition can be converted to meet the needs of another, related definition.
Compatibility of definitions	Definitions are aligned, congruous, and not conflicting with each other.
Consistency of definitions	Internal agreement of various elements of definitions, or agreement between systems of definitions.
Standardization	Applying the same definitions for a concept within different contexts, or applying the same rules for how locally applicable definitions are defined.

Another approach is to decompose definitions denoting similar concepts into smaller elements. This makes it possible to identify both common and distinguishing elements based on which data can be collected and compiled to meet the requirements of various definitions (Figure 1.1). In this manner, comparability of definitions and data can be achieved.

Figure 1.1 Decomposing of Definitions



One of the most significant benefits of harmonization is that monitoring and reporting data on common elements could be shared by several processes without unnecessary data conversion. The analysis pays therefore special attention to compatibility with FRA definitions given its current role as the principal monitoring system at the global level. Priority areas for harmonization are those which would significantly facilitate and reduce the burden of separate data collection or laborious adjustments. A key area is land use dynamics, i.e. transfers between land use classes, which are a focal area of global monitoring.

It should be noted that standardization of definitions, i.e. using the same definitions for several frameworks, should not necessarily be the aim of harmonization. Only if differences between existing definitions are minor, it may be feasible to merge the various definitions by using common wordings. On the other hand, there may be instances, where new terms become important, and where it may be possible to standardize the respective definitions at the outset and avoid the need for later harmonization, e.g. in the new field of "carbon forestry".

Scope

The analysis is concentrated on selected core definitions related to four international processes: the UNFCCC, the CBD, the ITTO and the FRA (Table 1.1). Other Conventions and initiatives such as UNCCD, Tehran Process, UNFF, Millennium Assessment, C&I processes, etc. have chosen not to develop separate sets of definitions, and they are largely depending on formulations provided by others.

Table 1.1 Main Processes Providing Forest-related Definitions

Process	UNFCCC	CBD	ITTO	FRA
Objective	Protection and enhancement of sinks and reservoirs of greenhouse gases ... [and] promotion of sustainable forest management practices, afforestation and reforestation *Source: Kyoto Protocol Art 2 (ii)*	The objectives of this Convention ... are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources *Source: Convention on Biodiversity Art. 1*	To promote and support research and development with a view to improving forest management ...as well as increasing the capacity to conserve and enhance other forest values in timber producing tropical forests *Source: ITTA Agreement, Art 1 (f)*	Forest Resources Assessments are to estimate the benefits from the forest, ultimately including all goods and services. ... the scope of FRA should be guided by the agreed criteria for sustainable forest management, i.e. including carbon stocks, biodiversity, and productive, protective and socio-economic functions of forests *Source: FRA homepage http://www.fao.org/forestry/fo/fra/index.jsp*
Purpose of forest-related definitions[8]	To enable assessment of carbon stocks and their changes	To enable quantification and characterization of forest biodiversity on multiple scales	To facilitate implementation of practical forest management	To enable comprehensive and integrated assessment of supply of goods and services from the forest
Available definitions	Kyoto Protocol/. Marrakech Accords/ Annex: Definitions, modalities, rules and guidelines relating to land use, land-use change and forestry activities under the Kyoto Protocol *http://unfccc.int/cop7/documents/accords_draft.pdf* *IPCC Guidelines and GPG*	UNEP/CBD/SBSTTA 2001. Indicative definitions taken from the Report of the *ad hoc* Technical Expert Group on Forest Biological Diversity *http://www.biodiv.org/programmes/areas/forest/definitions.asp*	ITTO 2002. ITTO Guidelines for the Restoration, Management and Rehabilitation of Degraded and Secondary Tropical Forests, Draft Report/ Appendix 9 Glossary of main terms used *http://www.itto.or.jp/ittcdd_ses/thirty_second_sessions.html*	FAO 2000a. Global Forest Resources Assessment 2000 - Main Report - FRA 2000, Forestry Paper 140 While global consistency is sought, some parameters still need further harmonization *http://www.fao.org/forestry/index.jsp*
Obstacles to compatibility with other schemes	Requirement of symmetry in accounting changes in carbon stock as well as the focus on carbon stock Controversial aspects are due to differing political interests among parties	Concentration on environmental aspects	Focus on practical forest management with extensive requirements for data collection and reporting	Possible inconsistencies in long-term time series Focus on national-level assessments

[8] These formulations are an interpretation made by the authors of this document.

The observed differences among available definitions are mainly due to the purposes for which definitions have been formulated, but also unawareness of existing definitions and political interests have caused differences. For example, the definitions for Articles 3.3 and 3.4 of the Kyoto Protocol (KP) agreed upon after extensive negotiations are highly context-specific and related to the roles of forests in climate change and carbon accounting, reporting and verification. The differences of these definitions in relation to other schemes rise mainly from their focus on carbon, and the requirement for symmetry in accounting changes in the carbon stock.

The CBD treats forests as a functional ecosystem unit which should be conserved, used sustainably, and the benefits derived from it should be equitably shared. In this sense, CBD's view on forests is function and ecosystem oriented. The differences in relation to other frameworks are mainly due to their focus on environmental aspects.

The forest-related definitions developed by ITTO (ITTO 2002) serve, in particular, to complement ITTO's guidelines for sustainable forest management. The differences with other schemes are primarily attributable to the fact that ITTO definitions are not necessarily used as a basis for reporting, which is one of the primary functions for other schemes.[9]

The different sets of definitions overlap and related definitions can be found in several instruments. The terms included in the analysis and their grouping is provided in Table 1.2.

Table 1.2 Terms Included in the Analysis and Their Grouping

Terms/Group terms	UNFCCC	CBD	ITTO	FRA
Forest	Forest	Forest	(Degraded forest land)	Forest
Forest land	Forest land, forested land, non-forested land			
Non-forest land	Revegetation (de-vegetation), grazing land, crop land			Other wooded land, trees outside forest, other land
Changes between forest and non-forest	Afforestation, reforestation, deforestation		Afforestation, reforesta-tion	Afforestation, reforestation, deforestation, natural regeneration, natural expansion of forests
Forest degradation		Degraded forest		Forest degradation
Undisturbed forest	Unmanaged forests*)	Primary forest, old-growth forest		Forest undisturbed by man
*Degraded forest**)		Secondary forest	Degraded primary forest, secondary forest	Natural forest disturbed by man
Managed forest	Forest management		Managed natural forest	Managed forest
*Forest aggradation**)			(Forest) rehabilitation, (forest) restoration	Forest improvement
*Fragmentation**)		Forest fragmentation		
Forest classification		Forest biome, forest type, forest ecosystem	Forest type	Ecological zone, domain
*Human impact**)	Directly and indirectly human-induced	Human induced (forest degradation)		
Forest plantation		Plantation forest	Planted forest	Forest plantation

*) These terms are discussed in Annex 1.

[9] ITTO has also developed a reporting format how member countries should provide information on the progress made towards sustainable forest management. The format is derived from the ITTO C&I process.

Comparative framework and Options for harmonization of definitions

Forest

At the international level, three widely used definitions of forest have been adopted by UNFCCC, CBD and FRA (Box 1.1). However, the CBD has not included the term 'forest' in its Art. 2 (use of terms), and the definition used in this analysis is taken from the Report (of the *Ad Hoc* Technical Expert Group (AHTEG) on Forest Biological Diversity UNEP/CDB/SBSTTA 2001).

The most widely used definition is the one formulated in the FRA process. For instance, AHTEG refers to it as the 'basic' definition (see annex 3).

Box 1.2 Definitions of Forests

UNFCCC, 2001

'Forest' is a minimum area of land of 0.05-1.0 hectares with tree crown cover (or equivalent stocking level) of more than 10-30 per cent with trees with the potential to reach a minimum height of 2-5 meters at maturity *in situ*. A forest may consist either of closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground or open forest. Young natural stands and all plantations which have yet to reach a crown density of 10-30 per cent or tree height of 2-5 meters are included under forest, as are areas normally forming part of the forest area which are temporarily unstocked as a result of human intervention such as harvesting or natural causes but which are expected to revert to forest.

UNEP/CBD/SBSTTA, 2001

Forest is a land area of more than 0.5 ha, with a tree canopy cover of more than 10%, which is not primarily under agricultural or other specific non-forest land use. In the case of young forests or regions where tree growth is climatically suppressed, the trees should be capable of reaching a height of 5 m *in situ*, and of meeting the canopy cover requirement.

FAO 2000a (FRA 2000 Main Report)

Forest includes natural forests and forest plantations. It is used to refer to land with a tree canopy cover of more than 10 percent and area of more than 0.5 ha. Forests are determined both by the presence of trees and the absence of other predominant land uses. The trees should be able to reach a minimum height of 5 m. Young stands that have not yet but are expected to reach a crown density of 10 percent and tree height of 5 m are included under forest, as are temporarily unstocked areas. The term includes forests used for purposes of production, protection, multiple-use or conservation (i.e. forest in national parks, nature reserves and other protected areas), as well as forest stands on agricultural lands (e.g. windbreaks and shelterbelts of trees with a width of more than 20 m), and rubberwood plantations and cork oak stands. The term specifically excludes stands of trees established primarily for agricultural production, for example fruit tree plantations. It also excludes trees planted in agroforestry systems.

The key features included in the various definitions are presented schematically in Table 1.3 where in the binary section '1' indicates the presence of a parameter in the definition and '0' its absence. The features are discussed in more detail in the next sections.

Table 1.3 Parameters of Definitions of 'Forest'

Parameter		UNFCCC	CBD	FRA
Binary parameters	Young stands	1	1	1
	Temporarily unstocked areas	1	0	1
	Non-forest land uses	0	1	1
	Agroforestry	0	?	1
Threshold parameters	Min. area (ha)	0.05-1.0	0.5	0.5
	Min. height (m)	2-5	5	5
	Crown cover (%)	10-30	10	10
	Temporary (years)	n/a	n/a	~10
	Strip width (m)	n/a	n/a	20

Threshold Defining Stand Characteristics

The definitions of the UNFCCC, CBD and FRA are compatible. All of them are based on land use and tree cover. Regarding tree cover, all definitions set thresholds for minimum area, tree height and canopy cover. The CBD and FRA definitions have the same numerical values for thresholds, and they apply universally in all countries. The UNFCCC thresholds differ from these in that the Parties to Kyoto Protocol can establish the numerical values drawing on their national definitions within the indicated ranges.

There is not necessarily a great need for further harmonization because the national thresholds applied under the UNFCCC definitions are largely harmonized under the FRA process. A number of countries have either adjusted their national definitions or converted their national data to make them comparable with the FRA definition, and this process is expected to continue. It is also worth noting that the UNFCCC process requires that Parties must report on changes in their forest stock as they reported in the past to FRA, i.e. applying not their national definitions but the FRA ones.

On the other hand, it should be noted that, in the context of the UNFCCC, the countries have an interest to ensure that the choice of threshold values (e.g. adoption of FRA definitions) does not lead to exclusion of significant carbon stocks from carbon accounting. It is therefore necessary to ensure that the entire classification and accounting system is able to accommodate the change without causing distortions. For instance, accumulation of carbon stocks in areas not classified as forest should be taken into consideration under other concepts such as UNFCCC's 'revegetation' or FRA's 'other wooded land' and 'other land'.

Definition of 'Temporary'

A pivotal feature of both the FRA and UNFCCC definitions of forest is that temporarily unstocked forest areas are classified as forest provided that their land use remains forestry[10]. There are a number of reasons why the term 'temporary' should be qualified.

Many lands which for legal or administrative reasons are classified as forest lands falling under forestry land use may not be covered with trees in a near future (or ever). On the other hand, there may be other ways than legal provisions or administrative decisions to ensure that the tree cover will

[10] This may not necessarily be true with the Kyoto Protocol.

be re-established and that forestry continues to be the land use. For example, existence of a management plan to reforest the land (soon) could be considered a qualifier, or that the tree cover is expected to expand to more than 10% of the crown cover and reach a minimum of 5 meters in height, if the area is brought under protection and not further disturbed by human intervention. However, the practicality of such options as qualifiers in connection with the term 'temporary' would have to be carefully assessed.

The term 'temporary' is present both in the UNFCCC and FRA definitions, but only the latter one is explicit on what it means; it is defaulted at roughly 10 years. The choice of default period is necessarily somewhat artificial given the wide range of conditions where forests regenerate. The reason why the UNFCCC lacks a definition is probably the highly varied national conditions for which an agreement on one definition would be difficult to reach.

The UNFCCC and FRA definitions are harmonized in the sense that data can theoretically be converted from one threshold to another. In practice, however, this may be difficult to achieve because data are usually insufficient to establish reliable conversion factors with regard to the period during which regeneration should occur. The other option is to standardize the default period[11], but it is unclear whether this is feasible or even desirable. The main benefit would be better convertibility of data which must be weighed against potential disadvantages such as disrupting established and agreed reporting patterns.

The CBD definition of forest does not include the concept 'temporary', possibly because the context where it is applicable, i.e. unstocked areas, are not referred to in the definition. The rationale for this could be reviewed together with a discussion on 'unstocked areas'.

Unstocked Areas

The FRA and UNFCCC definitions state that temporarily unstocked areas, are considered forest. The CBD definition does not explicitly mention these, but makes a reference to 'young forest'. Lacking an explicit definition, it is unclear whether young forests are equal to unstocked forest or not. It would probably be rare to have a virtually clean unstocked forest without any seedlings, and this would in most cases be a temporary situation. A forest is not considered 'stocked' before it has reached the thresholds set (10% and 5 meters). Before that it would be temporarily unstocked containing tree seedlings, i.e. it would be a young forest (natural or planted). If this interpretation is correct, the various definitions would be compatible.

The omission of unstocked forest from the CBD definitions has a number of connotations related to what extent unstocked forests house forest biodiversity and whether such areas are considered part of a forest ecosystem. On one hand, emergence of unstocked areas on a temporary basis is part of forest development dynamics, be the forest managed or unmanaged. On the other hand, a definition that would allow inclusion of (large) unstocked areas could be criticized from biodiversity standpoint (e.g. vastly reduced biodiversity at least temporarily).

The difference can be considered fundamental, and the possibility to agree on a common approach in this regard could be explored. The most promising option would be to modify the CBD definition of forest to explicitly include temporarily unstocked areas. Excluding unstocked areas from the FRA

[11] Not necessarily one default value.

and UNFCCC definitions is difficult to justify, since they are firmly anchored in the internal logic of these processes. The context where the CBD definition is used is probably still more flexible, and an adjustment of the definition may be acceptable.

If this kind of consistency between definitions is not considered feasible or desirable, another option is to harmonize them through improving comparability. This could be achieved by introducing a separate category of unstocked forest within the FRA and UNFFFC definitions of forest. From an inventory standpoint this would be rather easy to accommodate, and the cost implications would be modest.

Another aspect of unstocking is degraded forest land which is discussed in Annex 1, Section 3.

Expansion of Existing Definitions of Forest

The current definitions of forest have been criticized for lacking environmental and social criteria. and overemphasizing production aspects (e.g., World Rainforest Movement 2002). One of the key issues is the debate on what characteristics of a 'naturally' developed forest should be present in an area qualified as forest (see Annex 1, Section 1). Forest plantations, in particular, have been criticized for being 'too simplistic ecosystems' to be considered a forest.

It has proved difficult to agree on such distinctions as well as on appropriate classification criteria, and the current definitions of forest do not yet include references to them. However, most attempts to define the 'naturalness' of forests refer to indicators such as species composition and stand structure which, in principle, can be added as attributes to existing definitions. This may, however, lead to significant costs in data collection, since it would involve considerable field work.

Social criteria are more difficult to incorporate in definitions of forest in a manner that would make them practical to use. For instance, considerations such as "equitable sharing of benefits from forests", are difficult to operationalize, since the benefits are often intangible and it is difficult to make them comparable. 'Equitable sharing' is also a highly value-laden and context-specific concept. A possible option would be to address social issues mainly through more detailed and comprehensive conceptual frameworks (e.g. criteria and indicators) rather than through such basic and concise instruments as core definitions.

Summary of Options

(1) Threshold values for stand characteristics used by UNFCCC are fixed. However, under GPG a case could be made for countries to voluntarily adopt the FRA definitions as also applied by CBD.
(2) Assess the need to add a qualifier for the term 'temporary' in the UNFCCC and CBD definitions of forest.
(3) Consider including 'temporarily unstocked areas' in the CBD definition of forest to make it essentially the same as the FRA definition. Alternatively, make the CBD definition comparable with the FRA definition, by distinguishing 'temporarily unstocked areas' as a separate class of forest in FRA.
(4) Assess the need and justification for creating a sub-class of non-forest under FRA, 'degraded former forest land' to make it consistent with ITTO definition.

(5) Assess the feasibility of incorporating of social considerations in the definitions of forest vs. addressing these under such comprehensive frameworks as Criteria & Indicators for SFM.

Forest Land

None of the international sets of forest-related definitions include an explicit formulation of the term 'forest land' or 'forestland' (e.g. Lund 2002). The UNFCCC definition of 'forest management' includes the term 'forest land', but it is not defined (Box 1.3). Related UNFCCC terms including 'cropland management' and 'grazing land management', which define other land uses.

Box 1.3 Definitions of Forest and Other Land Management

UNFCCC 2001
Forest management is a system of practices for stewardship and use of forest land aimed at fulfilling relevant ecological (including biological diversity), economic and social functions of the forest in a sustainable manner;
Cropland management is the system of practices on land on which agricultural crops are grown and on land that is set aside or temporarily not being used for crop production;
Grazing land management is the system of practices on land used for livestock production aimed at manipulating the amount and type of vegetation and livestock produced.

Relationship with 'Forest'

Confusion arises from the fact that the UNFCCC definitions of afforestation, reforestation and deforestation (ARD) include three other related, but undefined terms, i.e. 'forested land' 'non-forested land' and 'land without forest'. For example, afforestation is defined as "the conversion of land that has not been forested for at least 50 years to forested land through planting, seeding and/or human-induced promotion of natural seed sources". In this context, it is unclear whether 'forested' refers to fully established stands or whether young forests which are not yet firmly established are included or not.

The simplest approach to make the definitions compatible would be to agree that the UNFCCC terms 'forested land' and 'forest land' are synonymous with 'forest'. Similarly, 'non-forested' and 'land without forest' would be equivalent of 'non-forest'. This would eliminate the ambiguity regarding young forests. It is also suggested that only one term be used, possibly 'forest', or that 'forest land' and 'forest' are considered synonymous. 'Non-forest' would be the symmetrical reverse of 'forest'. However, the issue of dividing non-forest into other wooded land and other land should be considered in this context.[12]

Relationship with Other Land Use Classes

Further confusion arises from the fact that the term 'forest land' appears to be referring to land use, in a similar fashion as 'cropland management' and 'grazing land management'. However, the situation is further complicated by the fact that these definitions do not exclude other land uses from an area. In other words, the available definitions do not provide clear guidance how to determine the

[12] This could possibly be taken up by GPG.

land category for an area where a combination of different land uses is practiced which is widely spread and often also a policy objective.

The problem derives from the ambiguity in the UNFCCC definition of forest which does not explicitly address the issue of combined land use. The FRA definition of forest represents a feasible approach where it is stated that 'other predominant land uses' should not be present in an area considered a forest. On the other hand, the UNFCCC definition may deliberately avoid references to land use because its main interest is carbon stock.

However, the possibility of overlap in the UNFCCC land classes makes the definitions incompatible with FRA and CBD definitions of forests, which do not allow it. In particular, they require that non-forest land uses should not be predominant in an area considered as forest. The FRA definition specifically excludes orchards, agroforestry and urban forests, and the CBD definition states that the area should not be primarily under agricultural or other specific non-forest land use.[13]

The difference may become an issue in the implementation of the Kyoto Protocol. Currently, the KP definitions assign any system of practices on land on which agricultural crops are grown to the activity 'cropland management'. If trees form part of such a system, they may thus be excluded from forest[14]. This would also make such lands ineligible under Article 12 of the UNFCCC. So far, the difference has not been an issue because the current UNFCCC definition applies only to Annex 1 countries, where forests are mainly boreal and temperate, and the distinction between forest and other land uses is usually relatively clear.

However, this difference must be explicitly addressed, when formulating a definition of forest to be applied under the CDM of the Kyoto Protocol. In developing countries, forestry is often combined with other land uses (agroforestry, silvopastoral systems etc.). Under the CBD and FRA definitions, they would not qualify as forest if other uses are predominant, whereas according to the current KP definition they would be classified as forests as long as the tree formations in these areas (fruit trees, oil palms etc.) meet the minimum criteria. The discussion to find a suitable approach is underway but still remains unresolved. If the future definition of forest under the CDM will include combinations of forest and other land uses without qualification related to predominant or primary use, it will be incompatible with the FRA and CBD definitions.

On the other hand, harmonization of these definitions could be achieved rather easily. It would suffice to split the land use class 'other land' applied by FRA into three classes: one would denote areas where trees are combined with other land uses in 'stand-like' formations within 'other land'. The second class would include 'scattered trees', i.e. patches below 0.5 ha (FRA minimum size). This corresponds to the existing FRA definition 'trees outside forest areas'. It is debatable whether a lower boundary such as 0.05 ha (UNFCCC minimum size) should be established. It may be an impossible condition to meet, because such high-resolution data are rarely available. It may be sufficient to establish a new class without a lower boundary. The remaining area under 'other land' would constitute the third class of 'no trees present'.

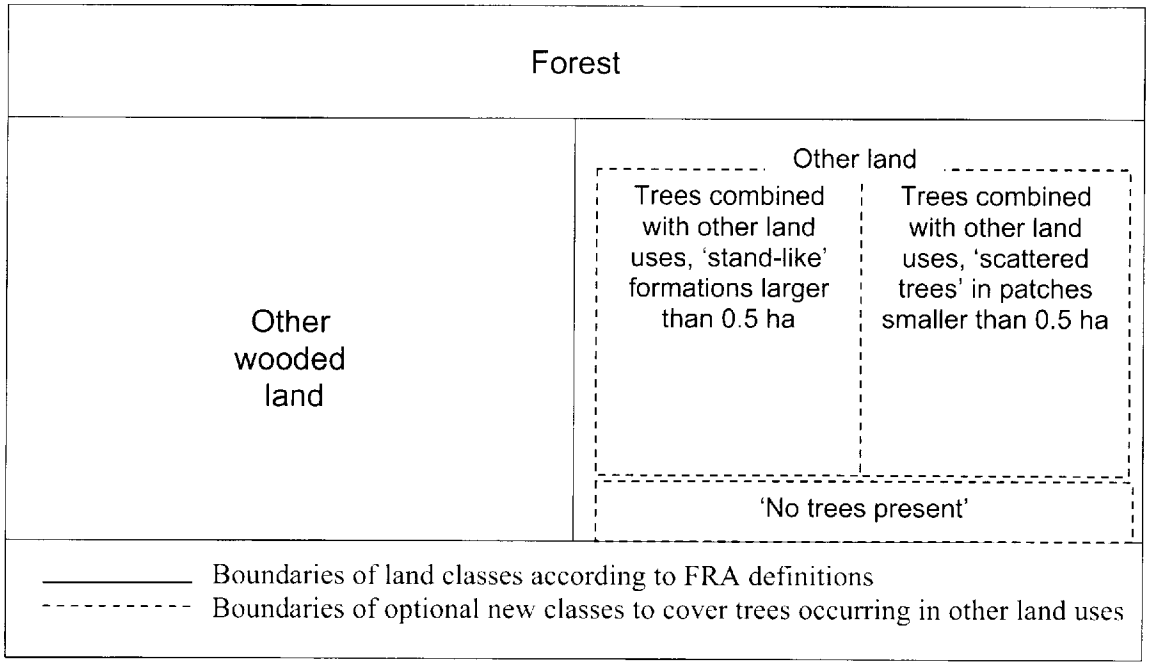
[13] Lands under silvo-pastoral systems where grazing is a complementary activity would be considered forest by the FRA definition.

[14] The countries may decide how they deal with such situations in reporting.

As the optional adjustment of the FRA classification would only split existing classes, it would not affect comparability with the CBD definition of forest. To some extent it might even be an improvement from the CBD's standpoint defining forest as function and ecosystem-oriented. The optional new classes could have distinguishable characteristics that may merit a separate different treatment as another, separate group of ecosystems from 'forest'.

The cost implications for countries reporting to FRA could be significant. It is not easy to distinguish combinations of land uses with remote sensing. Using current methods, it is also difficult to distinguish differences of tree cover classes with reasonable precision.

Figure 1.2 Relationship between Current FRA Land Classes and Proposed New Sub-classes Combining Forestry with Other Land Uses



Summary of Options

(1) Assess whether UNFCCC terms 'forested land' and 'forest land' can be considered synonymous with 'forest' and, if so, which term(s) should be used in the future.

(2) Clarify the method of classifying lands with a combined land use under the UNFCCC definitions and assess whether the UNFCCC approach can be aligned with the FRA classification by e.g. dividing the FRA land class 'other land' into sub-classes.

The work related to clarifying and streamlining definitions could be carried out under the process of developing Good Practice Guidance.

Non-forest

Definitions

'Other wooded land' and 'Trees outside forests' are terms found only in the FRA set of definitions (Box 1.4). The need for harmonization may arise from a desire to increase compatibility with the UNFCCC terminology which defines land areas eligible for 'revegetation'. Were the terms compatible, the FRA data would directly benefit the UNFCCC in terms of monitoring changes in carbon stock.

The land area, which revegetation applies to, has not been explicitly defined. Reference to vegetation that "does not meet the definitions of afforestation and reforestation contained here (reference to UNFCCC definitions)" suggests that areas which, after revegetation, qualify as forest are excluded. However, the available definitions leave it unclear whether it applies to lands under 'cropland management' and 'grazing land management'.

Box 1.4 Definitions of Non-forest Land, Trees Outside Forests, and Change in Vegetation

FAO 2000a (FRA 2000 Main Report)
Other Wooded Land is land that has either a crown cover (or equivalent stocking level) of 5 to10 percent of trees able to reach a height of 5 m at maturity; or a crown cover (or equivalent stocking level) of more than 10 percent of trees not able to reach a height of 5 m at maturity; or with shrub or bush cover of more than 10 percent.
FAO 2000b (FRA Working Paper No. 33)
Trees outside forests are trees and tree environments on land not defined as forest or other wooded land.
Explanatory note:
Trees outside forests (ToF) include: (a) groups of trees covering an area of less than 0.5 ha, including lines and shelterbelts along infrastructure features and agricultural fields; (b) scattered trees in agricultural landscapes; (c) tree plantations mainly for other purposes than wood, such as fruit orchards and palm plantations; and (d) trees in parks and gardens and around buildings. ToF are not assigned an area in the overall land use classification, but occurs inside Other wooded land and Other land. Although the definition of ToF is based on the trees, the concept includes also the site and other vegetation at the location.
Other land is, for the purpose of forestry, any land not classified as forest or other wooded land as defined above. Includes agricultural land, meadows and pastures, built-on areas, barren land, etc.
UNFCCC, 2001
Revegetation is a direct human-induced activity to increase carbon stocks on sites through the establishment of vegetation that covers a minimum area of 0.05 hectares and does not meet the definitions of afforestation and reforestation contained here [reference to UNFCCC definitions];
Devegetation lacks definition, but it can be assumed to be a symmetrical inverse of revegetation relying on same indicators and threshold values.

The proposals put forward by various countries suggest that revegetation would not apply to any of these lands, but to another, yet undefined land category outside of them. For instance, the Australian Government has suggested to consider the establishment of widely spaced trees, trees in windbreaks

and shelterbelts, trees in alley planting, salt bush tea tree and oil mallee as potential activities under revegetation (UNFCCC 2000b). The Government of Iceland has proposed growing of lupines, planting of grass and associated fertilization as eligible activities (UNFCCC 2000a).

The FRA definition of 'other wooded land', on the other hand, does not define a land use. It is therefore not clear whether agriculture or grazing can be practiced on 'other wooded land'. The FRA definition 'other land' includes agricultural lands and meadows outside 'forest' and 'other wooded land', but it does not provide guidance as to land uses in 'other wooded land'.

Another difference between the FRA definitions of 'other wooded land' and the areas under UNFCCC definition of land eligible for 'revegetation' is land cover. The FRA definition includes all 'woody' vegetation such as trees, shrubs and bushes. In the UNFCCC definition there are no restrictions regarding vegetation growing on land qualifying under the term revegetation (or devegetation).

Further, the UNFCCC definition of land eligible for revegetation sets a minimum limit of 0.05 ha for an eligible area, whereas the FRA applies 0.5 ha. In 'other land', this could be covered under the FRA definition 'trees outside forests' but in 'other wooded land', a new class would have to be created.[15]

The relationship between the FRA land classification and land eligible for 'reforestation' is illustrated in Figure 1.3 suggesting that harmonization of these definitions would be difficult because several new sub-classes should be created. The biggest hurdle is probably that the FRA land classes 'other wooded land' and 'other land' should be split according to land use, which would be a new practice. If harmonization of these definitions is considered useful, the first step would therefore be to find a common understanding on treatment of land use. Taking into account the fact that revegetation would probably be relevant only in a limited number of countries, a full harmonization may not be warranted because of the high cost involved as all countries should brake down their data accordingly.

Another approach would be to aim for partial harmonization. All the UNFCCC definitions require that changes are 'human induced'. This feature is currently not distinguished under FRA definition of 'other wooded land'. It would probably be possible and useful to distinguish between 'natural' 'other wooded land' (e.g., mountain shrubs or dry savanna) and 'human-made' 'other wooded land' (e.g., fallow or degraded land). For consistency, it would probably also be useful to distinguish between patch sizes, i.e. 0.5 ha (FRA minimum) and 0.05 ha (UNFCCC minimum). The respective set of sub-classes are illustrated in Figure 1.4 in the area denoting 'other wooded land'.

[15] The internal consistency of the FRA definitions for 'trees outside forests' and 'other wooded land' may need a review.

Figure 1.3 Relationship between Current FRA Land Use Classes and Land Areas Qualifying for 'Revegetation' under UNFCCC

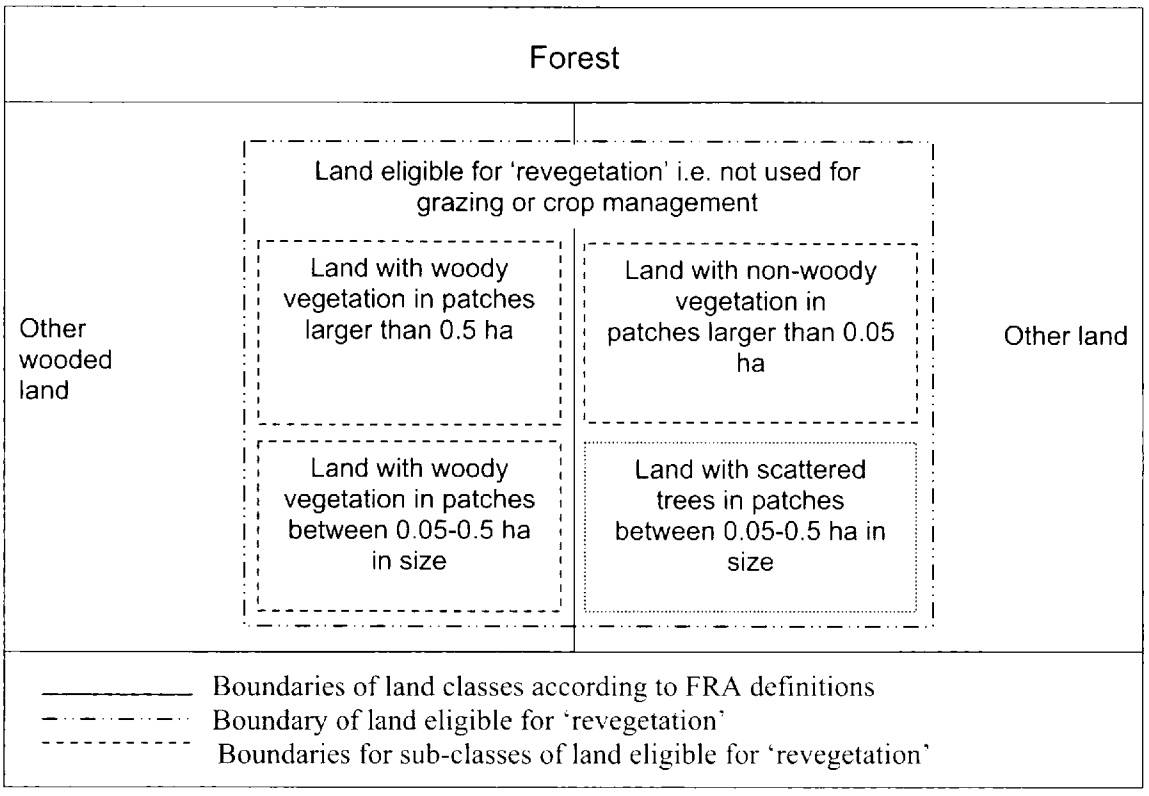
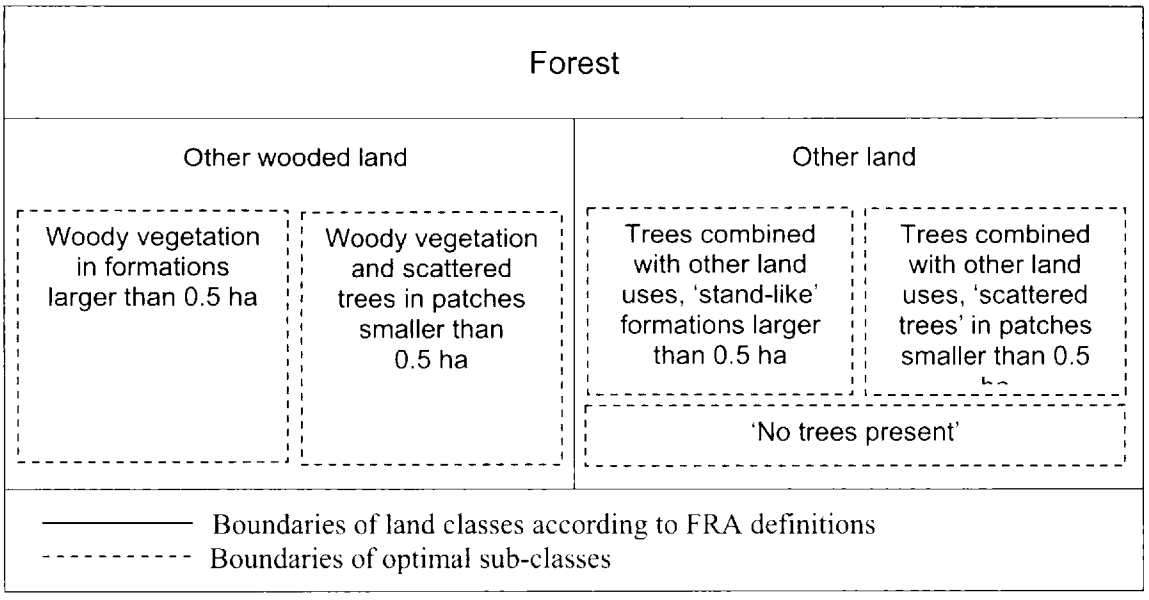


Figure 1.4 Relationship of Current FRA Land Classes with the Proposed Sub-classes under 'Other Wooded Land' and 'Other Land'



Option for Further Work

(1) Assess the feasibility of harmonizing the FRA land uses classes and lands qualifying under UNFCCC definition of revegetation.

Changes between Forest and Non-forest

Definitions

The two principal sets of definitions for deforestation, reforestation and afforestation are provided by FRA and UNFCCC. The CBD applies FRA definitions of reforestation and afforestation, but refers to wordings presented in FAO Working Paper 33 (FAO 2000b). ITTO has developed its own definitions of afforestation and reforestation. FRA has also developed a definition for natural regeneration and natural expansion of forests. The compatibility and potential for harmonization of the various definitions were extensively discussed in the first Expert Meeting on Forest-related Definitions (Proceedings 2002).

Afforestation and Natural Expansion of Forest

Afforestation, as applied by FRA 2000, is the conversion of non-forest into forest as a result of direct human action through planting or seeding. FRA does not make any qualification regarding the means of afforestation (through seeding or planting). The Expert Meeting recommended that FAO consider expanding the FRA definition of afforestation to include assisted succession to trees not involving direct seeding or planting. The ITTO definition refers only planting, and the option of including seeding and other assisted measures as a means of afforestation could be considered.

All three definitions of afforestation are compatible in the sense that they require human action, crossing of the forest/non-forest threshold and ceasing of other predominant land uses. They differ in that the Kyoto Protocol requires that the land has not been forested within the previous 50 years, whereas the FRA and ITTO definitions do not include any such qualification. In order to contribute to harmonization and simplification of definitions, the Expert Meeting recommended that the UNFCCC consider, in the second or subsequent commitment period, dropping the requirement for a 50-year non-forest condition for afforestation. This would eliminate the need for a separate definition of reforestation and bring the UNFCCC afforestation figures into closer agreement with the FRA results.

The treatment of young forests is compatible in the UNFCCC and FRA definitions. However, the UNFCCC definition explicitly includes young forests, whereas FRA definition considers as afforested only young forest stands that have been successfully established, but may not yet have crossed the applicable thresholds. The difference is minor, and harmonization of the definitions could be considered. The ITTO definition is problematic in the sense that afforestation is a 'planted forest', but ITTO does not provide a definition for 'forest'. ITTO may therefore consider adopting one of the existing definitions or formulate one, which is compatible with them.

The UNFCCC does not provide a definition for natural expansion of forest. This is logical in the sense that eligible activities include only those that are directly human-induced. ITTO, on the other hand, could consider developing a similar definition to make its set of definitions more complete.

Box 1.5 Definitions of Changes between Forest and Non-forest

Afforestation

FAO 2000a (FRA 2000 Main Report)

Establishment of forest plantations on land that, until then, was not classified as forest. Implies a transformation from non-forest to forest.

UNEP/CBD/ SBSTTA 2001

Applies FAO definition but refers to wording presented in FRA Working Paper 33 (FAO 2000b) (see annex 3)

UNFCCC 2001

The direct human-induced conversion of land that has not been forested for a period of at least 50 years to forest land through planting, seeding and/or the human-induced promotion of natural seed sources.

ITTO 2002

Planted forest on deforested land, or on non-forested land.

Natural expansion of forest

FAO 2000a (FRA 2000 Main Report)

Expansion of forests through natural succession on land that, until then, was under another land use (e.g. forest succession on land previously used for agriculture). Implies a transformation from non-forest to forest.

Reforestation

FAO 2000a (FRA 2000 Main Report)

Establishment of forest plantations on temporarily unstocked lands that are considered as forest.

UNEP/CBD/ SBSTTA 2001

Applies FAO definition but refers to wording presented in FRA Working Paper 33 (FAO 2000b) (see annex 3)

UNFCCC 2001

The direct human-induced conversion of non-forested land to forested land through planting, seedling and/or the human-induced promotion of natural seed sources, on land that was forested but that has been converted to non-forested land.

ITTO 2002

Re-establishment of trees and understorey plants at a site immediately after removal of natural forest cover

Natural regeneration on forest lands

FAO 2000a (FRA 2000 Main Report)

Natural succession of forest on temporarily unstocked lands that are considered as forest.

Deforestation

FAO 2000a (FRA 2000 Main Report)

The conversion of forest to another land use *or* the long-term reduction of the tree canopy cover below the minimum 10 percent threshold (see definition of forest and the following explanatory note).

Explanatory note: Deforestation implies the long-term or permanent loss of forest cover and implies transformation into another land use. Such a loss can only be caused and maintained by a continued human-induced or natural perturbation. Deforestation includes areas of forest converted to agriculture, pasture, water reservoirs and urban areas. The term specifically excludes areas where the trees have been removed as a result of harvesting or logging, and where the forest is expected to regenerate naturally or with the aid of silvicultural measures. Unless logging is followed by the clearing of the remaining logged-over forest for the introduction of alternative land uses, or the maintenance of the clearings through continued disturbance, forests commonly regenerate, although often to a different, secondary condition. In areas of shifting agriculture, forest, forest fallow and agricultural lands appear in a dynamic pattern where deforestation and the return of forest occur frequently in small patches. To simplify reporting of such areas, the net change over a larger area is typically used. Deforestation also includes areas where, for example, the impact of disturbance, overutilization or changing environmental conditions affects the forest to an extent that it cannot sustain a tree cover above the 10 percent threshold.

UNFCCC 2001

The direct human-induced conversion of forested land to non-forested land.

Reforestation

The FRA definition of reforestation implies active establishment (through seeding or planting) of forest on land previously forested but temporarily below the forest threshold due to harvesting or disturbances. Natural regeneration on forest lands is defined and accounted separately, which makes the FRA definition in the case of assisted natural regeneration compatible with the UNFCCC requirement that changes must be human induced. Full consistency would require FRA to separate assisted and unassisted regeneration.

The ITTO definition is compatible with these definitions as it states that reforestation takes place 'after removal of forest cover'. 'Re-establishment' does not indicate whether reforestation is human-induced or not, and an adjustment may be considered. As discussed above, the most problematic issue regarding compatibility is that the ITTO definition does not clearly refer to an established definition of forest.

Lands undergoing reforestation or natural regeneration (according to FRA) continue to be forest throughout. Neither of these transition processes involves a change in land-use class. The UNFCCC definition defines reforestation as conversion of land that was forested but had been converted to non-forested land. For the first commitment period, domestic reforestation is restricted to land that did not contain forest on 31 December 1989. Reforestation, as defined by the UNFCCC, is accounted as afforestation under FRA 2000 since the land was not previously forested. The current definitions of reforestation by FRA and the UNFCCC are therefore incompatible from a land-use point of view. The definitions cannot be reconciled. The ITTO definition is close to that of FRA, and the two could be harmonized with minor adjustments.

The terms afforestation and reforestation have not yet been defined under Article 12 of the UNFCCC referring to the CDM. If different thresholds are used from those under Article 3.3, this could have major implications for land area reported as afforested or deforested. The requirement of meeting sustainable development objectives will also introduce additional conditions. Credits for afforestation and reforestation activities that do not meet sustainable development objectives, as defined by the Party, are likely to be excluded.

Deforestation

A key feature of UNFCCC definition of deforestation is that the process is directly human-induced. The FRA definition, on the other hand, does not distinguish natural loss of forest from that caused by human action. While both definitions are consistent with the logic of their respective frameworks, the difference makes them incompatible with each other. The Expert Meeting recommended that FAO differentiate direct human-induced deforestation and permanent forest loss due to other causes. This would make the FRA data compatible with the needs of the UNFCCC.

Both definitions refer to non-temporary (long-term or permanent) change from forest to non-forest. The FRA defaults the time period for a 'temporary' unstocked state at usually a maximum of ten years, while the UNFCCC leaves it undefined.

Summary of Options

(1) Expand the FRA definition of afforestation to include assisted regeneration not involving direct seeding or planting
(2) Drop the requirement for a 50-year non-forest condition for afforestation in the UNFCCC definition to be applied from the second commitment period onwards
(3) Consider harmonizing the treatment of young forests in the FRA and UNFCCC definitions of afforestation
(4) Consider addition a definition of natural expansion of forest in the ITTO set of definitions that is compatible with the other existing definitions
(5) Consider developing the ITTO definitions by including a reference to an established definition of 'forest', and making minor adjustments to increase compatibility with FRA and UNFCCC definitions
(6) Differentiate direct human-induced deforestation and permanent forest loss due to other causes in the FRA definition of deforestation

Forest Degradation

Definitions

Definitions of forest degradation have been formulated by FRA and CBD. The ITTO proposal[16] has adopted the CBD definition but expands it with an additional qualifier. Forest improvement describes the reverse process of forest degradation. Other terms for this purpose may, however, be considered, such as aggradation, amelioration, melioration, rehabilitation, unsustainable management etc. The Expert Meeting discussed extensively the option to develop the concept and its definition (Proceedings 2002). Related concepts, 'forest fragmentation' and 'forest improvement', are discussed in Annex 1, Sections 4 and 5.

Box 1.6 Definitions of Forest Degradation

FAO 2000a (FRA 2000 Main Report)
Forest degradation. Changes within the forest which negatively affect the structure or function of the stand or site, and thereby lower the capacity to supply products and/or services.
UNEP/CBD/SBSTTA 2001
A ***degraded forest*** is a secondary forest that has lost, through human activities, the structure, function, species composition or productivity normally associated with a natural forest type expected on that site. Hence, a degraded forest delivers a reduced supply of goods and services from the given site and maintains only limited biological diversity. Biological diversity of degraded forests includes many non-tree components, which may dominate in the undercanopy vegetation.
ITTO 2002
Forest degradation. Long-term reduction of the overall potential supply of benefits from the forest, which include wood, biodiversity and any other product or service.
IPCC (draft version developed by a Task Force) 2002
Degradation is a long-term reduction of tree crown cover towards but not exceeding the minimum accepted 'forest' threshold.

[16] ITTO is still in the process of finalizing the guidelines where degraded and secondary forests are defined.

Table 1.4 Parameters of Various Definitions of 'Forest Degradation'

Parameter		UNFCCC	CBD	ITTO	FRA
Binary parameters	Reference point defined as - 'ideal' state - status in the beginning of the observation period	 0 1	 1 0	 0 1(?)	 0 1
	Reduced supply of goods and services caused by - human activities - natural causes	 1(?) 0(?)	 1 0	 1(?) 0(?)	 1 1
	Secondary forest	0	1	1?	0
Threshold parameters	Minimum crown cover (%)	'Accepted'			

Compatibility of Existing Definitions

The FRA definition defines 'degradation' as reduction in the capacity of the forest supply of goods and services. The CBD and ITTO definitions share this approach, but a notable difference in the CBD definition is that the reference point is a 'natural' state of forest. Significant deviation (defined in various ways) from such a state is considered degradation. The FRA and ITTO definitions, on the other hand, do not refer to a reference point, but imply any reduction in the supply of goods and services as degradation.

The draft definition formulated by IPCC for the UNFCCC tries to capture the essence of the degradation process through an operational definition using canopy cover as an indicator. Any reduction in indicator and value is considered 'degradation'.

The FRA, CBD and ITTO definitions are largely compatible, and a generic common definition could be formulated without greatly disrupting the existing use of them. The IPCC draft definition is geared towards operational use, and it is difficult to make it compatible with the others.

Composite Index

The principal difficulty of applying existing definitions arises from the fact that forests produce a multitude of various goods and services, and many of these are produced simultaneously on the same piece of land. Due to trade-offs, efforts to increase production of one output may reduce the availability of another. Owing to this interdependence, one of the key issues is to define how to deal with trade-offs between outputs, i.e., whether a reduction in the supply of one good or service can be offset by an increase in the supply of another. For instance, monoculture plantation could increase wood supply but lead to loss of biodiversity.

The Expert Meeting discussed the option that a generic, composite index for degradation, based on a weighted combination of indicators and/or their changes over time, could be a template for international application. A negative change in any indicator (beyond a certain threshold value) would represent an element of degradation. Weighting would be justified, as various negative changes would not have an equal impact on forest functions. In principle, the use of such a composite index implies that both negative and positive changes could be accommodated to be determined based on a combined impact. This was, however, not spelled out in the proceedings.

In some cases the supply of goods and services from a managed forest can be better than from a 'naturally' developed forest if all the economic, social and ecological functions are accounted for (e.g., planted forest on degraded marginal land) (Holmgren, pers. comm.). From this standpoint the key indicator would be the *change in the supply of goods and services* rather than the status of forest. The naturally developed forest could still be adopted as a reference point for assessing such a change.

In practice, there are a number of problems associated with this approach. Above all, many of the goods and services cannot be measured using the same, neutral yardstick. For instance, trying to determine trade-offs between environmental services and production of timber is a value-based choice. Many of the services (e.g. providing aesthetic values) are also intangible.

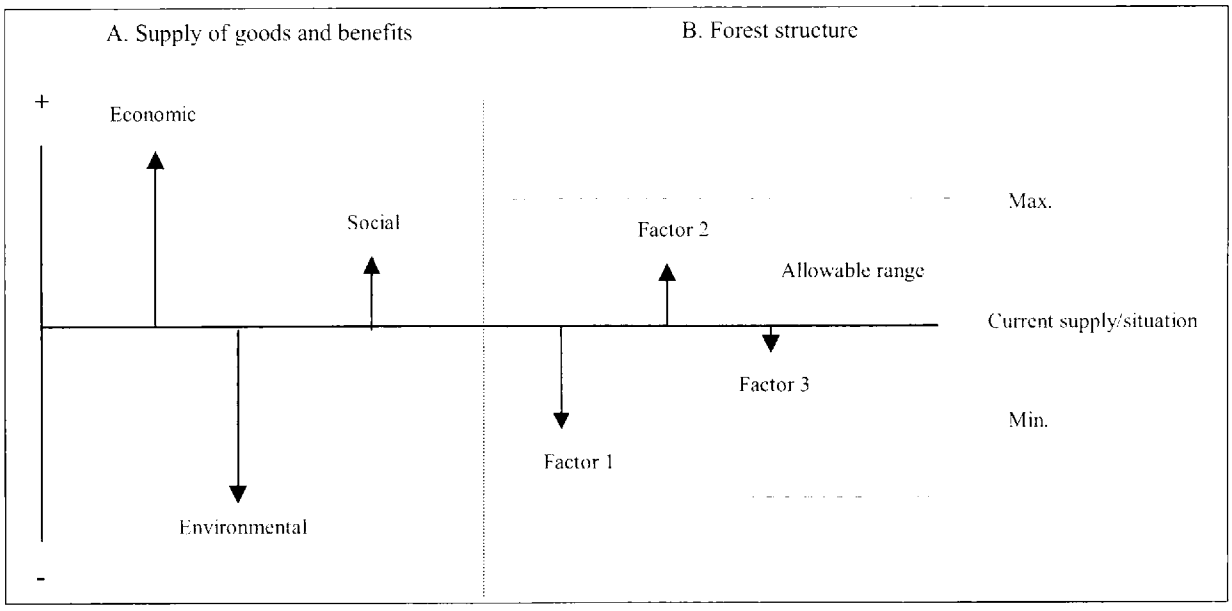
A further problem is that the degradation in the supply of environmental services (e.g. biodiversity) may materialize long after the activities causing degradation (or improvement) have taken place. For instance, forest species do not respond immediately to deterioration in the forest environment. Indicators based solely on the *current* supply of goods and services may not be able to detect these changes.

Another problem is the reference point. One option is to use the structure of 'naturally' developed forest as benchmark. However, it is unclear what would constitute a forest in this context, i.e. whether it is (a) a single stand, or (b) a group of stands of varying ages and development stages. In the latter case it is unclear how the concept should be applied to a single stand, if at all. It is also difficult to define which point of forest succession should be adopted as a reference point (early/mature/climax), as well as to determine at what stage of succession the stand(s) to be analyzed are. Acceptable deviations from the reference point would also be difficult to determine. For instance, should replacement of a broadleaved stand with a coniferous stand earlier than would happen in 'natural' succession be considered degradation?

Provided that the problems discussed above can be satisfactorily solved, the development of a comprehensive composite index could be considered. It should probably include indicators for the current as well as the potential supply of goods and services. For instance, the current supply of goods and services could serve as the main indicator, and change of forest structure could be used as a secondary indicator which is allowed to vary within a particular range (see Figure 1.5).

If this proves unfeasible, another approach could be to apply the generic definitions and develop individual indices for various aspects of degradation/improvement. Assessment on their combined effect would be done on a case-by-case basis.

Figure 1.5 Elements of Composite Index Comprising Supply of Goods and Benefits and Characteristics of Forest Structure



Other Considerations

Regarding the time frame the FRA definition indicates that degradation involves a 'long-term' reduction of potential supply. The term is included to avoid all logging operations to be considered degradation, as it would often lead to improvement of the stand in the long run (e.g., thinnings). Similarly, the damage caused by a fire would represent degradation in the short-term, but a long-term improvement in some ecosystems (Holmgren, pers. comm.). The CBD 2001 definition leaves the time frame open.

In this context, an important concept is the resilience of different forest ecosystems, which the ITTO definition refers to. The available definitions may be inadequate because they do not take into account the relative levels of resilience or buffering in different forest types.

The 'long-term reduction of potential supply' is almost equivalent to an indication that the resilience of forest has been exceeded (see above). However, the difference is that if the resilient capacity of a forest is exceeded, the result is an irreversible change. 'Long-term' may refer to a situation where the supply of goods and services is reduced for a long period time, but the resilience of the forest has not necessarily been broken down. In other words, reference to resilience implies more dramatic and permanent changes than an indication of 'long-term' changes. Harmonization could be approached by adjusting the FRA definition to include the concept of resilience.

Neither the FRA definition nor the CBD definition indicates spatial scale for assessments. The options include individual forest management units (FMU)[17], groups of small holdings, landscape, ecosystem, administrative district, national or some other level. From the operational standpoint, the FMU is an important concept and its operations should be assessed as a whole. If assessment is made only in harvested areas of an FMU, temporal observations would record reduction in stocking levels

[17] There are alternative interpretations for how a forest management unit is defined (cf. e.g., ISO 1998).

or canopy cover which could be interpreted as degradation. However, management of the entire FMU could still be sustainable, including areas with no harvesting.

Another difference between the FRA and CBD definitions is that the latter refers only to degradation that it human induced, whereas the FRA does not make this distinction. This makes the FRA definition more complete, since degradation is not always human-induced, as it can also take place for natural reasons (e.g., nutrient leaching, desertification). In principle, this distinction is required under UNFCCC, but in practice making the distinction may be difficult (Annex 1). Given the theoretical and practical problems of distinguishing between these two cases two feasible options could be considered: (1) not defining this attribute, or (2) qualifying all degradation as 'human-induced'.

Summary of Options

(1) Consider harmonizing the FRA, CBD and ITTO definitions of forest degradation
(2) Consider incorporating the concept of resilience in the existing definitions of forest degradation
(3) Explore options to determine on what spatial scale degradation should be assessed
(4) Analyze the feasibility of developing a composite index for forest degradation paying special attention to the justification/feasibility of (a) compensating degradation in the supply with one good or service with improvement in the supply of another one, and (b) adopting 'naturally' developing forest as a reference point for forest degradation

Managed Forests

Definitions

Definitions for managed forests are provided by FRA and ITTO (Box 1.7). The UNFCCC process provides a definition for forest management, which is closely related to the other two. Table 1.5 denotes the presence of parameters in alternative definitions. The IPCC (1996) refers to an inverse concept "unmanaged forest", which contains definitional elements.

Table 1.5 Parameters of Definitions of Managed Forest and Forest Management

Binary parameters	UNFCCC	IPCC	ITTO	FRA
Modification of natural forest development	0	1	1	0
Sustainable supply of goods and services	1	0	1	0
Management aims at fulfilling specific objectives/ functions	1	0	1	1
Duration of management	0	0	0	0

Box 1.7 Definitions of Managed Forests and Forest Management

FAO 1998 (FRA Working Paper No. 1)

Managed forest/other wooded land. Forest and other wooded land that is managed in accordance with a formal or an informal plan applied regularly over a sufficiently long period (five years or more).

ITTO 2002

Managed natural forest. Forest in which sustainable timber and non-wood harvesting (e.g. through integrated harvesting and silvicultural treatments), wildlife management and other uses have resulted in changes of forest structure and species composition. All major goods and service functions are maintained intact.

UNFCCC 2001

Forest management is a system of practices for stewardship and use of forest land aimed at fulfilling relevant ecological (including biological diversity), economic and social functions of the forest in a sustainable manner.

IPCC 1996

Natural, unmanaged (for wood products) forests are not considered to be either an anthropogenic source or sink, and are excluded from calculations. They can be excluded from woody biomass stocks accounting only, if there is no significant current interaction with these forests. If they are being used as a source of fuelwood, or are being affected in other ways by ongoing human activities, they should be accounted for.

All three definitions related to managed forests are based on the approach that management is a purposeful action with the objective of fulfilling specific objectives or functions. The ITTO definition states that management results in a modified forest structure or species composition, whereas the FRA and UNFCCC definitions do not define an outcome or add any qualifier to it.

This difference evokes the question, where to draw the line between managed and unmanaged stands. The ITTO definitions suggest that management is something that requires active intervention, i.e. altering natural forest development. The definition is rather broad covering a whole range of management objectives, which implies that unmanaged forests occur in rather rare circumstances. Strictly speaking, non-managed forests are limited to areas, which are in no way influenced by human intervention. Accordingly, managed forests are not limited to production forests, as protected areas are subject to management as well. For example, semi-natural forest meadows would not be able to maintain their status without active management. Even limited interventions, such as boundary demarcation, fire protection (e.g. against human-induced fire) are part of management.

The same principles can be derived from the FRA or UNFCCC definitions, but they, in principle, go one step further. Since no outcome is defined, a mere decision not to intervene, could be considered forest management in the sense that it involves a conscious choice between alternative development paths. In other words, making a choice is the key issue. On the other hand, this interpretation would be restricted to situations, where forest management is an option. In inaccessible areas, where "active" management is not an option, no management can be practiced, and, consequently, no choices are made. The difference may be significant and should be clarified.

All of the above-mentioned definitions disqualify anthropogenic influence that occurs without a specific purpose of forest management (Annex 1, Ch. 6). For instance, setting a forest accidentally in fire would not qualify as management. The IPCC definition applicable to carbon accounting, on the

other hand, is less clear in this regard. It states that "If they [forests] are being used as a source of fuelwood, or are being affected in other ways by ongoing human activities, they should be accounted for" [i.e. considered managed]. This formulation may be based on the notion that countries that are signatory to the Kyoto Protocol are responsible for protecting their forest resource against any kind of deterioration caused by humans. For instance, lack of proper fire protection should not be an excuse for not recording a reduction of carbon stock in a country's carbon accounts.

The ITTO and UNFCCC definitions include references to sustainability and maintenance of all forest functions, whereas the FRA definition does not mention these explicitly. For clarity, incorporation of these features in the FRA definition could be considered.

Summary of Options

(1) Consider clarifying the distinction between managed and unmanaged forest especially as regards non-intervention, and accidental anthropogenic influence.
(2) Consider incorporating a reference to sustainability into FRA definition of managed forests.

Forest Classification

The concepts of biome, forest type and forest ecosystem are interrelated in the sense that they serve to classify forest vegetation in various manners. The most commonly used term is forest type, which provides a basis for forest classification systems in most countries. The option to use biome as a basis for forest classification has also been discussed, mainly in conjunction with the implementation of Kyoto Protocol. It has been suggested that biome-based classifications would be particularly suitable for developing differentiated definitions or thresholds of forest. Forest ecosystem has not yet been applied as a basis for forest classification in international processes.

Biome

Among the international processes and instruments analyzed under this study the CBD is the only one that has provided a definition for 'biome'. The expression 'domain' used in the FRA ecological zoning is another similar concept (Box 1.8Box 1.).

Box 1.8 Definitions of Biome and Domain

UNEP/CBD/SBSTTA 2001

Forest biome. This reflects the ecological and physiognomic characteristics of the vegetation and broadly corresponds to climatic regions of the Earth. [In this document] it is used in reference to boreal, temperate and tropical forest biomes.

FAO 2001 (FRA Working Paper No. 56)

Domain. Broader entity or level in classification, equivalent to the five thermic Köppen – Trewartha climatic groups and including the tropical, subtropical, temperate, boreal and polar domain.

A number of other formulations are available, and there is also half a dozen of other words or expressions denoting similar concepts (e.g., formation, major life form, major life zone, major community, ecoregion, ecofloristic zone, etc.). The distinguishing features highlighted in these definitions vary considerably, and the expressions are, perhaps unavoidably, often so vague that the

difference in wordings has less significance for classification than the interpretation given to them by the one whom is doing it. The level of classification is also unclear; one definition may consider a forest type as an example of a biome, whereas for another definition the same forest type belongs to a hierarchically lower class (Rakonczay 2002).

However, as regards harmonization, the differences between these definitions are not yet a major issue, because they are not applied in any major international process. The key issue regarding biomes is whether it is necessary to apply different definitional thresholds in different forest conditions. This has been debated in particular in conjunction with the Kyoto Protocol. If a differentiated approach is adopted, the question is then, whether it should be done on the basis of biomes, or the current classifications based largely on forest type, or at all.

The Expert Meeting made a recommendation regarding the latter issue. It was concluded that biomes are probably less useful as a basis for different definitional thresholds than forest or vegetation types. The concept of biome is not necessarily compatible with the actual land use and the way forests are managed and utilized. As the territory of many countries includes several biomes, using biome-specific definitions would increase, rather than decrease, the reporting burden. Socio-economic parameters and land-use systems cross-cut the limits of biomes, which is another complicating factor.

Forest Type

Forest type has been defined by several processes, including CBD and ITTO while the FRA applied a related concept 'ecological zone' (Box 1.9).

The CBD definition of forest type refers to "groups of forest ecosystems of generally similar composition" as a basic unit of a forest type. In the ITTO definition it is "a community of trees and associated plant species with uniform physiognomy". The FRA system of ecological zones (Box 1.10) is close to these definitions, even though the approach is broader encompassing formations without trees. In the FRA system the basic classification is done on the basis of "zones or areas with broad, yet relatively homogenous vegetation formations".

Similarities in the physiognomy (structure) of vegetation formation are distinguishing features of both the FRA and ITTO definitions. The CBD definition includes structural elements (tree and undercanopy species composition, crown closure) as well as productivity as a separate aspect. However, productivity is largely a function of ecological and climatic conditions, and it is to large extent reflected in the physiognomy, which reduces the significance of the difference.

Both the ITTO and FRA definitions indicate similarity of ecological conditions as another distinguishing feature between classes. In the FRA definition a specific reference is made to climatic conditions based on temperature and rainfall. This attribute, however, is missing in the CBD definition. Another slight difference is that FRA and ITTO definitions refer to 'natural' formations, whereas this is not explicitly mentioned in the CBD definition.

The definitions are still rather broad, and there is ambiguity as to what level of hierarchy they represent, and what detail of classification they require. Sometimes forest type is confused with biome or used interexchangably with it (Rakonczay 2002). On the other hand, the concept of forest type is necessarily so diffuse that this is perhaps unavoidable. Even if there were a commonly agreed

definition of forest type, it would probably not be able to provide unambiguous guidance on determining the number of classes, distinguishing characteristics between classes, etc.

Box 1.9 Definitions of Forest Type

UNEP/CBD/SBSTTA 2001

Forest type. Within biomes, a forest type is a group of forest ecosystems of generally similar composition that can be readily differentiated from other such groups by their tree and undercanopy species composition, productivity and/or crown closure.

FAO 2001 (FRA Working Paper No. 56)

Ecological Zone. Defined as a zone or area with broad yet relatively homogenous natural vegetation formations, similar (not necessarily identical) in physiognomy. Boundaries of the Ecological Zones approximately coincide with Köppen-Trewartha climatic types, which are based on temperature and rainfall. An exception to this definitions are 'mountain systems', classified as one separate Ecological Zone in each domain and characterized by a high variation in both vegetation formations and climatic conditions.

ITTO 1998

Forest Type. A naturally occurring community of trees and associated plant species of definite botanical composition with uniform physiognomy (structure) and growing in uniform ecological conditions whose species composition remains relatively stable over time. These are most often scientifically described at the 'association' level.

Box 1.10 FAO Global Ecological Zoning

- Tropical rain forest
- Tropical moist deciduous forest
- Tropical dry forest
- Tropical shrubland
- Tropical desert
- Tropical mountain system
- Subtropical humid forest
- Subtropical dry forest
- Subtropical steppe
- Subtropical desert
- Subtropical mountain system
- Temperate oceanic forest
- Temperate continental forest
- Temperate steppe
- Temperate desert
- Temperate mountain system
- Boreal coniferous forest
- Boreal tundra woodland
- Boreal mountain system
- Polar

The main issue may therefore not be the harmonization of various, more or less vague definitions, but reaching an agreement on the key features of the classification to be adopted, as well as an assessment of the potential gain of more detailed harmonization. One option, therefore, is to adopt an existing system as a starting point. While the number of different classifications is large, few of them have been used systematically to gather and process large quantities of global data. The FRA classification by ecological zones is the most comprehensive and widely used system, and the option to adopt it as a basis for further development should be carefully considered. This approach was also recommended by Rakonczay (2002) in case a decision is made to adopt differentiated definitions.

Table 1.6 Parameters of Definitions of Forest Type

Binary parameters	CBD	ITTO	FRA
Basic unit			
group of forest ecosystem	1	0	0
community	0	1	0
formation	0	0	1
Characteristics of basic unit			
homogeneity	1	1	1
naturalness	0	1	1
Distinguishing features			
physiognomy	0	1	1
species composition	1	1	0
productivity	1	0	0
crown closure	1	0	0
climate	0	0	1
general ecological conditions	0	1	0

At the country level, the existing systems are well established, and have been developed to match the local conditions. It may therefore be advisable not to aim for harmonization of these systems with any international system, but rather to ensure that the information systems are able to provide data that is internationally required. This appears to be a highly feasible approach, as indicated by the reclassification of forest types used at the country level according to the FRA ecological zones.

Forest Ecosystem

The scientific community has formulated numerous definitions of ecosystem. Of the four international processes analyzed in this report, the CBD is the only one providing a definition for it (Box 1.11).

Box 1.11 Definition of Forest Ecosystem

UNEP/CBD/SBSTTA 2001

A forest ecosystem can be defined at a range of scales. It is a dynamic complex of plant, animal and micro-organism communities and their abiotic environment interacting as a functional unit, where trees are a key component of the system. Humans, with their cultural, economic and environmental needs are an integral part of many forest ecosystems

The CBD definition of ecosystem indicates that it can be applied at different levels of definitional hierarchy. It is also a complex approach, as it involves dynamic interaction between biotic and abiotic environment, including humans. Despite the fact that ecosystem is a sound concept in ecological terms, it is difficult to apply it as a basis for forest classification. Classification systems must be based on concepts, which are rather rigid and display as little ambiguity as possible. Concepts such as forest type are more robust, even if in ecological terms they may not capture all the elements of the state and change of forest. In addition, the fact that different interpretations of the ecosystem concept are fully justified in particular contexts makes it difficult to reach an agreement on a globally applicable definition which could be operationalized through data collection. For practical purposes, it may be sufficient to adopt an appropriate classification of forest types serving as a rough proxy for classifying ecosystems.

Differentiated vs. Universal Definitions

It is of interest to analyze what gaps differentiated definitions are intended to fill, and whether the current systems – including the definitions they apply - could be adjusted to meet the new requirements. The main conclusions reached by Rakonczay (2002) in this regard include:

- Even in a differentiated approach, the same basic parameters of definition of forest would apply, namely: minimum area, minimum tree height at maturity, and minimum canopy cover (or another appropriate measure of density).
- The values of the above parameters influence the amount of land that is classified as forest. The effect of these parameters appears to be greatest towards the margins of the natural distribution of forests, and in areas highly impacted (disturbed/fragmented) by humans.
- No strong arguments have been identified either in favour or against defining forest on a biome-specific basis. Left unchanged long enough, any reasonable definitional scenario will detect major trends in transitions between forest and non-forest areas. As long as the system is based on a set of threshold criteria, its sensitivity (its ability to detect small changes) can be increased by reducing the spatial assessment units than by changing the definition.

It is also noteworthy that a change in a definition always entails a significant cost increase. Reporting burden during the transition period from one definition to another would increase, inventories may be come more complicated and comparability with historical data is often difficult to maintain. There is also a risk that such a change would create loopholes and perverse incentives (Rakonczay 2002).

Alternative approaches include development of more accurate measurements. Reduction of spatial assessment units is one of the means for increased accuracy to detect small changes (Rakonczay 2002). This option, of course, also entails a significant cost increase, but it should be compared with the costs of other approaches.

Another option is to develop an overall classification and assessment system (Rakonczay 2000). Instead of focusing assessments on the extent of forest and non-forest land, the scope could be enlarged to detect changes within forest and non-forest land. This approach could achieve the same objectives as differentiated definitions (Figure 1.6).

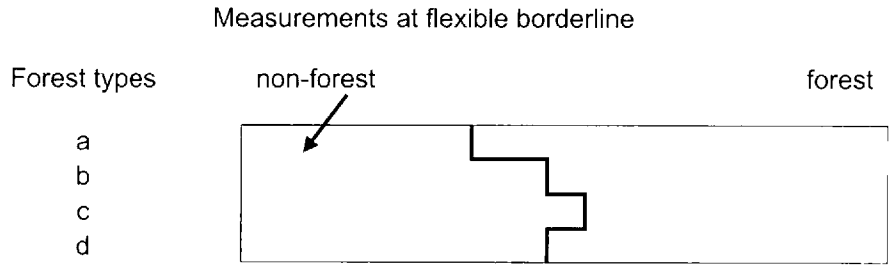
The UNFCCC has proposed a method for assessment of carbon stock within non-forest land. Revegetation (and devegetation) is a concept intended to capture an increase of carbon stocks in case the change does not qualify as reforestation or afforestation. Revegetation is a particularly useful concept in marginal areas of natural forest vegetation (e.g. areas subject to desertification), which has been pointed out as one of the problem areas for a non-differentiated definition of forest. Provided that appropriate monitoring methods are developed, revegetation may enable assessments that are sufficiently accurate for the purposes of UNFCCC. The FRA concepts 'other wooded land' and 'trees outside forest' serve for the same purpose, and introduction of new sub-classes could make them more useful than at present.

Regarding changes within forest land, the existing classification could also be developed to detect changes in zones which are highly disturbed or fragmented by human activities. These are claimed to be another problem area for a non-differentiated definition of forest. There is a concern that, in strict definitional terms, an area may remain forest, even if substantial degradation has taken place

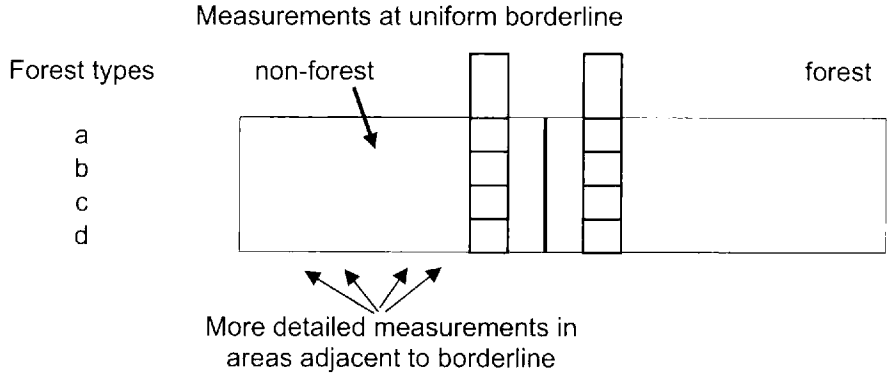
(Rakonczay 2002). Detecting such changes may be possible by developing the terminology and assessment methods related to 'forest degradation' in a manner suggested earlier.

Figure 1.6 Detection of Changes in and between Forest and Non-forest Land

Option 1



Option 2



The problem regarding carbon accounting is that the CDM has opted to exclude from its scope other changes than those related to afforestation and reforestation. In the CDM approach, the detection of changes is strictly based on changes between forest and non-forest areas. However, if changes in carbon stock within forest areas is considered the problem that has to be addressed under the UNFCCC, the option of enlarging the scope of eligible activities to forest degradation and aggradation would be studied. Changing an existing and well-established definition of forest is a complex and intricate process involving significant costs.

Summary of Options

(1) Consider harmonizing the various definitions of forest type using the FRA classification of ecological zones as a starting point.
(2) Clarify the difference between forest type and biome in terms of their level in the definitional hierarchy.
(3) Review the possibility of developing the terms 'revegetation/devegetation' and 'forest degradation/improvement' as an alternative to introducing a differentiated definition of forest.

Natural Forest vs. Forest Plantation

Definitions

Definitions of forest plantations vs. natural forests have a whole range of connotations which are subject to debate at an international level which are beyond the scope of this analysis. The key issue underlying the debate is the criticism that plantations are claimed not to fulfil the functions of a 'normal' or 'natural' forest. The available definitions are reviewed only briefly concentrating on their relationship with other definitions. Definitions of plantation forests are provided by FRA, ITTO and CBD (Box1.12). A definition of natural forest and semi-natural forest, which is a related concept, is provided by FRA.

Box1.12 Definitions of Natural and Plantation Forest

FAO 2000a (FRA 2000 Main Report)
Natural forest. A forest composed of indigenous trees and not classified as forest plantation.
Forest plantation. A forest established by planting or/and seeding in the process of afforestation or reforestation. It consists of introduced species or, in some cases, indigenous species.
FAO 2000b (FRA Working Paper No. 33)
Semi-natural forest. Managed forests modified by man through silviculture and assisted regeneration.
ITTO, 2002
Planted forest. Forest stand that has been artificially established by planting or seeding.
UNEP/CBD/SBSTTA 2001
A ***plantation forest*** may be afforested land or a secondary forest established by planting or direct seeding. A gradient exists among plantation forests from even-aged, single species monocultures of exotic species with a fiber production objective to mixed species, native to the site with both fiber and biodiversity objectives. This gradient will probably also reflect the capability of the plantation forest to maintain "normal" local biological diversity.

The FRA definition of natural forests is based on an exclusion, 'forests *excluding* plantations', which suggests the difficulty of formulating an appropriate definition, and probably explains why other processes have limited their definitions to concern only plantations.

The three definitions of plantation provided above are very similar. All of them refer to forest stands established either through planting and seeding. A minor difference is that the FRA definition includes a qualifier regarding introduced and indigenous species which are lacking in other definitions. The CBD definition provides site characteristics.

In many cases the difference between natural forest and forest plantation is not clearcut, as planted seedlings can be mixed with naturally regenerated seedlings. This is often the case in the European forests, where the line between semi-natural and plantation forests can be difficult to determine. Semi-natural forests often have stand characteristics, which resemble those of a 'naturally' developed forest (e.g. Buchwald 2002).

Table 1.7 Parameters of Definitions of Forest Plantations

Binary parameters	UNFCCC	CBD	ITTO	FRA
Site characteristics	n/a			
afforested land		1	0	1
secondary forest		1	0	1
reforested land		0	0	1
Method of establishment	n/a			
planting		1	1	1
(direct) seeding		1	1	1
Stand characteristics	n/a			
introduced species		0	0	1
indigenous species		0	0	1
intensively managed		0	0	1
number of species		0	0	1
age		0	0	1
spacing		0	0	1

This suggests that the method of re-establishing a tree stand may have less significance for forest functions than the characteristics of the stand that ultimately develops. AHTEG (UNEP/CBD/SBSTTA 2001) pointed out that a gradient exists among plantation forests from even-aged, single species monocultures of exotic species with a fiber production objective to mixed species, native to the site with both fiber and biodiversity objectives. This gradient would probably also reflect the capability of the plantation forest to maintain 'normal' local biological diversity.

If this argument is accepted, it may be inferred further that the way in which forest stands are established would not have to be a starting point for classification from the biodiversity point of view[18]. If a distinct class is considered necessary, it could be established based on the characteristics of established stands. On the other hand, the concepts 'afforestation' and 'reforestation' are closely tied to the forest plantation concept.

Regarding the various definitions analyzed in this study, the distinction between plantations and natural forest is particularly pertinent to forest degradation and improvement. The mere establishment of plantations has been considered forest degradation, especially if they replace natural forests (e.g. World Rainforest Movement 2002). The argument is that they should therefore be either excluded from a definition of forest, or at least should be treated separately from natural forests in terms of assessing their status, supply of goods and services, etc.

On the other hand, if a composite index of degradation could be developed, the less desirable characteristics of plantations (monoculture, uniform stand structure, etc.) could be taken into consideration as components of this index. The negative changes could be weighted against the positive contributions that plantations may have (e.g., increase in fiber production or soil protection) which would make the classification based on plantation/natural forest less relevant. However, as discussed previously, this approach faces a number of theoretical and practical problems.

[18] For the Kyoto Protocol, the method would remain a relevant aspect.

Summary of Options

(1) Explore the possibilities to combine stand characteristics as a descriptor of forest plantations in addition to the method of establishment.
(2) Assess whether the sustainability of forest plantations could be evaluated using a composite index or using the C&I frameworks.

Low Forest Cover

Definition Approaches

The Intergovernmental Forum on Forests (IFF) identified countries of Low Forest Cover (LFC) as being of special concern. The Tehran process initiated in 1999 has been promoting the development of appropriate relevant definitions (FAO 2002). In response, UNEP and IUFRO carried out an analysis on options to define low forest cover (Lund 1999). It suggested that one of the most interesting alternatives is classification of countries based upon a combination of variables. These include, *inter alia*, ratios of:

- forest/total land area
- forest and other wooded/total land area
- existing/original forest area
- actual/potential forest area
- forest per capita

Many of the countries, which potentially qualify as low forest cover countries, are situated in dry zones. In these areas, the indicator values are very sensitive to changes of the thresholds set for the definition of forest. The accuracy of estimating forest area in marginal natural conditions is another key issue.

Two possible approaches have been discussed to increase the sensitivity and accuracy of assessments: (i) differentiated definitions based on biome or forest type, (ii) development of technical means to improve accuracy of classifications based on universal definitions. Regarding differentiated definitions, it is not clear whether they increase accuracy of measurements (Rakonczay 2002). In addition, problems with technical feasibility and cost may hinder efforts to pursue this strategy.

An alternative approach is to retain universal definitions, but increase the ability of technical means to assess the status of vegetation in marginal areas. With respect to FRA, enhancing the ability to detect changes in the FRA classes 'other wooded areas' and 'trees outside forest' would probably increase the accuracy significantly in LFC environments. There is a cost factor involved but, as indicated earlier, it may be less expensive and technically more feasible than using differentiated definitions. The development of the concept 'revegetation' under the UNFCCC process is another key approach.

Alternative approaches to define low forest cover are in some respects a separate issue not directly related to harmonization of definitions of the core terms of international instruments. Exploring further options for LFC definition(s) (e.g. development of combined indexes), should continue to be part of a concerted, comprehensive effort to develop compatible and harmonized definitions. How

vegetation cover is assessed in marginal areas is linked to development of definitions not only under the FRA but also within the UNFCCC (e.g. as regards the term 'revegetation'). To ensure that the definitions emerging from these processes are mutually compatible and consistent, it is necessary that all relevant parties take part in this process.

Summary of Options

(1) Assess the options to increase accuracy of assessments on vegetation cover in marginal (dry) natural conditions in conjunction with the work carried out under other relevant processes, especially the FRA and UNFCCC.
(2) Assess the feasibility of composite indices for characterizing low forest cover countries.

Conclusions

As the recommendations of the Expert Meeting indicated, there is an agreement on the necessity of increasing compatibility of definitions used by different international processes and the use of employing existing definitions in new applications. An improved definitional framework would facilitate reporting at country level, as it would, in particular, enable more efficient data collection and reduce the cost of reporting to various instruments. The principal strategy to achieve this would be harmonization of related definitions, i.e. making them comparable, fully compatible and increasingly consistent with each other. Standardization of definitions, i.e. adoption of similar wordings to be used under several frameworks, is a relevant option only in a few cases where differences are minor and the objectives are clearly aligned, or in emerging new contexts.

Some of the current differences between existing definitions are attributable to fundamental differences in the objectives and purposes for which the definitions have been formulated, and they simply cannot be reconciled. A case in point are the differences between definitions applied under FRA and UNFCCC, e.g., regarding reforestation and possibly also the treatment of agroforestry. Still, even in these cases, it may be possible to partially harmonize the definitions, for instance in implementation of GPG or where an optional range is given for threshold values. In other words, individual definitions could be reformulated so that part of the data collection based on them could benefit other processes (decomposition approach).

It is remarkable that various definitions differ only marginally. Incompatible features have probably grown out of differences in the context, where the definitions have been formulated. Personal experiences or interests of the people involved in definition work is another possible reason. In such cases, the potential for increased harmonization should be carefully explored. This could often apply, even if differences are due to objectives. For instance, some of the special features found in the draft ITTO definitions are probably attributable to their principal objective, which is to provide guidelines for practical forest management rather than constitute a basis for reporting. On the other hand, both aspects are relevant in the ITTO context.

Any new international initiative to develop forest-related definitions is always a potential source of risk for confusion if the work is not aligned with the existing terms and definitions under different instruments. The added value of potential new definitions for core terms should be carefully assessed before adopting them. Some international processes have been too hermetic in the past which has probably been an additional reason for unnecessary differences. Negotiators working under

international agreements should have as comprehensive information as possible on the implications of alternative definitions, including cost of data collection and reporting.

Considering efficiency it would be highly desirable that data collection at the global level be concentrated in as few institutions as possible serving various data uses and users. Strengthening of the FRA process is a recommended option in view of its effective role in the past. On the other hand, if FRA is to assume a central position in data collection, it is necessary that its procedures and especially the framework of definitions and various classifications are made as flexible as possible. While some of the requirements deriving from other international processes may be difficult to accommodate, and do not directly serve for the FRA objectives, compatibility should be established at least on a conceptual level. The existence of a common definitional framework would reduce the need to undertake costly adjustments in the future. With improved data collection systems (coverage, accuracy, speed, etc.), compatibility can be further increased.

The elements of the common framework were largely identified by the Expert Meeting. When defining the detailed provisions, the options presented in this discussion paper under each core term could be considered.

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ANNEX 1

EXPLORATION OF DEFINITIONS FOR SELECTED COMPLEMENTARY TERMS

1. Primary and Old-growth Forests

There is a wealth of definitions for primary forest, old-growth forest, virgin forest- etc. (Lund 2002). Of the four processes analyzed in this study, the CBD and FRA have developed related definitions.

Box A. Definitions of Naturalness

UNEP/CBD/SBSTTA 2001

Primary forest. A primary forest is a forest that has never been logged and has developed following natural disturbances and under natural processes, regardless of its age. It is referred to "direct human disturbance" as the intentional clearing of forest by any means (including fire) to manage or alter them for human use. Also included as primary, are forests that are used inconsequentially by indigenous and local communities living traditional lifestyles relevant for the conservation and sustainable use of biological diversity. In much of Europe, primary forest has a different connotation and refers to an area of forest land which has probably been continuously wooded at least throughout historical times (e.g., the last thousand years). It has not been completely cleared or converted to another land use for any period of time. However traditional human disturbances such as patch felling for shifting cultivation, coppicing, burning and also, more recently, selective/partial logging may have occurred, as well as natural disturbances. The present cover is normally relatively close to the natural composition and has arisen (predominantly) through natural regeneration, but planted stands can also be found. However, the suggested definition above would include other forests, such as secondary forests.

Old growth forest stands are stands in primary or secondary forests that have developed the structures and species normally associated with old primary forest of that type have sufficiently accumulated to act as a forest ecosystem distinct from any younger age class.

FAO 1998 (FRA Working Paper No. 1)

Natural forest undisturbed by man. Forest which shows natural forest dynamics such as natural species composition, occurrence of dead wood, natural age structure and natural regeneration processes, the area of which is large enough to maintain its natural characteristics and where there has been no known human intervention or where the last significant human intervention was long enough ago to have allowed the natural species composition and processes to have become re-established.

The CBD definitions of primary and old growth forest differ in two respects. First, primary forest can be of any age, as long as it has developed following natural processes, whereas old growth forests has to be - by definition - old. Second, primary forests must not have been directly disturbed by humans, apart from inconsequential traditional use. Old-growth forest may have been subject to human disturbance, but it has always developed a structure and species composition that are normally associated with old primary forests. This overlaps with the definition of primary forests. Forests without any past human disturbance also qualify under the definition of old growth forest as long as they are 'old' (Table A.)

Table A. Applicability of CBD Definitions (2001) of Primary and Old-growth Forest to Various Types of Forest Not Affected by Human Intervention

Human influence/age class	No or inconsequential human disturbance	Recovered to 'natural state' after significant human disturbance
'Old'		
'Young'		

Primary
Old-growth
Primary & old-growth

The FRA definition of natural forests undisturbed by man also emphasizes characteristics of forest that have developed based on natural processes. However, in contrast to the CBD terminology, the FRA definition covers all the four types of forests not affected by human intervention. The FRA definition also makes an explicit reference natural forests, thus excluding plantation forests.

The current situation is confusing because of overlapping terms. Improved clarity would require, e.g., that the four different types of forests not affected by human intervention are clearly distinguished as separate classes (Table B). The following working definitions and characterizations could be applied:

(i) *old primary forest:* old forests with no or inconsequential human disturbance
(ii) *young primary forest:* young forests with no or inconsequential human disturbance
(iii) *old recovered primary forest:* old forests which have regained natural-like status after human disturbance
(iv) *young recovered primary forest:* young forests which have regained natural like status after human disturbance

Table B. Key Characteristics of Proposed Definitions Denoting Forests not Affected by Human Intervention

Human influence/ age class	No or inconsequential human disturbance	Recovered to 'natural state' after significant human disturbance
'Old'	Old primary forest	Old recovered primary forest
'Young'	Young primary forest	Young recovered primary forest

2. Definitions Related to Degraded Forests

Definitions related to degraded forests have been developed by FRA, CBD and ITTO. In addition, the latter organization has proposed a comprehensive framework of related concepts, including secondary forests, aimed at facilitating rehabilitation and restoration of degraded forest areas (ITTO 2002).

Box B. Definitions of Degraded and Secondary Forests

ITTO, 2002

Degraded primary forest. The initial forest cover of a primary, old-growth or managed forest has been affected by unsustainable, excessive timber and wood exploitation or by such intensity of extraction of non-wood forest products, that its structure, processes, functions and dynamics are altered beyond the elastic capacity of the forest ecosystems.

Secondary forest. Woody vegetation re-growing on land that was totally (or at least 90%) cleared of its original forest vegetation.

FAO, 1998 (FRA Working Paper No. 1)

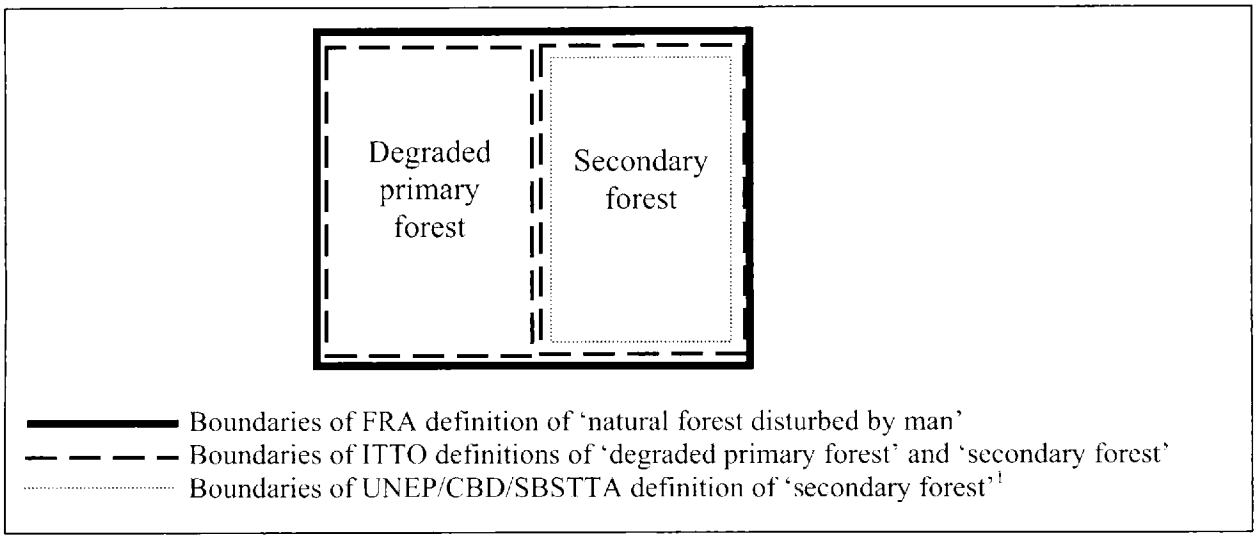
Natural forest disturbed by man. Includes (i) logged over forests associated with various intensity of logging (ii) various forms of secondary forests, resulting from logging or abandoned cultivation.

UNEP/CBD/SBSTTA, 2001

Secondary forest. A secondary forest is a forest that has been logged and has recovered naturally or artificially. Not all secondary forests provide the same value to sustaining biological diversity, or goods and services, as did primary forest in the same location. In Europe, secondary forest is forest land where there has been a period of complete clearance by humans with or without a period of conversion to another land use. Forest cover has regenerated naturally or artificially through planting.

The ITTO definitions distinguish between degraded primary forests and secondary forests, while the FRA definition combines them under one definition. The CBD provides only one definition for secondary forest.

Figure A. Components of Natural Forest Disturbed by Man



The main difference between the two definitions of secondary forest is that the ITTO definition sets a fixed limit for forest clearance. If this limit is exceeded the subsequent regrowth is termed secondary forest. Since the difference is minor, harmonization or even formulation of a generic definitions could be considered.

Harmonization of the FRA definition with the others could be approached by splitting the FRA definition into two classes along the lines suggested by the ITTO definitions.

3. Degraded Forest Land

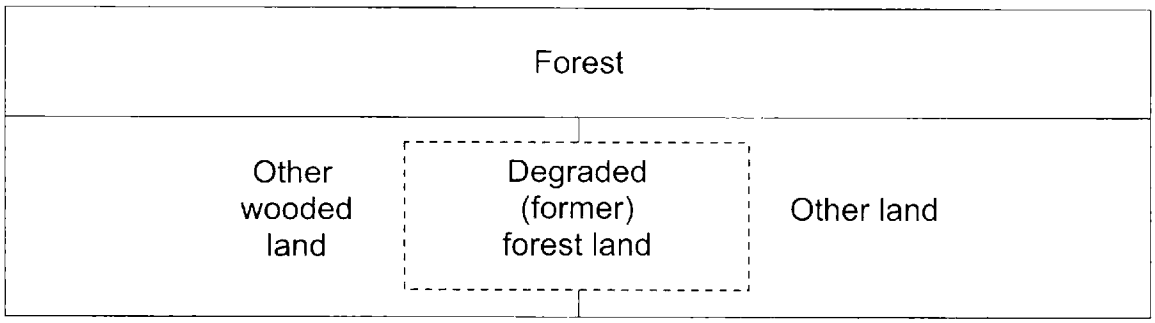
Another definition relevant to unstocked forest areas is the term degraded forest land put forward in the ITTO Guidelines for the Restoration, Management and Rehabilitation of Degraded and Secondary Tropical Forests (ITTO 2002) (Box C)[19]. It refers to unstocked forest areas which are so severely damaged by unsustainable use or natural causes that forest regrowth is either inhibited or substantially delayed.

Box C. ITTO Definition of Degraded Forest Land

ITTO 2002
Degraded forest land. Former forest land severely damaged by excessive timber and NWFP harvesting, poor management, repeated fire, grazing or other disturbances and land uses that damaged soil and vegetation to a degree which inhibited or severely delayed forest regrowth after abandonment.

The wording suggests that forest cover is absent and that the area may remain unstocked indefinitely. Despite the reference to 'forest land', the definition implies that other land uses such as grazing, and possibly agriculture may be present in the area. On the other hand, 'after abandonment' at the end of the definition would suggest that there is no economic use present in degraded forest land. These differences make it fundamentally different from the FRA definition of forest, which requires that other predominant land uses are not present and that restoration of forest cover takes place within a established timeframe (Figure B). In FRA terms, 'degraded forest land' would probably be classified as 'other wooded land' or 'other land' if the land use has not been changed.

Figure B. Relationship between Current FRA Land Classes and ITTO Definition of Degraded Forest Land



———— Boundaries of land classes according to FRA definitions
---------- Boundary of ITTO definition of 'degraded forest land'

One conceivable avenue to harmonization is to assign this type of land to a new sub-class under FRA e.g. under 'degraded former forest land'. It would be extracted from existing FRA classes of non-forest land, i.e. 'other wooded land', and 'other land' (for definitions see Ch. 4.5). In technical terms,

[19] The Guidelines are still a draft and the definitions have not yet been endorsed by the ITTC.

this may be feasible, since the new class could be distinguished based on a comparison of historical and current data on the extent of forest cover. Some additional ground truthing might also be necessary to clarify the current land use.

On the other hand, it is doubtful whether such adjustments are necessary, and whether the expected benefit would justify the related cost. The purposes for which the FRA and ITTO definitions have been formulated are quite different and links between them are few. The FRA definition applies to a global process focusing on national-level data collection to serve international reporting and comparisons, while the ITTO guidelines are aimed at providing guidance to practical management decisions, rather than offering a basis for reporting. Achieving compatibility between the two may therefore, in this particular case, be beneficial, but the benefits should be weighed against the respective development effort. On the other hand, national-level policy design and planning would require adequate data on degraded forest lands which cover vast areas in many countries.

4. Forest Improvement

In the FRA terminology, forest improvement is the reverse of forest degradation. However, the Expert Meeting discussed whether other terms such as aggradation, melioration, amelioration, initiation of sustainable management, etc. could be considered. Related terminology has been developed by ITTO (2002).

Box D. Definitions of Forest Improvement

FAO 2000a (FRA 2000 Main Report)
Forest improvement. Changes within the forest which positively affect the structure or function of the stand or site, and thereby increase the capacity to supply products and/or services.
ITTO 2002
(Forest) Rehabilitation. A management strategy applied in degraded forest lands that aims at re-establishing site productivity and protective functions and many of the ecological services provided by a functional forest or woodland ecosystem.
(Forest) Restoration. A management strategy applied in degraded primary forest areas. Forest restoration aims to enhance and accelerate natural processes of forest regeneration in order to regain the elastic capacity of the forest ecosystem.

The FRA definition refers to changes in the capacity of the forest to supply products and/or services. The optional approaches to capture it are discussed in relation to forest degradation (see Ch. 4.5).

The concepts of forest rehabilitation and forest restoration were developed by ITTO (2002) as a complement to their definitions of degraded forest land and degraded primary forest areas. However, as discussed above (cf. Section 3), the term 'degraded forest land' is not compatible with other international definition frameworks such as the FRA and UNFCCC, and it is doubtful, whether harmonization should be attempted.

Forest restoration applies distinctly only to degraded primary forest areas, and it is therefore a much more restricted term than FRA's forest improvement, which applies to all forests. Further, forest restoration sets a specific target, regaining the elastic capacity of the forest ecosystem, whereas FRA's forest improvement is based on a continuum of positive changes in forest condition. One

possible approach to harmonization is to incorporate forest restoration in the FRA scheme by referring to it as one of the means of forest improvement.

A parallel concept to forest improvement is stand improvement, which refers to forest improvement targeted at wood production at the stand level. Development and introduction of accepted forestry terminology of stand improvement could be considered as the activity is part of practical forest management.

5. Forest Fragmentation

Forest fragmentation is a special, and commonly encountered case of forest degradation. However, finding an agreement on a common definition has proved difficult. The only international process proposing a definition of forest fragmentation is CBD.

Box E. Definition of Forest Fragmentation

UNEP/CBD/SBSTTA 2001

Forest fragmentation. Forest fragmentation refers to any process that results in the conversion of formerly continuous forest into patches of forest separated by non-forested lands.

According to the CBD definition, fragmentation occurs only if forest patches are separated by non-forested lands. Forest can be divided into smaller blocks due to a variety of reasons, either by roads, clearing for agriculture, urbanization, or other human development. The CBD definition applies to a case where forest is fragmented by agricultural or urban development, but an other common case of fragmentation is a forested landscape composed of a mosaic of mature and regenerating stands that results from forest management for wood production. Incorporation of this feature in the definition could be considered.

The definition also lacks guidance regarding scale. The purpose is to study habitats for different species at different scales, and this varies from species to species. One option would be to refer to multiple scales.

Regarding harmonization, one possible approach is to include fragmentation as one indicator in a composite index measuring the level of degradation. On the other hand, the cost factor may be significant, since there are no agreed and established methods of measuring fragmentation as yet. A variety of indicators have been used in the past to assess fragmentation, such as changes over time in edge to interior ratio, parcel size, proximity to development, percentage of forest cover, etc. However, for any one of the indicators, the apparent degree of fragmentation is highly dependent upon the definition of forest, the scale at which forests are mapped, and the scale at which fragmentation is measured.

6. Directly and Indirectly Human-induced Changes

The terms directly and indirectly human induced changes were introduced in the Kyoto Protocol. The basic approach in the Kyoto Protocol is that only changes that are directly human induced will enter carbon accounting. Of the seven change process defined by FAO, only afforestation and reforestation are entirely 'directly human-induced'. The rest may be triggered either by humans or by natural causes[20] (Table C).

However, the terms have not been defined in more detailed manner, and in some instances there are difficulties to determine, how to distinguish (i) human induced changes from natural changes, and (ii) directly human induced changes from indirectly induced changes.

Table C. Human Activities as Triggering Factor of Forest Change

Change Process	'Human-inducedness'	Remarks
Deforestation	Often	Large-scale natural damage such as fire in extreme climatic conditions may sometimes cause long-term loss of forest cover
Afforestation	Always	By definition a 'human-induced' activity
Natural expansion of forests	Seldom	May, however, be 'human-induced', if e.g. a land area is deliberately left undeveloped in order to allow natural expansion of forest
Reforestation	Always	By definition a 'human-induced' activity
Natural regeneration	Sometimes	Natural regeneration after final felling may be assisted by human intervention
Degradation	Often	Large-scale natural damage may cause degradation
Improvement	Always	Management interventions typically influence natural development in order to accelerate forest growth, water catchment or other functions

Source: Puustjärvi & Simula 2002

In a few cases, the distinction may be clear and the triggering factor can be easily singled out. For instance, direct human-induced deforestation and permanent forest loss due to other causes (e.g. due to large-scale fire or extreme climatic conditions) can probably be distinguished with reasonable accuracy. The Marrakesh Accords cites changes that result from carbon dioxide fertilization and nitrogen deposition as examples of indirectly human-induced effects. The link is known to exist, even though the impact should probably be estimated based on theoretical models.

However, a number of other less clear cases can be identified. For instance, an immediate cause of storm damage is natural, but the underlying reason may be excessive thinning, which increased the stand's exposure to effects of strong wind, or no thinnings, which resulted in excessive h/dbh ratios

[20] As the world's forests have hundreds of millions of dwellers, there is also the philosophical issue whether their activities, often as an essential part of relatively stable ecosystems, should be considered 'human induced' in this context.

and instability of individual trees. Damage caused by landslides may be traced back to removal of forest cover in higher altitudes.

It is possible that the concept will be subject to abuse. It may create a perverse incentive to gain credit for positive changes that happen naturally, and to avoid discredit for negative developments by claiming that they are natural changes, even though the triggering event may have been human action. For instance, it is unclear what level of assistance of natural regeneration is required to be considered reforestation. In favorable conditions, no assistance may be necessary, but a nominal effort may be made to ensure gain of credit. A conceptually more complex case arises when assistance to natural regeneration may not be motivated by a need to ensure the establishment of a tree stand, but by a wish to ensure a particular species composition. This would usually be termed reforestation, even though the outcome in terms of carbon sequestration is not necessarily any different from that achieved by unassisted natural regeneration.

It would be theoretically correct to distinguish between effects that are directly or indirectly human-induced, or attributable to natural causes, but it may be difficult to carry out in practice. One conceivable approach is to limit the focus of such efforts by identifying effects that can be expected to be significant and/or that can be measured with a reasonable effort. They would constitute priority areas for development of definitions and practical methods of monitoring.

ANNEX 2

DEFINITIONS OF FOREST AND RELATED LAND USE CLASSIFICATIONS AND FOREST CHANGE PROCESSES

Applied by the FAO Global Forest Resources Assessment (FRA) as at the end of the FRA 2000 project (FAO 2000a)

Forest. Forest includes natural forests and forest plantations. It is used to refer to land with a tree canopy cover of more than 10 percent and area of more than 0.5 ha. Forests are determined both by the presence of trees and the absence of other predominant land uses. The trees should be able to reach a minimum height of 5 m. Young stands that have not yet but are expected to reach a crown density of 10 percent and tree height of 5 m are included under forest, as are temporarily unstocked areas. The term includes forests used for purposes of production, protection, multiple-use or conservation (i.e. forest in national parks, nature reserves and other protected areas), as well as forest stands on agricultural lands (e.g. windbreaks and shelterbelts of trees with a width of more than 20 m), and rubberwood plantations and cork oak stands. The term specifically excludes stands of trees established primarily for agricultural production, for example fruit tree plantations. It also excludes trees planted in agroforestry systems.

Natural forest. A forest composed of indigenous trees and not classified as forest plantation.

Forest plantation. A forest established by planting or/and seeding in the process of afforestation or reforestation. It consists of introduced species or, in some cases, indigenous species.

Other wooded land. Land that has either a crown cover (or equivalent stocking level) of 5 to10 percent of trees able to reach a height of 5 m at maturity; or a crown cover (or equivalent stocking level) of more than 10 percent of trees not able to reach a height of 5 m at maturity; or with shrub or bush cover of more than 10 percent.

Afforestation. Establishment of forest plantations on land that, until then, was not classified as forest. Implies a transformation from non-forest to forest.

Natural expansion of forest. Expansion of forests through natural succession on land that, until then, was under another land use (e.g. forest succession on land previously used for agriculture). Implies a transformation from non-forest to forest.

Reforestation. Establishment of forest plantations on temporarily unstocked lands that are considered as forest.

Natural regeneration on forest lands. Natural succession of forest on temporarily unstocked lands that are considered as forest.

Deforestation. The conversion of forest to another land use *or* the long-term reduction of the tree canopy cover below the minimum 10 percent threshold (see definition of forest and the following explanatory note).

Explanatory note: Deforestation implies the long-term or permanent loss of forest cover and implies transformation into another land use. Such a loss can only be caused and maintained by a continued human-induced or natural perturbation. Deforestation includes areas of forest converted to agriculture, pasture, water reservoirs and urban areas. The term specifically excludes areas where the trees have been removed as a result of harvesting or logging, and where the forest is expected to regenerate naturally or with the aid of silvicultural measures. Unless logging is followed by the clearing of the remaining logged-over forest for the introduction of alternative land uses, or the maintenance of the clearings through continued disturbance, forests commonly regenerate, although often to a different, secondary condition. In areas of shifting agriculture, forest, forest fallow and agricultural lands appear in a dynamic pattern where deforestation and the return of forest occur frequently in small patches. To simplify reporting of such areas, the net change over a larger area is typically used. Deforestation also includes areas where, for example, the impact of disturbance, overutilization or changing environmental conditions affects the forest to an extent that it cannot sustain a tree cover above the 10 percent threshold.

Forest degradation. Changes within the forest which negatively affect the structure or function of the stand or site, and thereby lower the capacity to supply products and/or services.

Forest improvement. Changes within the forest which positively affect the structure or function of the stand or site, and thereby increase the capacity to supply products and/or services.

ANNEX 3

FOREST BIODIVERSITY DEFINITIONS UNDER THE CBD PROCESS

Indicative definitions taken from the Report of the ad hoc Technical Expert Group on Forest Biological Diversity (versions available on 17 September 2002 at *http://www.biodiv.org/programmes/areas/forest/definitions.asp*)

Terms	Definitions
Forest	The group considers the FAO definition of a forest as the basic one (FAO, 1998; FRA 2000), but acknowledge that many other useful definitions of "forest" exist in published form. The fact that "forest" has been defined in many ways is a reflection of the diversity of forests and forest ecosystems in the world and of the diversity of human approaches to forests.In this document, a forest is a land area of more than 0.5 ha, with a tree canopy cover of more than 10%, which is not primarily under agricultural or other specific non-forest land use.In the case of young forests or regions where tree growth is climatically suppressed, the trees should be capable of reaching a height of 5 m *in situ*, and of meeting the canopy cover requirement.
Forest biome	This reflects the ecological and physiognomic characteristics of the vegetation and broadly corresponds to climatic regions of the Earth. In this document, it is used in reference to boreal, temperate and tropical forest biomes.
Forest type	Within biomes, a forest type is a group of forest ecosystems of generally similar composition that can be readily differentiated from other such groups by their tree and undercanopy species composition, productivity and/or crown closure.
Forest ecosystem	A forest ecosystem can be defined at a range of scales.It is a dynamic complex of plant, animal and micro-organism communities and their abiotic environment interacting as a functional unit, where trees are a key component of the system. Humans, with their cultural, economic and environmental needs are an integral part of many forest ecosystems.
Forest biological diversity	Forest biological diversity means the variability among forest living organisms and the ecological processes of which they are part; this includes diversity in forests within species, between species and of ecosystems and landscapes.
Primary forest	A primary forest is a forest that has never been logged and has developed following natural disturbances and under natural processes, regardless of its age.It is referred to "direct human disturbance" as the intentional clearing of forest by any means (including fire) to manage or alter them for human use. Also included as primary, are forests that are used inconsequentially by indigenous and local communities living traditional lifestyles relevant for the conservation and sustainable use of biological diversity. In much of Europe, primary forest has a different connotation and refers to an area of forest land which has probably been

Terms	Definitions
	continuously wooded at least throughout historical times (e.g., the last thousand years). It has not been completely cleared or converted to another land use for any period of time. However traditional human disturbances such as patch felling for shifting cultivation, coppicing, burning and also, more recently, selective/partial logging may have occurred, as well as natural disturbances. The present cover is normally relatively close to the natural composition and has arisen (predominantly) through natural regeneration, but planted stands can also be found.However, the suggested definition above would include other forests, such as secondary forests.
Secondary forest	A secondary forest is a forest that has been logged and has recovered naturally or artificially.Not all secondary forests provide the same value to sustaining biological diversity, or goods and services, as did primary forest in the same location.In Europe, secondary forest is forest land where there has been a period of complete clearance by humans with or without a period of conversion to another land use. Forest cover has regenerated naturally or artificially through planting.
Old growth forest	Old growth forest stands are stands in primary or secondary forests that have developed the structures and species normally associated with old primary forest of that type have sufficiently accumulated to act as a forest ecosystem distinct from any younger age class.
Plantation forest	A plantation forest may be afforested land or a secondary forest established by planting or direct seeding.A gradient exists among plantation forests from even-aged, single species monocultures of exotic species with a fibre production objective to mixed species, native to the site with both fibre and biodiversity objectives. This gradient will probably also reflect the capability of the plantation forest to maintain "normal" local biological diversity.
Degraded forest	A degraded forest is a secondary forest that has lost, through human activities, the structure, function, species composition or productivity normally associated with a natural forest type expected on that site. Hence, a degraded forest delivers a reduced supply of goods and services from the given site and maintains only limited biological diversity. Biological diversity of degraded forests includes many non-tree components, which may dominate in the undercanopy vegetation.
Agro-forest	An agro-forest is a complex of treed areas within an area that is broadly characterised as agricultural or as an agro-ecosystem.
Reforestation	Reforestation is the re-growth of forests after a temporary (<10 years.) condition with less than 10% canopy cover due to human-induced or natural perturbations (FAO, FRA 2000).
Afforestation	Afforestation is the conversion from other land uses into forest, or the increase of canopy cover to the 10% defined threshold for forest (FAO, FRA 2000).
Forest fragmentation	Forest fragmentation refers to any process that results in the conversion of formerly continuous forest into patches of forest separated by non-forested lands.

Habitat loss	Habitat loss, used with reference to an individual species, is the permanent conversion of former (forest) habitat to an area where that species can no longer exist, be it still forested or not.
Forest species	A forest species is a species that forms part of a forest ecosystems or is dependent on a forest for part or all of its day-to-day living requirements or for its reproductive requirements. Therefore, an animal species may be considered a forest species even if it does not live most of its life in a forest.
Native species	A native species is one which naturally exists at a given location or in a particular ecosystem, i.e. it has not been moved there by humans.
Endemic species	An endemic species is a native species restricted to a particular geographic region owing to factors such as isolation or in response to soil or climatic conditions.
Alien species	An alien species is a species, sub-species or member of a lower taxon that has been introduced outside its normal past and present distribution; the definition includes the gametes, seeds, eggs, propagules or any other part of such species that might survive and subsequently reproduce (GISP, 2001).
Invasive alien species	An invasive alien species is an alien species which becomes established in natural or semi-natural ecosystems or habitats. It is an agent of change and threatens native biological diversity (IUCN, 2000).

ANNEX 4

ITTO'S FOREST-RELATED DEFINITIONS

as presented in Appendix 9 of ITTO (Draft) Guidelines For The Restoration, Management And Rehabilitation of Degraded and Secondary Tropical Forests (ITTO 2002)

Adaptive management	Process by which people adjust their management strategies to better cope with change, while also maintaining the integrity of their forest management objectives (Wollenberg et al. 1999)
Afforestation	Planted forest on deforested land, or on non-forested land.
Agro forest	A complex of tree areas within an area that is broadly characterized as agricultural or as an agro-ecosystem.
Alien species	A species or a sub-species or lower taxon introduced outside of its normal past and present distribution.
Carbon offset	The result of any action specifically undertaken to prevent the release of, and/or to remove from, carbon dioxide into the atmosphere in order to balance emissions taking place elsewhere.
Biodiversity[21]	A word made up from two words: biological diversity. The variability among living organisms from all sources, including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.
Biological diversity	The variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems (CBD 1992)
Canopy	Simplified, four canopy layers can be distinguished: A-layer containing emergent canopy species, B-layer intermediate canopy species, C-layer containing subcanopy species, and D-layer that comprises the tree regeneration.
Collaborative (forest) management	A working relationship between different stakeholder to manage forest and tree resources.
Degraded forest landscapes	Forest conditions other than those found in primary or managed natural and planted forests. 'Landscape' is defined in this context as a cluster of interacting ecosystem types of forest and other woodland vegetation.
Degraded forest land	Former forest land severely damaged by excessive timber and NWFP harvesting, poor management, repeated fire, grazing or other disturbances and land uses that damaged soil and vegetation to a degree which inhibited or severely delayed forest regrowth after abandonment.

[21] Source: The Convention of Biological Diversity

Degraded primary forest	The initial forest cover of a primary, old-growth or managed forest has been affected by unsustainable, excessive timber and wood exploitation or by such intensity of extraction of non-wood forest products, that its structure, processes, functions and dynamics are altered beyond the elastic capacity of the forest ecosystems.
Elastic capacity of the forest ecosystem	Dynamic forest processes within a range of changing vertical forest structure, species composition and biodiversity, and productivity normally associated with the natural forest type expected at that site.
Endemic species	A species native to, and restricted to, a particular geographical region.
Enrichment	The practice of planting trees or favor natural regeneration within a natural forest, mainly for commercial purposes.
Forest degradation	Long-term reduction of the overall potential supply of benefits from the forest, which include wood, biodiversity and any other product or service.
Forest fallow	The intermediate time between two periods of shifting agriculture. In a functional shifting agricultural system, the fallow period is long enough so that a functional secondary forest stand can develop (>20 years).
Forest fragmentation	Refers to any process that results in the conversion of formerly continuous forest into patches of forest separated by non-forested lands (UNEP/CBD/SBSTTA 2201).
High forest	Generic term used to describe a forest situation close to "climax": primary forest, pristine forest, old-growth forest and managed natural forest under a strict selection system.
Key species	A plant, animal or microbial species which binds together an interactive feedback loop in the trophic and functional networks on an ecosystem[22].
Landscape	A cluster of interacting ecosystem types that occur in a given area.
Managed natural forest	Forest in which sustainable timber and non-wood harvesting (e.g. through integrated harvesting and silvicultural treatments), wildlife management and other uses have resulted in changes of forest structure and species composition. All major goods and service functions are maintained intact.
Modified natural forest	Primary forests managed or exploited for timber, wood and/or non-wood forest products, for wildlife or other purposes. The more intensive the use, the more the structure and composition is altered from that of the primary forests. Two major categories can be distinguished: managed natural forest and degraded forest landscapes.
Native species	A species that occurs naturally in a region.
Natural regeneration[23]	Renewal of trees by self-sown seeds or vegetative means.
Non-wood forest products (NWFP)	All forest products except timber and wood other than timber, including products from trees, plants and animals in the forest area.

[22] Source: Bruenig 1996

[23] Source: Ford-Robinson, cited in Wadsworth (1996)

Nurse species	Nurse species are robust tree and shrub species adapted to colonize site degraded forest areas. They rapidly cover soils, shade out weeds and attract seed-dispersing animals. They are generally strongly light-demanding (pioneer species).
Nutrient cycle	A natural process in which nutrients, mainly minerals, are taken up from the soil and used for plant growth, and then, once the plant dies, are returned to the soil through decomposition processes.
Old-growth forest	Is a primary or a secondary forest which has achieved an age at which structures and species normally associated with old primary forests of that type have sufficiently accumulated to act as a forest ecosystem distinct from any younger age class (UNEP/CBD/SBSTTA 2001).
Participatory forest management	Attempts to secure and improve the livelihoods of local people dependent on forest resources (Hobley 1996), by involving all key stakeholders in the process of forest management, understanding their needs and situations, allowing them to influence decisions and receive benefits, and increasing transparency (DFID 1996). Participatory Forest Management is used as an umbrella term to include shared forest management, joint forest management, collaborative forest management and community forestry.
Permanent Forest Estate[24]	Land, whether public or private, secured by law and kept under permanent forest cover. This includes land for the production of timber and other forest products, for the protection of soil and water, and for the conservation of biological diversity, as well as land intended to fulfill a combination of these functions.
Pioneer species	Heavily light-demanding and short-lived species that can rapidly invade large canopy gaps in disturbed natural forests and colonize open land.
Planted forest	Forest stand that has been artificially established by planting or seeding.
Reclamation	A management strategy aiming at recovering productivity at a degraded site using mostly exotic tree species.
Reforestation	re-establishment of trees and understorey plants at a site immediately after removal of natural forest cover.
(Forest) Rehabilitation	A management strategy applied in degraded forest lands that aims at re-establishing site productivity and protective functions and many of the ecological services provided by a functional forest or woodland ecosystem.
Residual stand	Forest that remains after harvesting and extraction.
(Forest) Restoration	A management strategy applied in degraded primary forest areas. Forest restoration aims to enhance and accelerate natural processes of forest regeneration in order to regain the elastic capacity of the forest ecosystem.
Secondary forest	Woody vegetation re-growing on land that was totally (or at least 90%) cleared of its original forest vegetation.

[24] Source: ITTO

Silviculture	The art and science of producing and tending forests by manipulating its establishment, species composition, structure and dynamic to fulfill the management objectives.
Stakeholders	Any individuals or groups who are directly or indirectly affected by, or interested in a given resource (in this case forest) and that have a stake in it.
Shifting agriculture	Used here as a synonym for shifting or swidden cultivation, or "culture itinérante" in French. The burning and cleaning of forest vegetation and subsequent plantation of agricultural crops for a short period of time (1 to 5 years) followed by abandonment.
Succession	Progressive change in species composition and forest structure caused by natural processes over time.
Sustained yield	Production of forest products in perpetuity, ensuring that the harvesting rate does not exceed the rate of replacement (natural and/or artificial) in a given area over the long term. Sustained yield is a part of the concept of sustainability in forestry.
Tenure	Socially defined agreements held by individuals or groups, recognized by legal statutes or customary practice, regarding the bundle of rights and duties of ownership, holding, access and/or usage of a particular land unit or the associated resources there within (such as individual trees, plant species, water, minerals, etc.).
User rights	Rights for the use of forest resources that can be defined by local custom, agreements, or prescribed by other entities holding access rights. These rights may restrict the use of particular resources to specific harvesting levels or specific extraction techniques.
Yield regulation	The techniques for calculating and controlling the harvesting level to ensure that sustained yield is respected.

ANNEX 5

DEFINITIONS RELATING TO LAND USE, LAND-USE CHANGE AND FORESTRY ACTIVITIES UNDER THE KYOTO PROTOCOL

as presented in Annex of Report Of The Conference Of The Parties On Its Seventh Session, Held At Marrakesh From 29 October To 10 November 2001, Addendum Part Two: Action Taken By The Conference Of The Parties Volume I (UNFCCC 2001)

For land use, land-use change and forestry activities under Article 3 [of the Kyoto Protocol], paragraphs 3 and 4, the following definitions shall apply:

(a) "Forest" is a minimum area of land of 0.05-1.0 hectares with tree crown cover (or equivalent stocking level) of more than 10-30 per cent with trees with the potential to reach a minimum height of 2-5 metres at maturity *in situ*. A forest may consist either of closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground or open forest. Young natural stands and all plantations which have yet to reach a crown density of 10-30 per cent or tree height of 2-5 metres are included under forest, as are areas normally forming part of the forest area which are temporarily unstocked as a result of human intervention such as harvesting or natural causes but which are expected to revert to forest.

(b) "Afforestation" is the direct human-induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding and/or the human-induced promotion of natural seed sources;

(c) "Reforestation" is the direct human-induced conversion of non-forested land to forested land through planting, seeding and/or the human-induced promotion of natural seed sources, on land that was forested but that has been converted to non-forested land. For the first commitment period, reforestation activities will be limited to reforestation occurring on those lands that did not contain forest on 31 December 1989;

(d) "Deforestation" is the direct human-induced conversion of forested land to nonforested land;

(e) "Revegetation" is a direct human-induced activity to increase carbon stocks on sites through the establishment of vegetation that covers a minimum area of 0.05 hectares and does not meet the definitions of afforestation and reforestation contained here;

(f) "Forest management" is a system of practices for stewardship and use of forest land aimed at fulfilling relevant ecological (including biological diversity), economic and social functions of the forest in a sustainable manner;

(g) "Cropland management" is the system of practices on land on which agricultural crops are grown and on land that is set aside or temporarily not being used for crop production;

(h) "Grazing land management" is the system of practices on land used for livestock production aimed at manipulating the amount and type of vegetation and livestock produced.

ANNEX I
LIST OF PARTICIPANTS

List of Participants

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Ouk Syphan Deputy Director General Department of Forestry and Wildlife No. 40 Bvd. Preah Norodom Phnom Penh Cambodia Telephone: (855 23) 986 460 Fax: (855 23) 986 460 E-mail: dfw.syphan@bigpond.com.kh or o.syphan@camintel.com	Pande Sudhir Ex-Director General of Forests, Government of India Personal Capacity CII-149 Satya Marg New Dehli 110021 India Telephone: (91 11) 687 8707 Fax: (91 11) 436 3957 E-mail: sudhirpande@hotmail.com

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ANNEX II
MEETING AGENDA

Meeting Agenda

Wednesday, 11 September 2002

08.00 – 09.00	Registration of participants	
09.00 – 09.30	Statements on the process by:	
	FAO	M. Hosny El-Lakany
	IPCC	G. Love
	IUFRO	H. Schmutzenhofer
	CIFOR	R. Nasi
	UNEP	J. Mackensen
09.30 – 09.45	Stocktaking, objectives, scope, expected results of meeting and further steps	W. Killmann
09.45 – 10.15	Coffee break	
10.15 – 10.25	Review of activities of UNFCCC during trial period	D. Tirpak
	Latest developments in CDM, IPCC and FRA processes of relevance to meeting	D. Schoene P. Holmgren
10.25 – 10.45	Introduction into Draft Analytical Framework	M. Simula
10.45 – 11.00	Tasks of Working Groups	M. Simula
11.00 – 12.00	Start of group work	
12.00 – 13.30	Lunch	
13.30 – 15.00	Group work	
15.00 – 15.30	Coffee break	
15.30 – 17.30	Group work	
20.00	Dinner hosted by Dr M. Hosny El-Lakany, ADG FO	

Thursday, 12 September 2002

08.30 – 09.00	Review of progress of group work (plenary)	M. Simula
09:00 – 10.00	Group work	
10.00 – 10.30	Coffee break	
10.30 – 12.00	Group work	
12.00 – 13.30	Lunch	
13.30 – 15.00	Group work	
15.00 – 15.30	Coffee break	
15.30 – 17.30	Stocktaking and interchange (subplenaries)	

Friday, 13 September

08.30 – 10.00	Group work	
10.00 – 10.30	Coffee break	
10.30 – 12.00	Presentation and discussion of group work (plenary)	M. Simula
12.00 – 13.30	Lunch	
13.30 – 15.00	Presentation and discussion of group work	M. Simula
15.00 – 15.30	Coffee break	
15.30 – 16.00	Results and further steps	M. Simula
16.45 – 17.00	Closing session	FAO

ANNEX III
OPENING SPEECHES

M. Hosny El-Lakany
Assistant Director-General
FAO Forestry Department

Ladies and gentlemen, colleagues, good morning.

It is a great pleasure for me to welcome you on behalf of Mr Jacques Diouf, Director-General of FAO, and on behalf of my colleague Mr Jacques Eckebil, Assistant Director-General of the FAO Sustainable Development Department, and of all the staff of the Forestry and Sustainable Development departments of our Organization.

This is the second meeting on harmonizing forest-related definitions for use by various stakeholders, building upon the discussions and results of the first meeting, which took place here in Rome earlier this year. During the next three days you will discuss and detail a draft analytical framework on some core definitions.

The need for this process was reiterated this year at the second session of the United Nations Forum on Forests (UNFF), the Sixth Conference of Parties of the Convention on Biological Diversity (CBD), and the sixteenth session of the Subsidiary Body of Scientific and Technological Advice of the United Nations Framework Convention on Climate Change (UNFCCC).

We are very pleased to note that this meeting is the result of a collaborative effort between FAO, the Intergovernmental Panel on Climate Change (IPCC), the Centre for International Forestry Research (CIFOR), the International Union of Forest Research Organizations (IUFRO), and our sister Organization, the United Nations Environment Programme (UNEP). We are glad to see their representatives here, and also the representatives of three important post-UNCED conventions – CBD, UNFCCC and the United Nations Convention to Combat Desertification (UNCCD). I also recognize and welcome distinguished colleagues conversant with the subject, most of whom have been with us already in January this year. The high level of experts gathered here today puts the process in an excellent position to succeed.

We are aware that this process on harmonizing forest-related definitions is closely linked to the Kotka process, led by FAO, to the UNFCCC process on developing definitions for afforestation and reforestation under article 12 of the Kyoto Protocol, and to IPCC-led processes, such as that on Good Practice Guidance and the IPCC Task 2 process on Definitions and Methodological Options to Inventory Emissions from Direct Human-induced Degradation of Forests and Devegetation of Other Vegetation Types. I am glad to see that experts involved in these processes are among the participants today; this will enable us to make use of synergies and avoid duplication of work.

This definition process is also closely linked to other activities of the Collaborative Partnership on Forests (CPF) in assisting UNFF, as stated in the Plan of Action of the World Summit on Sustainable Development (WSSD), concluded last week, e.g. the work of the CPF Task Force on Harmonizing and Streamlining Forest-related Reporting. As chairperson of the CPF, I am therefore glad to realize that attendance at this meeting includes representatives of nearly all CPF members and colleagues dealing with the CPF programme, which indicates the importance given to the definition work in the UNFF process. This meeting could also be regarded as the first post-WSSD activity.

The discussion on forest-related definitions may touch sensitive issues, and this subject certainly has a political profile. Please let us keep in mind that our mandate is a purely technical one. You have been invited on the basis of your technical expertise in this field.

We expect the process to come up with a draft analytical framework document on forest-related definitions, and suggestions on how to proceed in this process. It is expected that the documents will be submitted to the IPCC, the Subsidiary Bodies of the UNFCCC, CBD and UNCCD, as well as to Member Countries of the United Nations Forum on Forests and to the FAO Committee on Forestry, for their consideration.

My colleagues will address the objectives and mechanics of the meeting in more detail. Allow me to wish you a fruitful, interesting and challenging meeting, and to all of us success in this endeavour.

Thank you.

Geoff Love
Secretariat
Intergovernmental Panel on Climate Change

Distinguished guests, ladies and gentlemen, colleagues.

Good morning. Let me start by saying how pleased I am to be here in this beautiful city this morning.

I am here because the Chairman of the Intergovernmental Panel on Climate Change (IPCC), Dr Rajendra Pachauri unfortunately cannot be here, and so I am standing in for him.

For those of you unfamiliar with the IPCC, let me give you a little background. The IPCC is jointly sponsored by the World Meteorological Organization (WMO) and the United Nations Environment Program (UNEP). Its role is to assess scientific, technological and socio-economic information on climate change. It does not undertake, or sponsor research nor does it implement programmes to deal with climate change.

The IPCC is probably best known for its assessment reports, with the latest, the Third Assessment Report, comprising three large volumes, having been completed in 2001. The IPCC also undertakes shorter Special Reports and Technical Papers on specific topics of interest to government decision-makers.

The IPCC's interest in this meeting arises because of the program of work being undertaken by its Task Force on Greenhouse Gas Inventories. At the request of the UNFCCC the IPCC is very active in developing guidance to assist countries in the development of their inventories of carbon – not only the carbon in their greenhouse gas emissions but also in their forests and other biomass. We see this inventories work as becoming increasingly important.

The IPCC is particularly pleased to be able to assist in the sponsorship of this meeting for a number of reasons. Firstly we recognise that in matters such as developing widely accepted and used definitions of such terms as "forest" we need to consult those with most experience in the area - and these experts are not in the community of scientists who have worked most closely with the IPCC in the past. These experts are known to FAO and so it is excellent to be able to cooperate with FAO to work with them.

Secondly, the IPCC recognises that climate change is being monitored in the atmosphere, the oceans and on the land surface. Paradoxically, the integrated global database for monitoring climate change is most poor for the land surface. We hope that in working with FAO to standardise terms related to the definition of the earth's biomass we can, in the long run, improve the global monitoring of the vegetation systems that are so important in carbon sequestration.

So, let me conclude this morning by saying that the IPCC recognises that to understand and make the best decisions relating to climate change, the analysis of it must be a broad-based, multi-disciplinary one. The IPCC sees meetings such as this as very important in establishing the multi-disciplinary dialogue and so is very pleased to be here.

Thank you.

Heinrich Schmutzenhofer
IUFRO Executive Secretary
International Union of Forest Research Organizations

Dear colleagues, ladies and gentlemen,

It is with great pleasure and satisfaction that I am able to participate in this second Expert Meeting on Harmonizing Forest-related Definitions for Use by Various Stakeholders. The International Union of Forest Research Organizations (IUFRO), which celebrates its 110th anniversary this October, has developed from a home of standards to a modern service centre. This shows that the traditional mandate of IUFRO in standardization, besides taking account of the present needs also evolves towards harmonization, compatibility and better access to information.

In this sense, IUFRO is proud to cooperate in this multi-stakeholder initiative and has made every effort during these past six months to promote and make known the work of this process:

This has been done:

- within the IUFRO network, the IUFRO Board, and in meetings organized by IUFRO member organizations, the most recent one being: the European Regional Conference on Urban Forestry, in Copenhagen in late August;
- and outside IUFRO – by co-organizing, for example with FAO and CIFOR a Side Event on Terminology and Definitions at the UNFF2 Conference in New York in March 2002, and;
- by placing information about this process at the IUFRO Website (under the section: harmonization process) and by linking to the Proceedings and documents of the first Expert Meeting, and finally;
- by distributing the working draft document to selected IUFRO representatives; their comments and reactions will be submitted through the IUFRO representatives at this meeting.

We are also interested to learn from this cooperation of many different organizations, countries and backgrounds. We are eager to exchange our views and experiences. It will not always be easy to come to a compromise, but it will prove useful to learn more about the differences in forest-related concepts as used by the International Processes and Organizations.

As it was reported in the first meeting, IUFRO, with the financial assistance of the Austrian National Bank (OeNB) is establishing a multilingual glossary on carbon in forests. This glossary work is being realised in close cooperation with IUFRO experts and other experts in this field in the four official IUFRO languages. We will be glad to send the draft version to all participants of this meeting, for review as soon as it is available. For the terms which are treated in this process and framework, we will certainly follow closely your discussions and results. For other terms, we will be glad to count on your cooperation.

In this sense IUFRO's traditional role is to contribute with its expertise, but also to learn from the International Processes and Conventions. We see ourselves as facilitator and promoter through IUFRO's network of more than 15,000 scientists in almost 700 Member Organizations and as a bridge providing access to the definitions, not only in English but also in other languages.

I refer to the traditional cooperation of FAO and IUFRO in the field of terminology. Already in 1971 the Joint FAO/IUFRO Committee on Forestry Bibliography and Terminology published the English language version edited by F.C. Ford-Robertson (Oxford), the Multilingual Forestry Terminology Series No. 1. Translations into the French and Italian languages followed thereafter.

IUFRO emphasizes the multilingual aspect of forest terminology, and will continue to play its role in the process of bringing the knowledge and outcome of this series of meetings to its scientists and improve the multilingual understanding. Again we would like to place our infrastructure at the service of this process and present the final results and outputs in IUFRO's multilingual terminology database SilvaTerm.

Before I come to the end, I would like to sincerely thank FAO for being our host and Markku Simula and his collaborators for drafting the background document for this Expert Meeting. It will give us an excellent basis for the discussions.

May I finally convey to you the best wishes from the IUFRO President, Professor Risto Seppala and the Board for successful deliberations for our better mutual understanding.

Thank you.

Robert Nasi
Program Leader, Biodiversity
Centre for International Forestry Research (CIFOR)

Dear friends and colleagues,

It is really a great pleasure for me to here with you in Rome at FAO's headquarters for this Second Expert Meeting on Harmonizing Forest-related Definitions. I have first to convey the best wishes of success from our Director General, Dr David Kaimowitz and together with his best wishes, the regrets of our former Director of Research, Dr Ken MacDicken who attended the previous meeting in January 2002 but has left CIFOR for a new working experience in August 2002 and is therefore not able to be with us today.

It is a great pleasure because the issue of forest definition has been in my mind for several years and also because this is my first time in Rome and in FAO Headquarters. Now I can see in their "natural" environment all the FAO colleagues with whom I have been working during the last 20 years in Asia, Africa and the Pacific.

It is also a great challenge for me to replace Ken MacDicken but with your help and active participation, I am sure that this meeting will be successful and will add an important stone to the international debate on forests. I wish to reiterate CIFOR's commitment with this process. I have been interested by the issue of forest definitions for a long time and, I must admit, sometimes a strong critic of some of these definitions or of the multiplicity of these. This initiative of the FAO with the support of IPCC, CIFOR, IUFRO and UNEP appears therefore highly relevant to me and I am really looking forward to work with you all during the coming days.

I must also stress the importance of a genuine participation and commitment from you all. Without this, harmonization will not occur.

Thank you very much

Jens Mackensen
Division of Policy Development and Law, Nairobi
United Nations Environment Programme

UNEP likes to thank FAO, in particular Assistant General Mr. Hosny El-Lakany and Mr. Killmann, as well as the fellow co-sponsors, IPCC, CIFOR, IUFRO and ITTO, for offering UNEP co-sponsorship for these expert consultation on the harmonization of forest-related definitions for various stakeholders. I would like – on behalf of UNEP, namely Mr. Bakary Kante, Director of UNEP's Division for Policy Development and Law – to welcome all experts to this second meeting. It is a pleasure to join this expert consultation and to continue to actively participate in it.

Why is the harmonization of forest-related definitions of importance to UNEP?

Firstly because UNEP, as the environmental UN body, is mandated to promote synergies between key environmental themes, including forests, and to relate them development issues. It is an essential first step towards the development of synergies to find the common base for jointly used terminology, especially on such an important, broad and cross-cutting issue like forestry.

Secondly, UNEP acknowledges that the harmonization of forest-related definitions is not for academic reasons, but serves the purpose of reducing the reporting requirements of countries on forest matters. This is a most appealing objective and should be strengthened throughout the process to contribute to more cost-efficient implementation of relevant international environmental agreements as well as in support to the UN Forum on Forest and the Collaborative Partnership on Forests, of which UNEP is a member.

Harmonising and not necessarily standardising forest definitions is also about bridging different concepts such as the forest production orientated approach and an environment, namely biodiversity focused perspective. Linking both these concepts closer to each other – moving from both directions – is a commendable and necessary objective.

The successful co-operation between UNEP and FAO on global land cover classification and assessment links directly to harmonising forest definitions and should be reflected accordingly in this process and the subsequent implementation.

Finally, UNEP together with IUFRO is mandated by IPF/IFF to especially address the need of countries with low forest cover to adequately integrate their specific requirements into the international process on forests and forest management. UNEP therefore welcomes the opportunity to relate the issue of low forest cover, especially in relation to the conditions in drylands, to this forum for achieving a closer link to other relevant processes such as the UNCBD, UNFCCC, UNCCD and the Forest Resource Assessment.

I would like to thank you and wish this expert meeting much success!

ANNEX IV
PRESENTATIONS

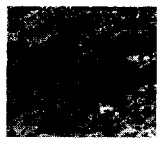
Wulf Killmann
Director, Forest Products Division, FAO

Stocktaking, Objectives, Scope, Expected Result, Mechanics of Meeting

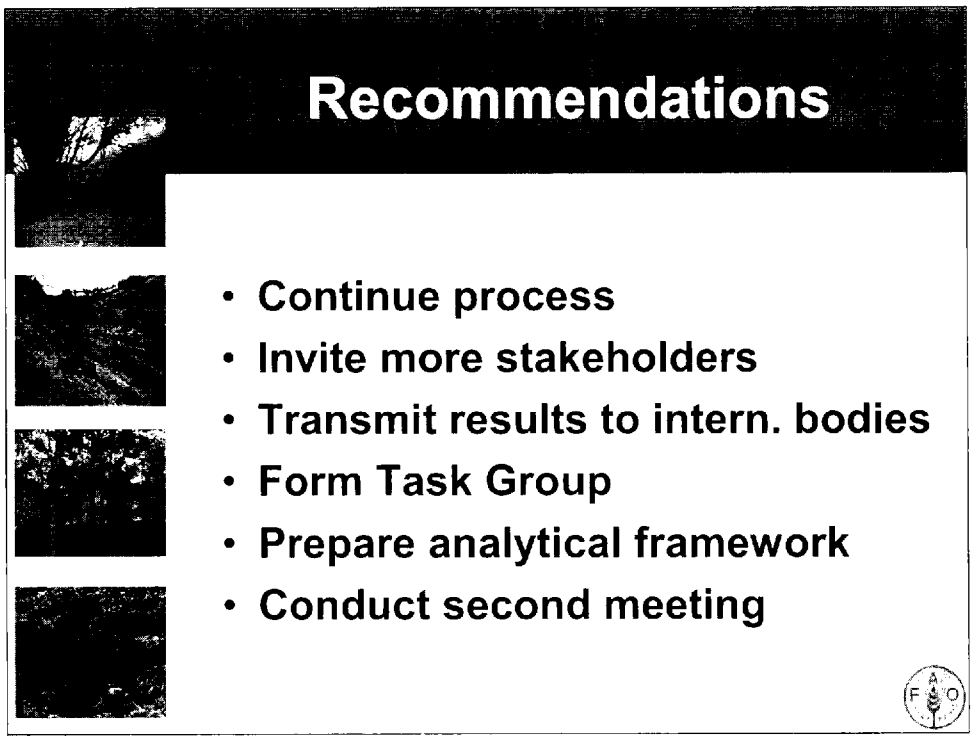
Wulf Killmann

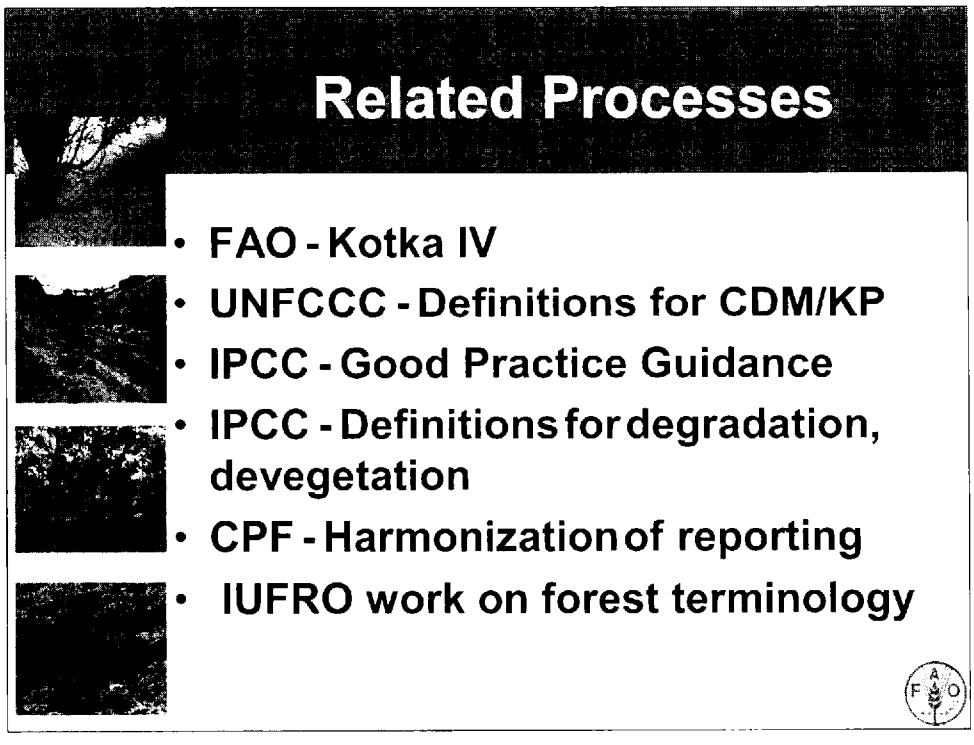
Second Expert Meeting on Harmonizing Forest-related Definitions
Rome, 11-13 September 2002

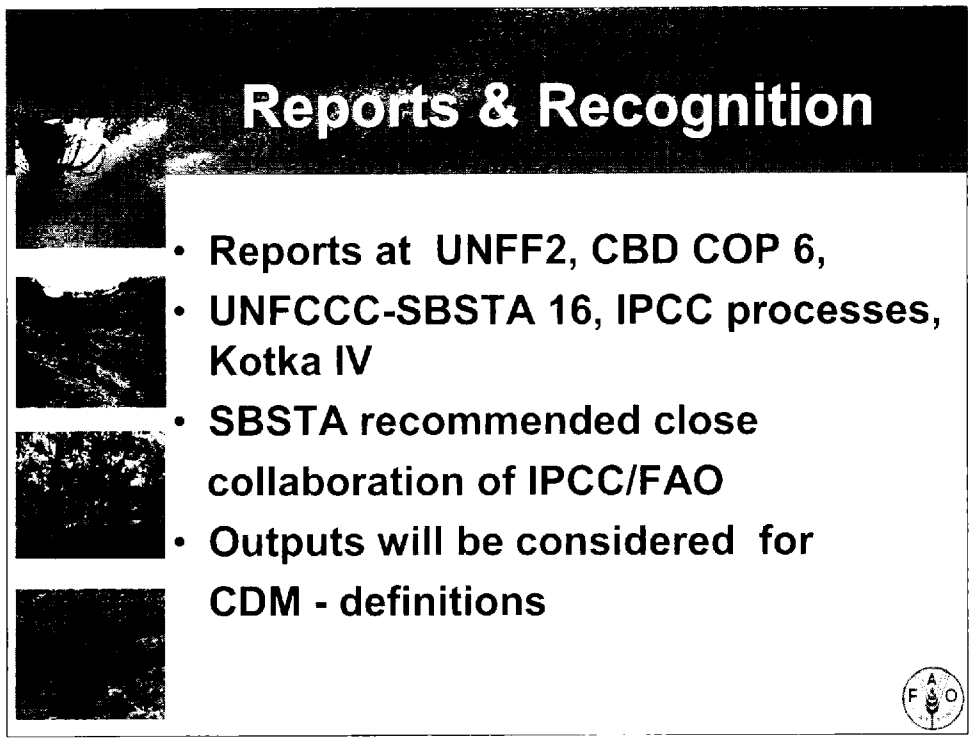
Recommendations first meeting

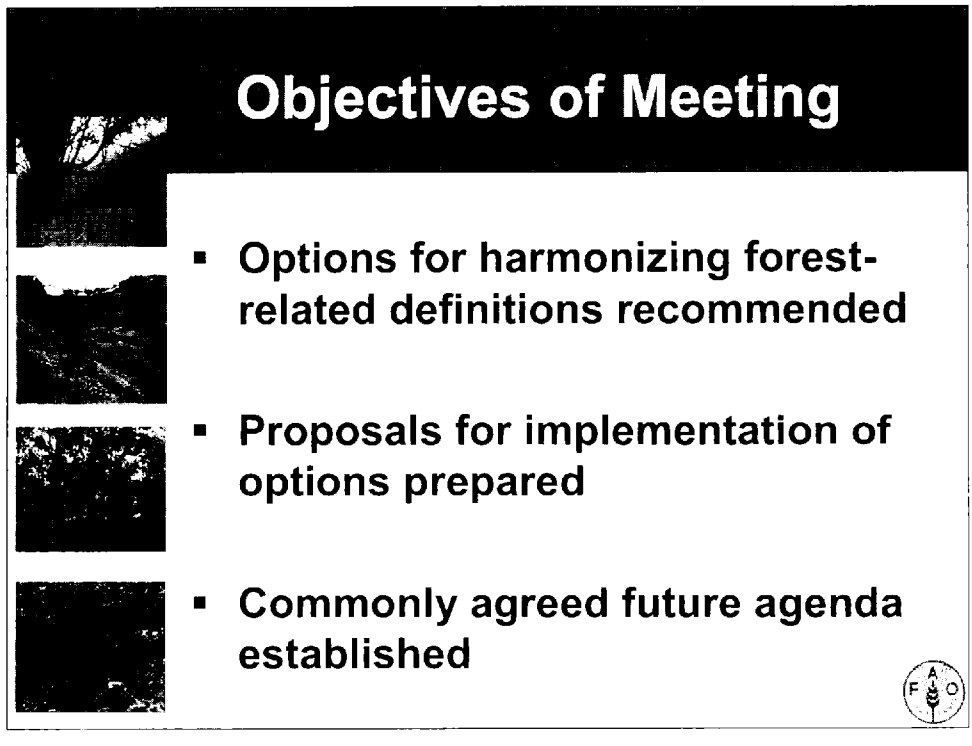


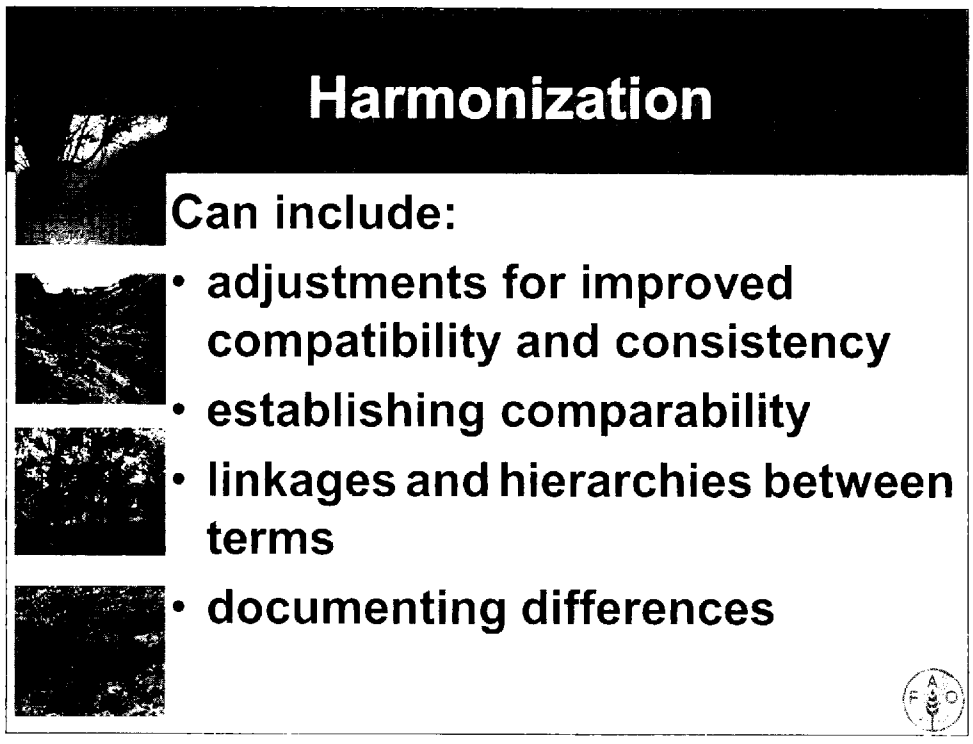
- **Parties KP drop 50 years condition for afforestation**
- **FAO**
  - **Make FRA 2000 definitions public**
  - **Expand FRA-def for afforestation**
- **CBD to use FRA - afforestation/reforestation**

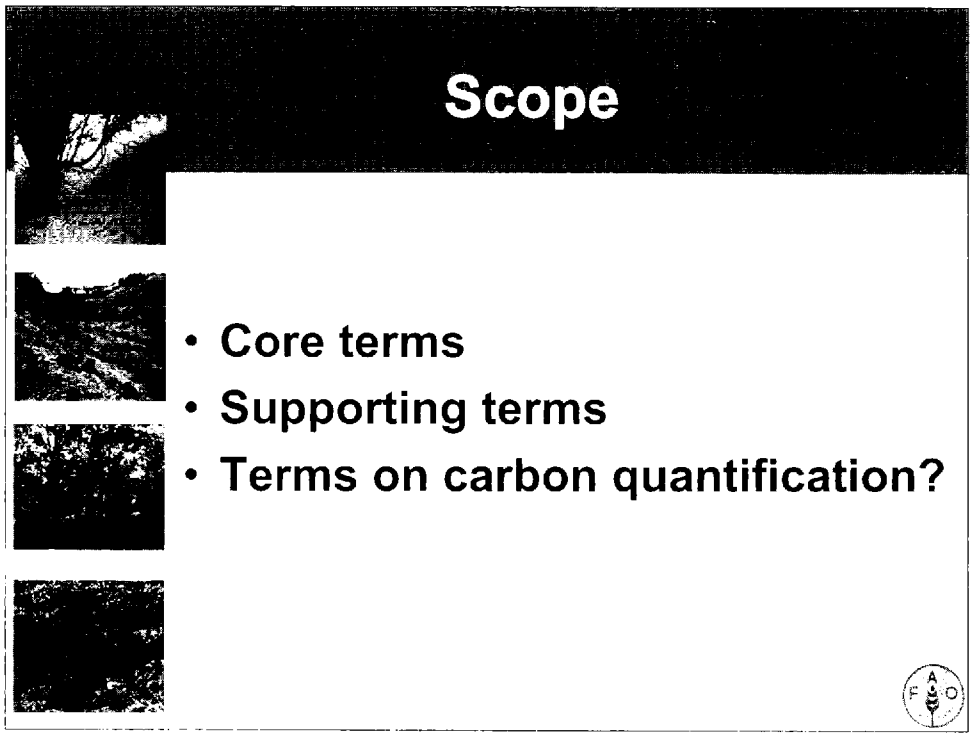

Recommendations
• Continue process
• Invite more stakeholders
• Transmit results to intern. bodies
• Form Task Group
• Prepare analytical framework
• Conduct second meeting

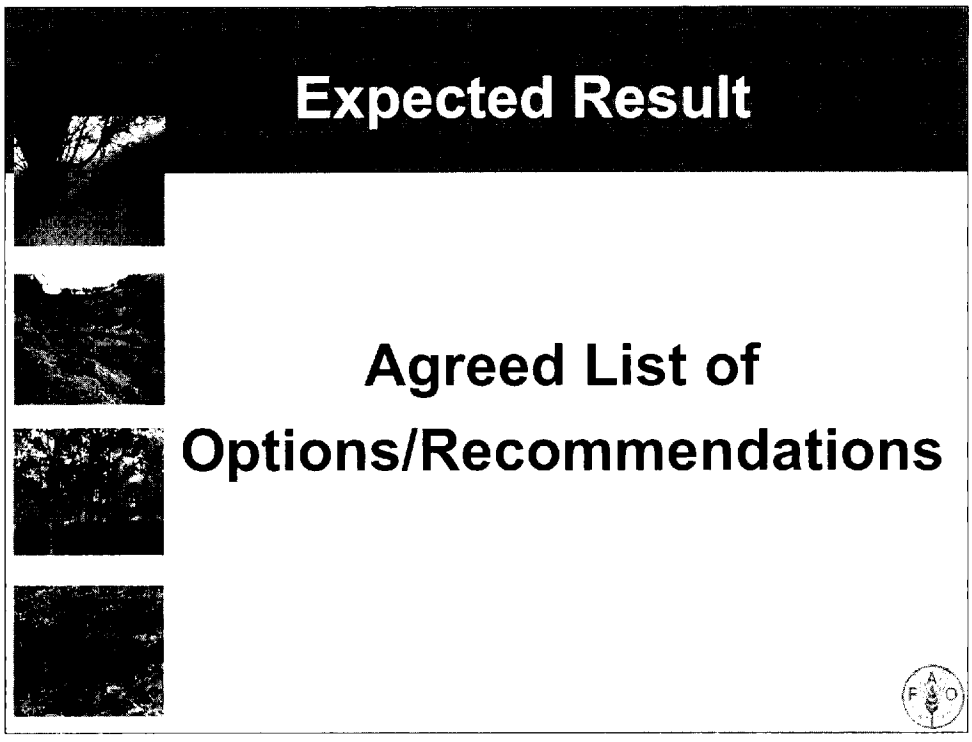

Related Processes
• FAO - Kotka IV
• UNFCCC - Definitions for CDM/KP
• IPCC - Good Practice Guidance
• IPCC - Definitions for degradation, devegetation
• CPF - Harmonization of reporting
• IUFRO work on forest terminology

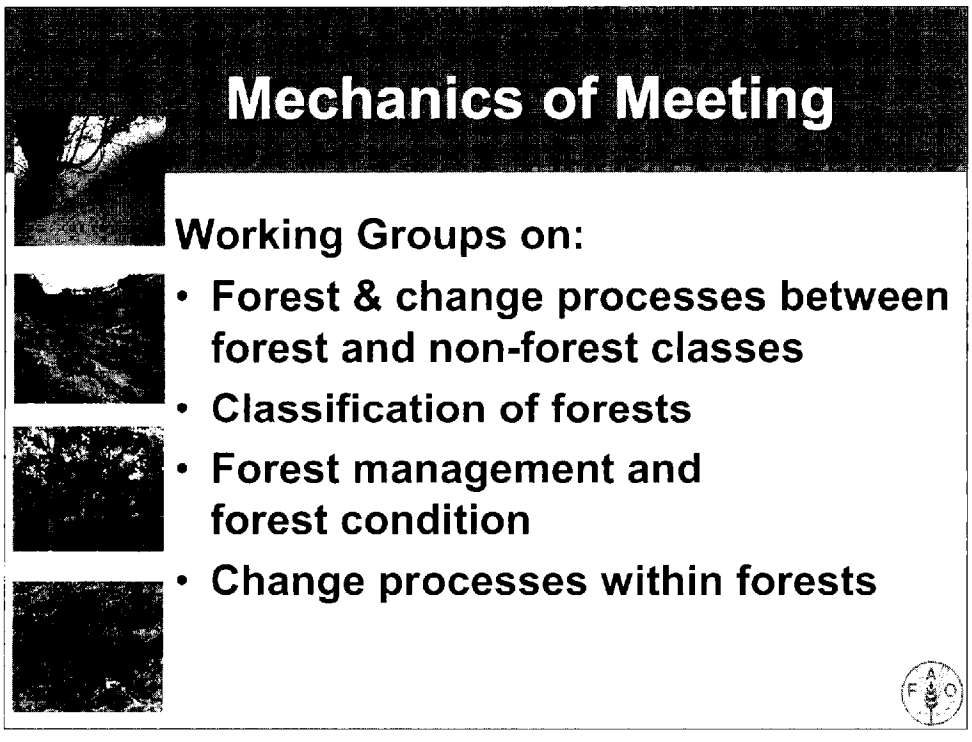

Reports & Recognition
• Reports at UNFF2, CBD COP 6,
• UNFCCC-SBSTA 16, IPCC processes, Kotka IV
• SBSTA recommended close collaboration of IPCC/FAO
• Outputs will be considered for CDM - definitions


Objectives of Meeting
▪ Options for harmonizing forest-related definitions recommended
▪ Proposals for implementation of options prepared
▪ Commonly agreed future agenda established


Harmonization
Can include:
• adjustments for improved compatibility and consistency
• establishing comparability
• linkages and hierarchies between terms
• documenting differences


Scope
• Core terms
• Supporting terms
• Terms on carbon quantification?


Expected Result
Agreed List of
Options/Recommendations


Mechanics of Meeting
Working Groups on:
• Forest & change processes between forest and non-forest classes
• Classification of forests
• Forest management and forest condition
• Change processes within forests

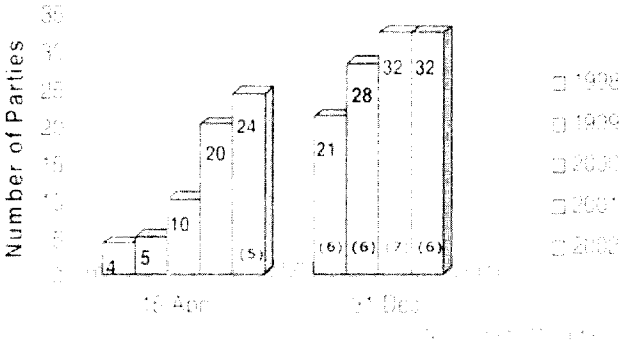
Dennis Tirpak
Coordinator, Science and Technology, UNFCCC

Review activities during the trial period (2001)

- Initial checks of 49 inventories *(submitted in 2000 and 2001)*
- Two synthesis and assessments reviews of 49 inventories
- Individual review of 39 inventories:
  - 4 desk reviews of 19 inventories;
  - 2 centralized reviews of 12 inventories; and
  - 6 in-country reviews

Review reports: UNFCCC web site

More inventories reported and better adherence to deadlines



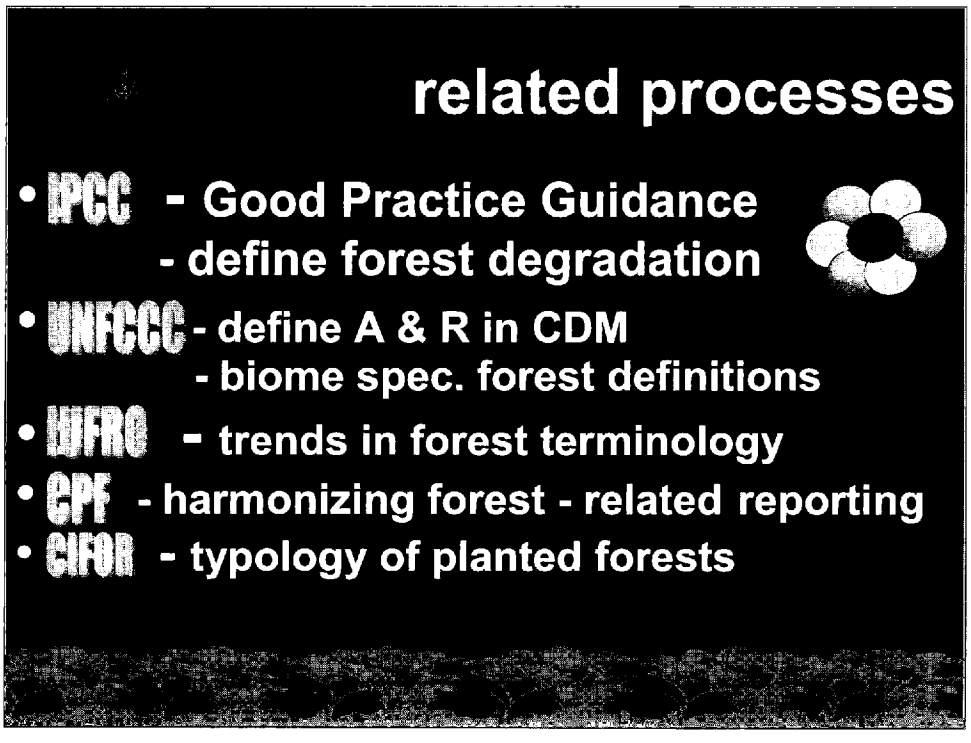
Increasing completeness of reporting

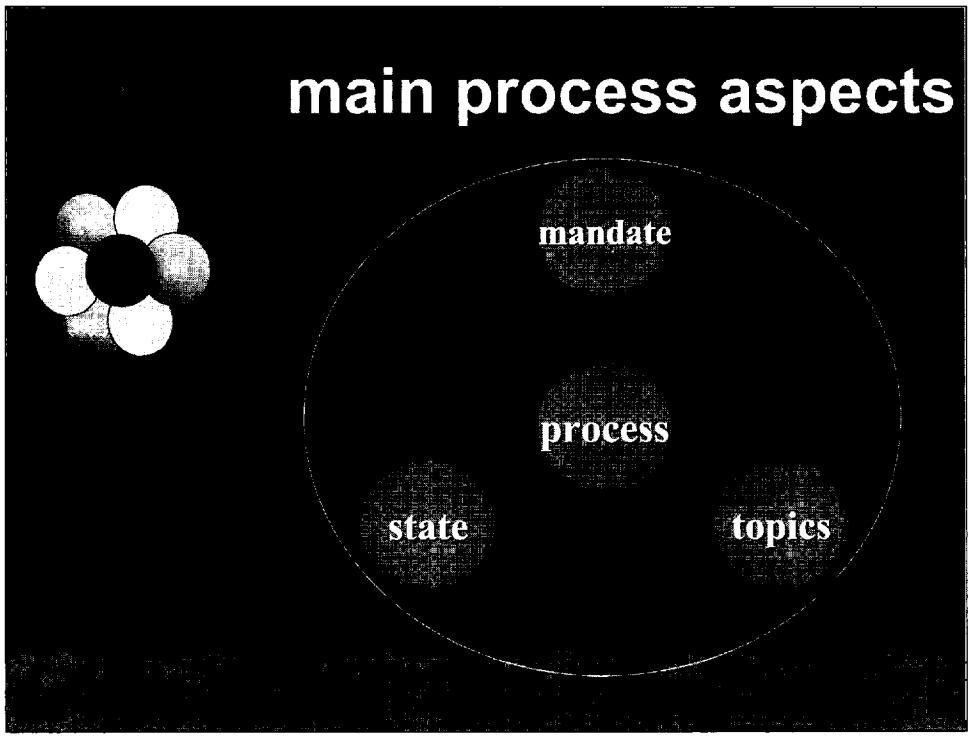
			2002
Information for whole time series	8	13	16 (1990-2000)
Complete CRF for one or more years	20	25	26 (27)
Provision of NIR	7	13	16

Experiences of the trial period: expert review teams

- Involvement of 136 national review experts in 14 expert review teams:
  - 51 experts from non-Annex I Parties
  - 19 experts from EITs
  - 52 experts from Annex II Parties
  - 3 experts from international organizations
- Inclusion of 2 lead reviewers in each review team: 1 from non-Annex I and 1 from Annex I Parties

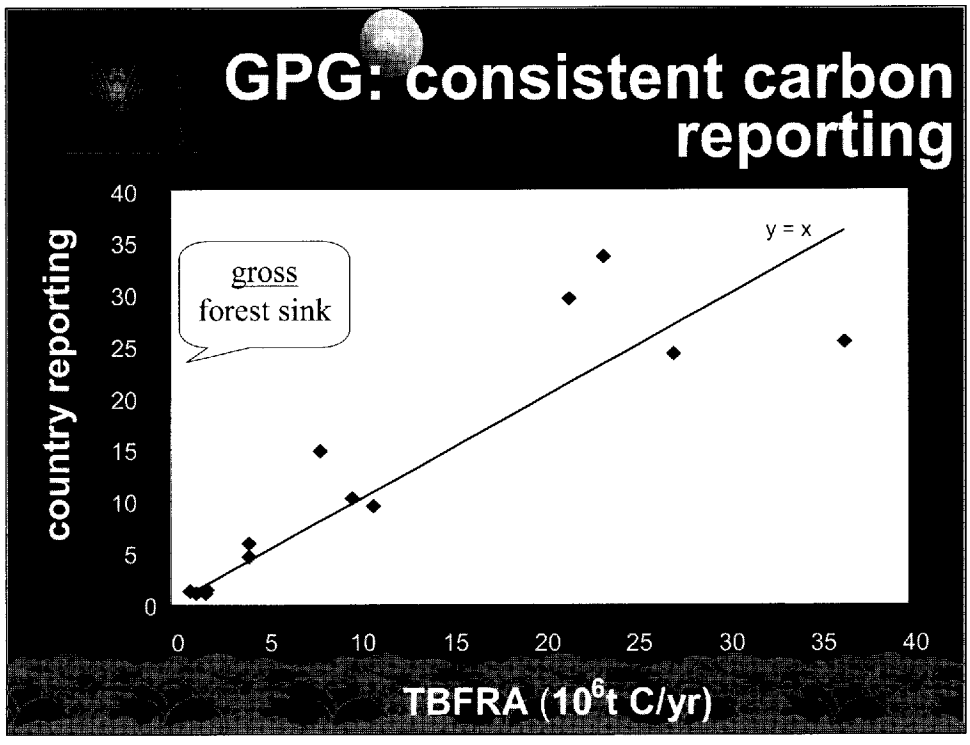
Dieter Schoene
Senior Forestry Officer, Forest Products Division, FAO

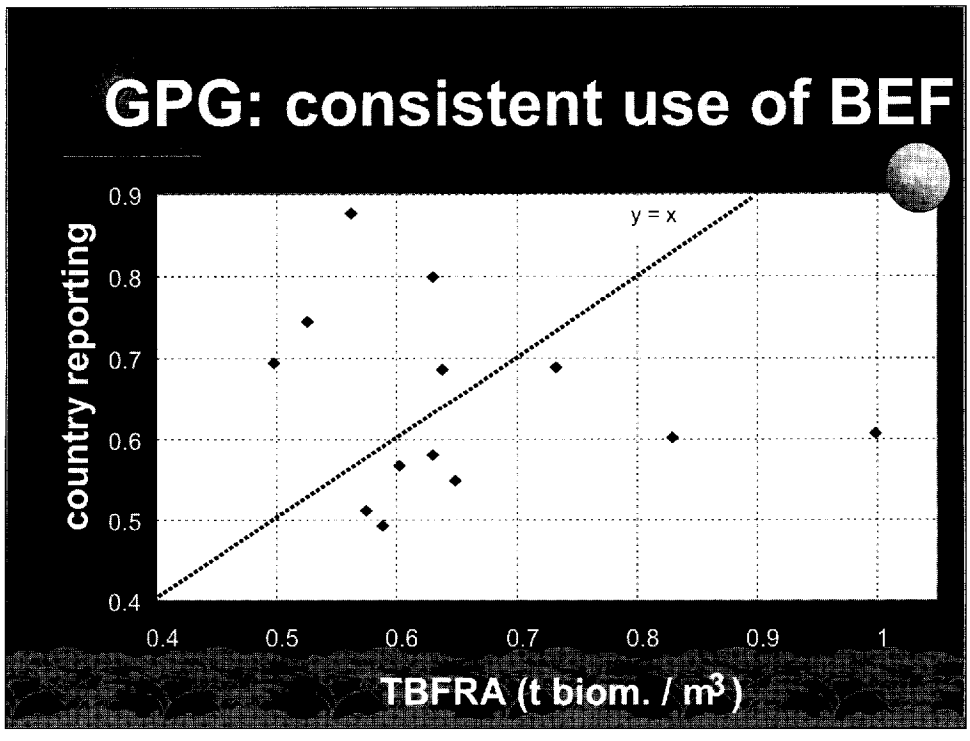


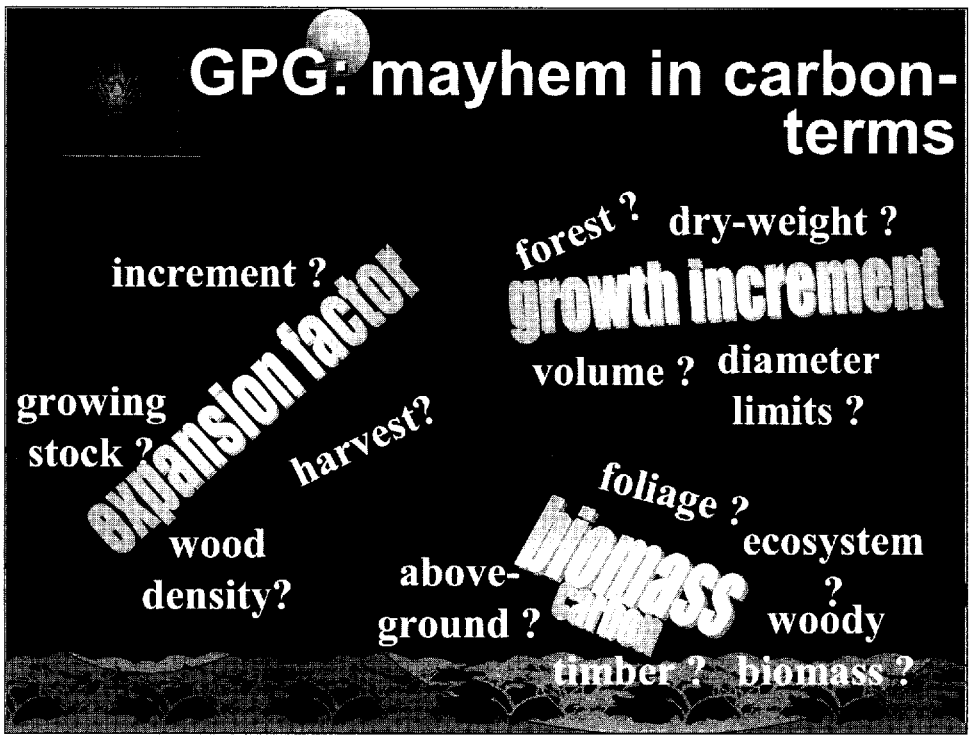


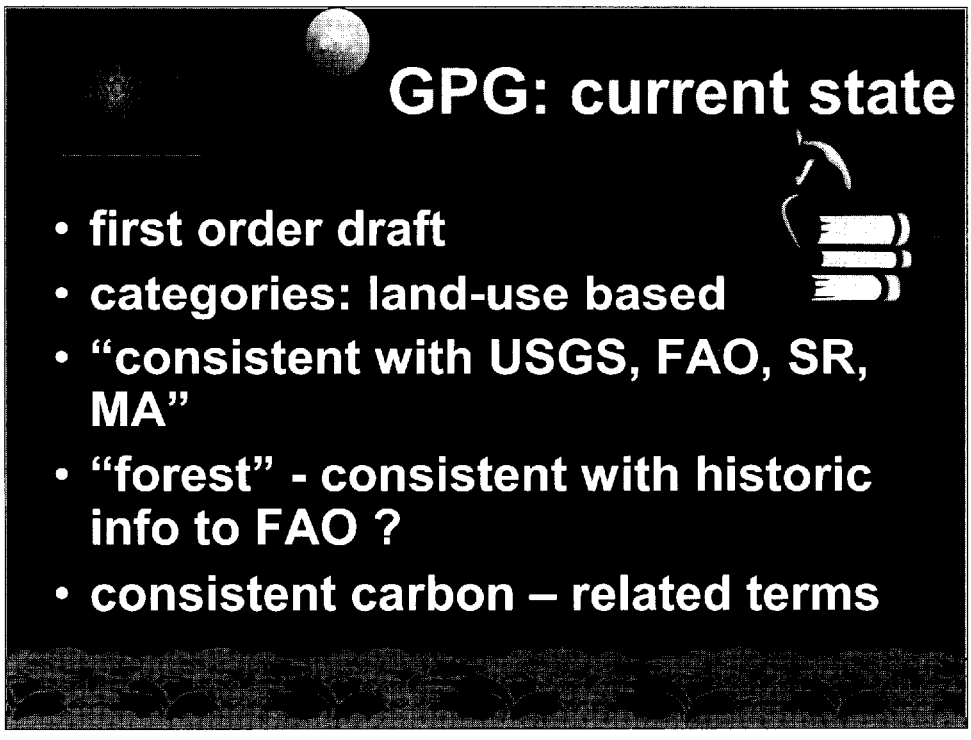
GPG for LULUCF: mandate

- methods to estimate, report C-stock changes
- prepare GPG
- basis 1996 IPCC Guidelines
- IPCC work with FAO encouraged
- adoption at COP9


GPG: consistent carbon reporting
country reporting
gross forest sink
y = x
0
5
10
15
20
25
30
35
40
TBFRA (10^6t C/yr)


GPG: consistent use of BEF
country reporting
y = x
0.4
0.5
0.6
0.7
0.8
0.9
1
TBFRA (t biom. / m3)


GPG: mayhem in carbon-terms
increment ?
expansion factor
growing stock ?
harvest?
wood density?
forest ?
dry-weight ?
growth increment
volume ?
diameter limits ?
foliage ?
biomass
above-ground ?
ecosystem ?
woody
timber ?
biomass ?


GPG: current state
• first order draft
• categories: land-use based
• "consistent with USGS, FAO, SR, MA"
• "forest" - consistent with historic info to FAO ?
• consistent carbon – related terms


forest degradation: mandate
• develop definitions for direct human-induced "degradation" of forests…
• options to inventory emissions
• adoption at COP9

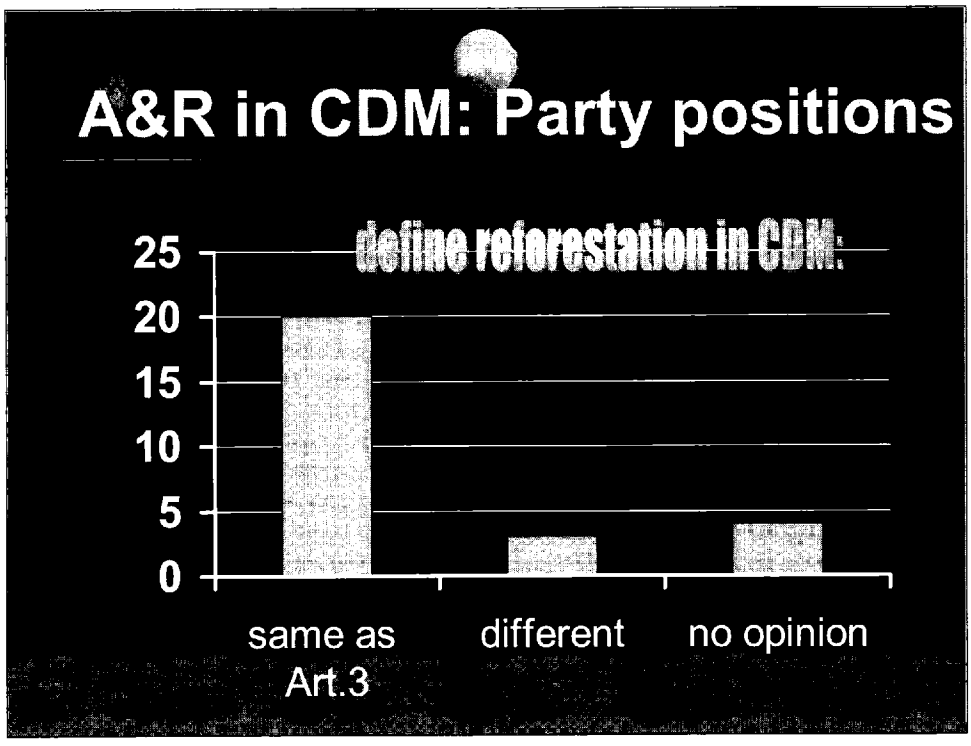

degradation: current state
• link to FAO process
• first order draft
• draft definition consistent with FRA

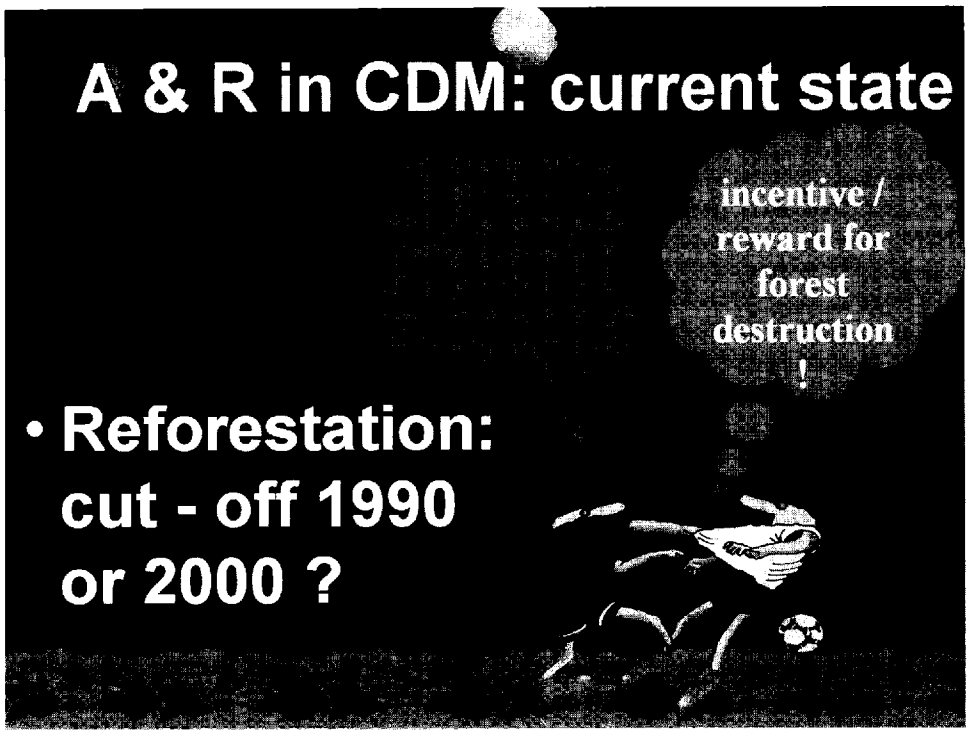
degradation: current state

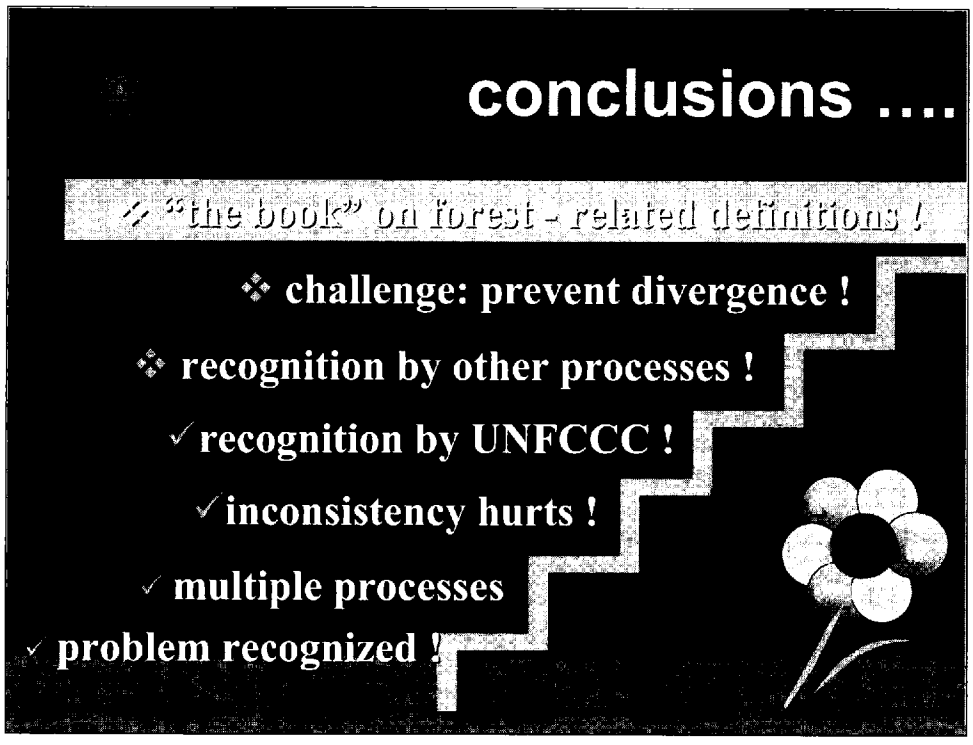
- IPCC: long-term reduction of crown cover towards but not exceeding the minimum accepted threshold
- FRA: a reduction of canopy cover…through…, provided that it stays above 10%....

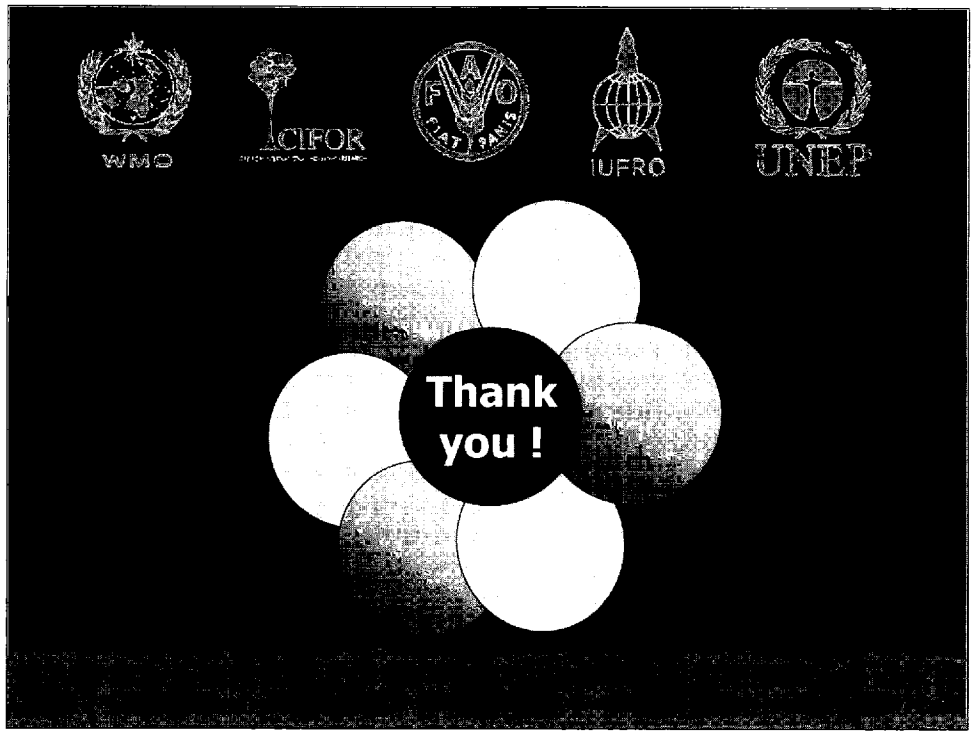
A&R in CDM: mandate

- develop definitions for including A&R under Art.12
- TOR, work program at SBSTA 16
- input from FAO definitions report
- decision at COP9

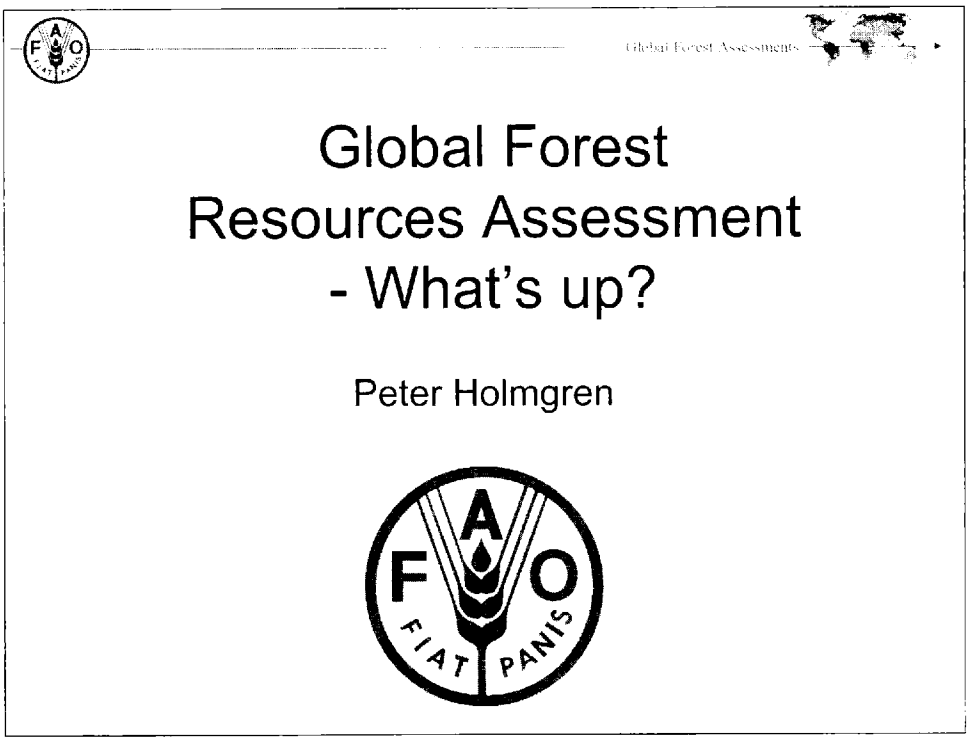

A&R in CDM: Party positions
define reforestation in CDM:
25
20
15
10
5
0
same as Art.3
different
no opinion

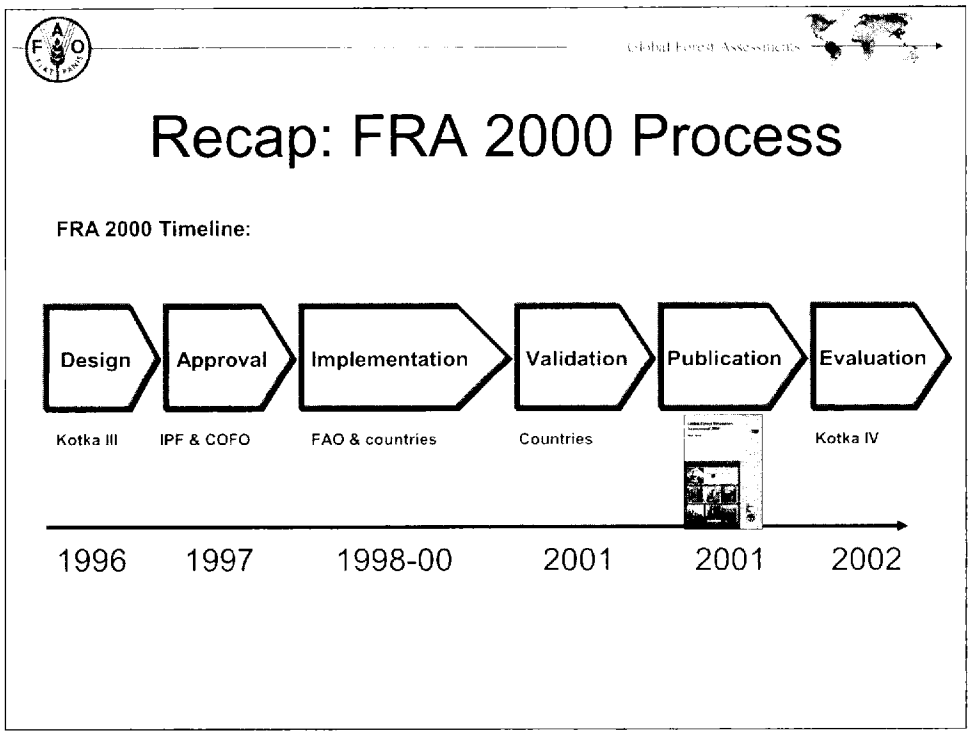

A & R in CDM: current state
incentive / reward for forest destruction !
• Reforestation: cut - off 1990 or 2000 ?


conclusions ....
"the book" on forest - related definitions !
challenge: prevent divergence !
recognition by other processes !
recognition by UNFCCC !
inconsistency hurts !
multiple processes
problem recognized !


WMO
CIFOR
IUFRO
UNEP
Thank you !

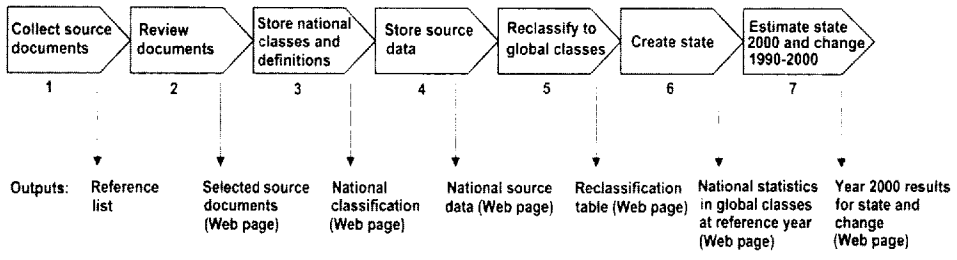
Peter Holmgren
Forestry Officer, Forest Resources Development Service, FAO





Global Forest Assessments

Recap: Transparency, Documentation



Global Forest Assessments

Defining FRA

- Global (= all countries)
- Forest Resources (= the assets that provide forest goods and services)
  - » Note! This is not confined to the forest area!
- Assessments (= evaluation over time)

Global Forest Assessments

Kotka IV, 1-5 July 2002

Global Forest Resources Assessment – Linking National and International Efforts (FAO, UNEP and UNECE)

Global Forest Assessments

Kotka IV Objectives

- To guide implementation of FRA regarding:
  - overall scope of global forest assessments;
  - participation of countries;
  - relationships between FAO/FRA and other international bodies;
  - organization;
  - approach to support national forest assessments;
  - role of independent remote sensing surveys.

Global Forest Assessments

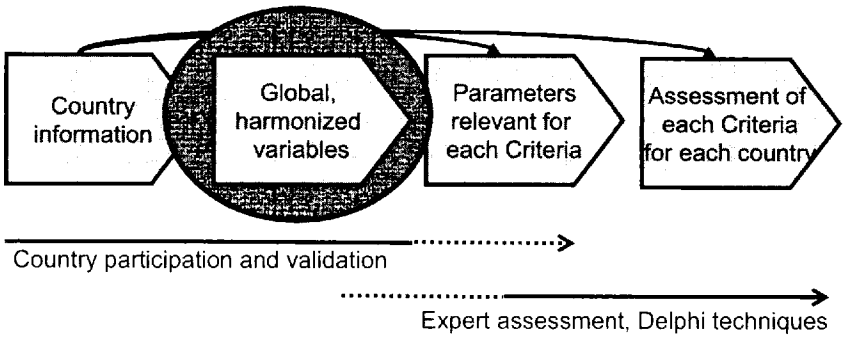
Some Kotka IV findings (Relevant to this meeting)

- Reinforce the participation of countries and links to country data;
- Establish Advisory Group;
- Criteria of SFM to be the framework for FRA;
- Contribute information to international processes;
- Consistency and Stability.

Global Forest Assessments

What will FRA 2005(?) look like?

Current proposal under discussion:



Conclusion

- Common definitions do not bring us all the way to an assessment;
- But they provide an important base for our analysis;
- And the attached data may be useful for other processes.

Is this where we are heading?

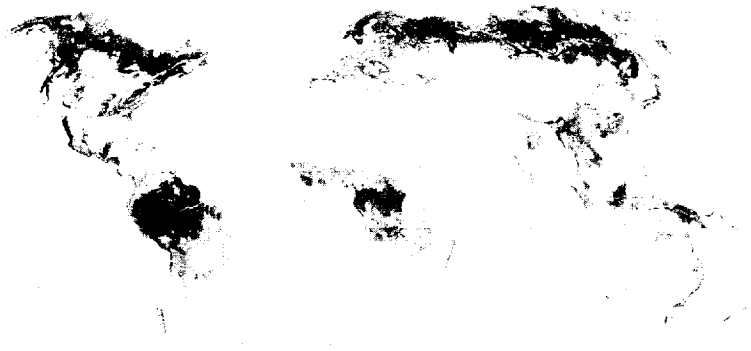
Table 1 in FRA 2005

Country	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5	Overall
A	+	++	-	0	0	+
B	+	-	0	-	-	-
C	++	+	+	+	0	+
D	-	-	-	-	-	--

What next?

- Design phase of FRA 2005(?) involving Advisory Group and National Correspondents;
- Present design and work plan to COFO 2003 for approval;
- Aim for (partial) report in 2005.

Thank you.

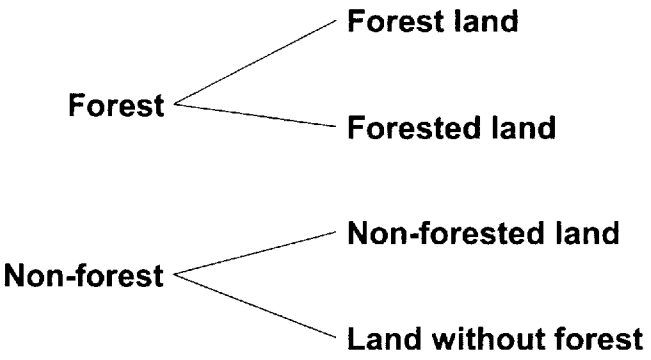


Markku Simula
Indufor Oy

Key Aspects of Forest Definitions

- **Threshold defining stand characteristics**
- **Definition of temporary**
- **Unstocked areas**
- **Expansion of existing definitions of forest**

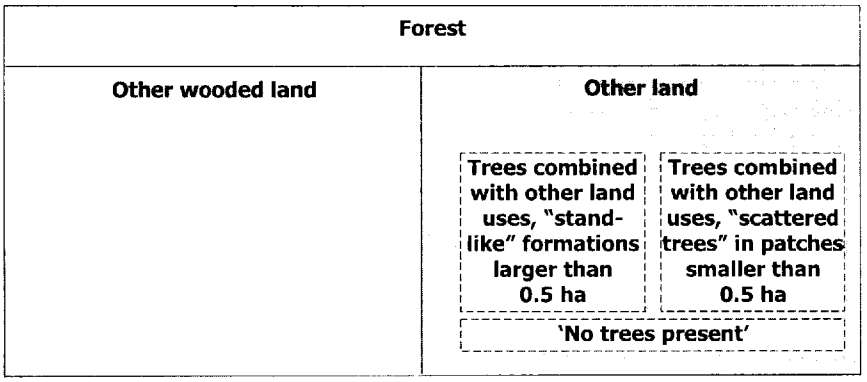
Forest and Non-forest Land



Issues Related to Land-use Classes

- Current apparent land use may not correspond to assigned land use
- Treatment of combined land uses
- Exclusion of certain types of trees and woody vegetation from "forest"

Optional New Subclasses Combining Forestry with Other Land Uses



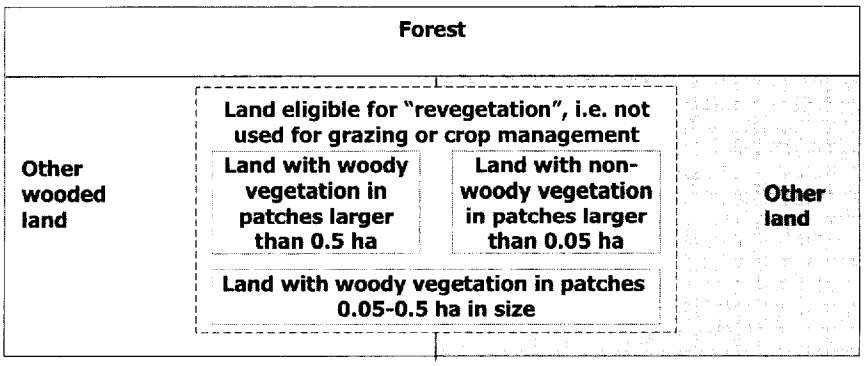
——— Boundaries of land classes according to FRA definitions

- - - - - - - - - Boundaries of optional new classes to cover trees occurring in other land uses

Definitions of Non-forest Land

- **FAO 2000b**
  - **other wooded land**
  - **trees outside forests**
  - **other land**
- **UNFCCC, 2001**
  - **revegetation**
  - **devegetation**

Revegetation in FRA Land-use Classes

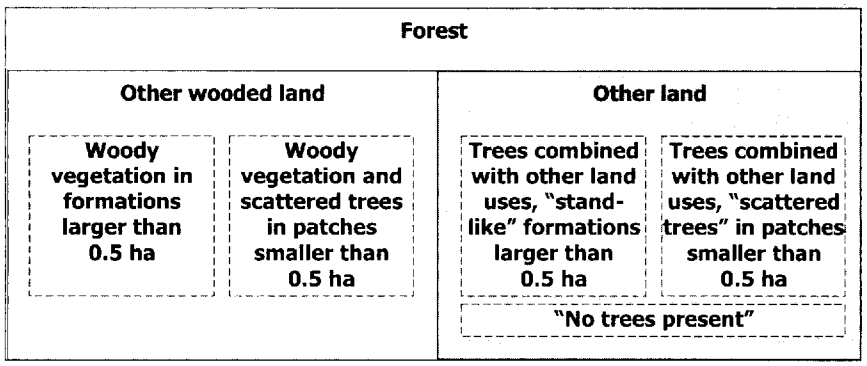


Boundaries of land classes according to FRA definitions

Boundary of land eligible for "revegetation"

Boundary for subclasses of land eligible for "revegetation"

Optional Subclasses of Other Wooded Land and Other Land



Boundaries of land classes according to FRA definitions

Boundaries of optimal subclasses

Changes Between and Within Forest and Non-forest

Afforestation

Reforestation

Natural expansion of forest

Natural regeneration

Deforestation

Conversion of land use

Conversion of forested land

Definitions of Forest Degradation

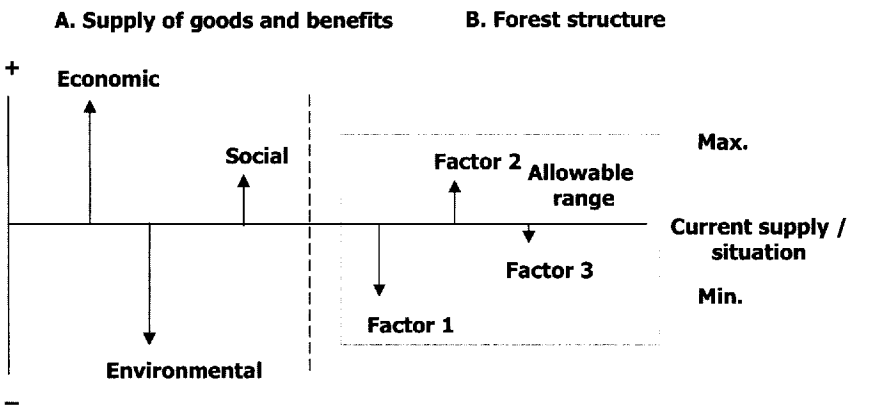
- **FRA 2000**
  - **forest degradation**
- **UNEP/CBD/SBSTTA 2001**
  - **degraded forest**
- **ITTO 2002**
  - **degraded and secondary forests**
- **IPCC**
  - **degradation**

Issues Related to Degradation

- **Multiple goods and services**
- **Trade-offs**
- **State and change in the supply of goods and services**
- **Time lags**
- **Selection of reference point(s)**
- **Measurement problems**

Composite index ↔ Individual indices

Approaches to Composite Indices



Considerations Related to Degradation

- **Permanence of effects (long and short term)**
- **Resilience of the ecosystem**
- **Spatial scale**
- **Natural and human-induced degradation**

Parameters of Various Definitions of Forest Degradation

Parameter		UNFCCC	CBD	ITTO	FRA
Binary parameters	Reference point defined as -'ideal' state -status in the beginning of the observation period	 0 1	 1 0	 1 0	 0 1
	Reduced supply of goods and services caused by -human activities -natural causes	 1(?) 0(?)	 1 0	 1(?) 0(?)	 1 1
	Secondary forest	0	1	1?	0
Threshold parameters	Minimum crown cover (%)	'Accepted'			10

Managed Forests and Forest Management

- **FAO 2000a**
  - **managed forest/other wooded land**
- **ITTO 2002**
  - **managed natural forest**
- **UNFCCC 2001**
  - **forest management**
- **IPCC 1996**
  - **natural, unmanaged (for wood products) forests**

Parameters of Definitions of Managed Forest and Forest Management

Binary parameters	UNFCCC	IPCC	ITTO	FRA
Modification of natural forest development	0	1	1	0
Sustainable supply of goods and services	1	0	1	0
Management aims at fulfilling specific objectives/ functions	1	0	1	1
Duration of management	0	0	0	0

Considerations Related to Managed Forests

- **Borderlines between managed and unmanaged**
  - **active human intervention**
  - **explicit management decision**
- **Production and protection forests**
- **Specific management purpose vs. management outcomes without intention**
- **Sustainability, maintenance of forest functions**

Forest Classification

- **Biome**
  - **forest biome**
  - **domain**
- **Forest Type**
- **Ecological zone**
- **Ecosystem**

Parameters of Definitions of Forest Type

Binary parameters	CBD	ITTO	FRA
Basic unit			
- group of forest ecosystem	1	0	0
- community	0	1	0
- formation	0	0	1
Characteristics of basic unit			
- homogeneity	1	1	1
- naturalness	0	1	1
Distinguishing features			
1.physiognomy	0	1	1
2.species composition	1	1	0
3.productivity	1	0	0
4.crown closure	1	0	0
5.climate	0	0	1
6.general ecological conditions	0	1	0

Forest Classification Issues

- Harmonization vs. compatibility between international and national classifications
- Basis of classification (international)
  - ecological zoning (FAO)
  - forest type
  - ecosystem
- Coverage (forest/non-forest)
- Differentiated vs. universal definitions
- Accuracy of measurement
- Costs

Natural and Plantation Forest

- FAO 2000a
  - natural forest
  - forest plantation
  - semi-natural forest
- ITTO, 2002
  - planted forest
- UNEP/CBD/SBSTTA 2001
  - plantation forest

Parameters of Definitions of Forest Plantations

Binary parameters	UNFCCC	CBD	ITTO	FRA
Site characteristics	n/a			
- afforested land		1	0	1
- secondary forest		1	0	1
- reforested land		0	0	1
Method of establishment	n/a			
- planting		1	1	1
- (direct) seeding		1	1	1
Stand characteristics	n/a			
1.introduced species		0	0	1
2.indigenous species		0	0	1
3.intensively managed		0	0	1
4.number of species		0	0	1
5.age		0	0	1
6.spacing		0	0	1

Issues Related to Plantation

- **Method of establishment**
- **Stand characteristics**
- **Impacts on biodiversity and other environmental functions**
- **Impacts on land rights and other socioeconomic aspects**
- **Assessment of sustainability**

Low Forest Cover

- Range of potential variables
- Sensitivity to thresholds in dry zones
- Accuracy of assessment
  - differentiated definitions
  - technical means to detect vegetation
- Combined indices

Conclusions

- Analytical comparative framework potentially useful instrument
- Decomposition approach to address fundamental differences in definitions which cannot be harmonized
- Need for improved awareness of the existing definitions and their roles
- Clarification of added value of any new potential definitions
- Strengthening of FRA as the cornerstone of the global monitoring system

ANNEX V
GROUP WORK ORGANIZATION AND TASKS

Group Work Organization and Tasks

Workshop objectives:

- Selected forest-related definitions are harmonized[25];
- Options for use of definitions suggested;
- Commonly agreed future agenda established.

Working Groups Tasks:

1. discuss and revise the draft analytical framework with respect to the terms assigned to the group;
2. consider options proposed and recommend to what extent of harmonizing[26] the definitions of key terms would be desirable, and suggest ways and means to implement it;
3. identify the applicability and possible implications of the proposed harmonization (and the underlying definitional framework) in international processes, negotiations and reporting;
4. recommend follow-up action for the harmonization process within and between international processes.

Suggested working group topics:

1. Forest and change processes

1.1. Forest in relation to other land classes
Forest, Forest Land, Non-forest Land, Trees Outside Forests, Other Wooded Land.

1.2. Change processes between forest and non-forest classes
Afforestation, Reforestation, Deforestation, Natural Expansion, Forest Fragmentation, Revegetation, Devegetation.

2. Classification of forests

Forest Type, Forest Ecosystem, Biome, Ecological Zone, Domain, Low Forest Cover.

3. Forest management and forest condition

3.1. Management of forests
Managed Forest, Unmanaged Forest

3.2. Forest condition with respect to productivity and environmental functions
Natural Forest, Undisturbed Forest, Primary Forest, Old Growth Forest, Secondary Forest Semi-natural Forest, Degraded Forest, Forest Plantation.

4. Change processes within forest

Forest-Improvement, Restoration, Rehabilitation, Reforestation[27], Natural Regeneration Forest Degradation, Forest Fragmentation

---

[25] Harmonization can include adjustment for improved compatibility, synchronization, establishing comparability and linkages, listing in order, documentation of differences

[26] e. g. adjustments across definitions, where easy to agree upon (like synonymy of 'forested land', 'forest land' and 'forest');

[27] Reforestation and Forest Fragmentation fall under two groups and reflect the close interrelationship of all terms- which calls for an interchange between groups.

ANNEX VI
GROUP WORK RESULTS

Working Group 1: Forest and Change Processes

Introduction

Our group considered options for harmonizing definitions of forests in relation to other land classes which have been developed under three distinct processes:

- FRA defines data on trees in the following categories: forest (including forest plantations), other wooded land, other land with trees outside forest.
- UNFCCC/KP is concerned mainly with measuring carbon and carbon stock changes and defines all areas within the defined parameters as forest.
- CBD is concerned primarily with biodiversity issues and appears to follow the FRA definition of forest with the exception that temporarily unstocked areas are not explicitly included. (See section 4.1.3).

Each has different purposes and as a consequence each has defined forests differently.

- All definitions include threshold parameters covering minimum area, minimum height, and crown cover.
- In the case of the UNFCCC/KP each of the threshold parameters has a range of optional values within which parties must choose a specific value; the other two specify the same fixed values.
- In addition the FRA specifies a minimum strip (stand) width and defines a maximum period for which a forest may remain temporarily unstocked.

The FRA and CBD definitions of forest include a predominant land use component. Lands where non forestry uses predominate are not classified as forest even where tree cover exceeds the threshold values of the other parameters. The UNFCCC/KP does not make this distinction.

See Figure.

There is a need to clarify the clause in FRA definition below:

"Predominantly forestry" within the FRA refers to forests that are used for purposes of production, protection, multiple use or conservation (i.e. forest in national parks, nature reserves and other protected areas), as well as forest stands on agricultural lands (that is, windbreaks and shelterbelts of trees with a width of more than 20m), and rubberwood plantations and cork oak stands. It excludes stands of trees established explicitly for agricultural production and agroforestry systems.)

Summary of Options: Forestry Definitions	**Comment Working Group 1: New Version**
4.1.5 (page 10)	
Threshold values for stand characteristics used by UNFCCC are fixed. However, under GPG a case could be made for countries to **voluntarily adopt** the FRA definitions as also applied by CBD.	Suggest Alternative Wording: (1) Threshold parameters for defining forest under UNFCCC/KP are flexible within a fixed range. **Reporting burden may be reduced** where countries adopt the same threshold parameters for UNFCCC/KP and FRA reporting. However, there may be **practical reasons** for countries adopting different threshold values.
Ex 3. Consider including '**temporarily unstocked areas'** in the CBD definition of forest to make it essentially the same as the FRA definition. Alternatively, make the CBD definition comparable with the FRA definition, by distinguishing 'temporarily unstocked areas' as a separate class of forest in FRA.	(2) Request the CBD clarify whether definition of "temporarily unstocked" as used by FRA is **intentionally** excluded in their definition. The UNFCCC/KP rules require parties to provide information on how they **distinguish** temporarily unstocked forests from deforestation. This is compatible with the FRA 10 year limit.
Ex. 2 Assess the need to add a qualifier for the term 'temporary' in the UNFCCC and CBD definitions of forest.	(3) See recommendation new (2) above.
Assess the need and justification for creating a sub-class of non-forest under FRA, '**degraded former forest land'** to make it consistent with ITTO definition.	(4) Awaiting information from group 2.
Assess the feasibility of incorporating **social considerations in** the definitions of forest vs. addressing these under such comprehensive frameworks as Criteria & Indicators for SFM.	(5) The group agreed that it was **not appropriate** to **further** incorporate social considerations into definitions of forest but should be included in further characterisation of forest. Instead this should be explored through mechanisms such as frameworks for criteria & indicators for SFM.
FRA already collects data on forest **plantations** and categorises plantations managed for fibre production, protection etc, as forest, but plantations managed for tree crops as non forests. UNFCCC/KP defines all plantations (including afforestation and reforestation) as forest. New recommendation The CBD is recommended to consider the inclusion of plantations as separate category(ies) of forest, so that changes in biodiversity associated with the transformation of other forests to plantations can be monitored.	
4.2.3 (page 13)	
(1) Assess whether UNFCCC/KP terms '**forested land'** and 'forest land' can be considered synonymous with 'forest' and, if so, which term(s) should be used in the future.	The group understood that in the context of UNFCCC/KP the terms 'forested land' and 'forest land' are **synonymous** with 'forest'.
(2) Clarify the method of **classifying lands** with a combined land use under the UNFCCC definitions and assess whether the UNFCCC approach can be aligned with the FRA classification by e.g. dividing the FRA land class 'other land' into sub-classes.	To be drafted **later**. The IPCC Good Practice process and subsequent discussions in SBSTA/COP will clarify the UNFCCC/KP approach.

4.4.5 (page 19)	
(1) Expand the FRA definition of afforestation to include assisted regeneration not involving **direct seeding** or planting.	The group **endorses** the recommendation as it makes the definition more inclusive of desirable outcomes.
(2) Drop the requirement for a **50-year** non-forest condition for afforestation in the UNFCCC definition to be applied from the second commitment period onwards	The group **endorses** the recommendation. In some countries, records are insufficient to discriminate between the alternatives and the treatment of afforestation and reforestation is equivalent within the UNFCCC/KP. The group is considering a broader suggestion on **harmonizing** the terms afforestation and deforestation in future drafting of UNFCCC/KP documents with FRA definitions.
(3) Consider harmonizing the treatment of **young forests** in the FRA and UNFCCC definitions of afforestation	No action required. The group recognised that there is **no substantive difference** between the definitions, and that attempts to change the definitions will cause confusion.
(4) Consider adding a definition of **natural expansion** of forest in the ITTO set of definitions that is compatible with the other existing definitions	**ITTO** needs to address the issue of compatibility with other existing definitions.
(5) Consider developing the ITTO definitions by including a reference to an **established definition of 'forest'**, and making minor adjustments to increase compatibility with FRA and UNFCCC definitions	The group **recommends** that ITTO reference an established definition of forests and make the necessary adjustments to increase compatibility with FRA, UNFCCC/KP and CBD definitions.
(6) Differentiate **direct human-induced** deforestation and permanent forest loss due to **other causes** in the FRA definition of deforestation	The group concluded that permanent forest loss is rarely a natural occurrence. The definitions of deforestation are specific to the purposes of the two processes; however **compatibility can never be achieved** because the FRA and UNFCCC/KP definitions of forest are different. See discussion below.
	Under the FRA definition of forest it is possible for an area to be reported as forest expansion, afforestation or deforestation as a result of changes in land use, even though there is no immediate change in tree cover. As a result change figures reported by the two processes are not likely to be comparable.

Working Group 2: Change Processes Within Forest

Second Expert Meeting on Harmonizing Forest-related Definitions, Rome 9/02
Working Group 2

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Chatterji, J.
Govil, K.
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Masripatin, N.
Nasi, R.
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Working Group 2

Forest Degradation as Core Term

Definition as in Draft Analytical Framework (page 19)

- FRA 2000 Definition in background paper does not match sources cited
- Draft IPCC definition is preliminary

Amendment of Table 4.2 (page 20) to further include additional parameters as contained in definitions

Second Expert Meeting on Harmonizing Forest-related Definitions, Rome 9/02 Working Group 2

Biophysi	*Elements*	*Sub-elements*	*Measurat*	*Value-lade*	*FRA2000*		*CBD*		*ITTO*		*IPCC*	
Biophysical	Structure		y	n							0	
		canopy cover	y	n			0		0			threshold
		stocking	y	n			0		0		0	
		hor. Structure	y	n								
		vert. structure	(y)	n								
	Resilience	components?	n	n			0				0	
Functions											0	
	Goods										0	
		wood	y	n								
		non-wood	y	(y)								
	Services										0	
		biophysical	y	n								
		cultural	n	y								

	Elements	*Sub-elements*	*Identifiable*		*FRA2000*		*CBD*		*ITTO*		*IPCC*	
Others?	Site specific		y								0	
	Reference state		y			potential?		natural forest		natural forest	0	
	Spatial scale		y				0		0		0	
	Temporal scale		y			long-term	0		0			long-term
	Cause	human	y								0	
		natural	(y)				0		0		0	

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Core Definition (FRA2000, CBD, ITTO)

Forest degradation (process) is the reduction of the capacity (referring to reference state and temporal scale) of a forest to produce goods and services [maintain biodiversity and ecosystem structure and functions].

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Working Group 2

FRA2000 and draft IPCC definitions do not mention any causes whereas CBD and ITTO are only considering "human induced" causes of forest degradation.

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Working Group 2

Option 1 (chapter 4.5.5)

The draft IPCC and FRA (Working Paper 33) definitions are very similar (harmonised) vis-à-vis their operational element: minimum canopy cover above the limit of the minimum 'forest' threshold.

For broader concepts (like functions, goods and services), there's no need for harmonizing, because of the specific IPCC/UNFCCC purpose.

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Option 1 (chapter 4.5.5)

Time scale issue (long term) are a problem. IPCC rightly considers the long-term character of degradation while mainly interested in assessing carbon stock changes over a commitment period (a few years). FRA mention the long-term character but not in the operational part of the definition.

Option 1 (chapter 4.5.5)

Recommendation: FRA 2000 and IPCC should not equate short-term carbon or growing stock reduction to forest degradation. Proposed term: stock reduction. IPCC: If maintaining the term FD consider to expand the definition.

Recommendation: Change the order of the two sentences in the FRA definition (WP 33), starting from the second sentence (more general) and following with the operational part. Monitoring of canopy cover or stocking should be phrase in such a way that it is **only one of the relevant indicators** of forest degradation.

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Option 2 (chapter 4.5.5)

Resilience is not easily operationally measurable (though some components can be). The concept is implicit in various elements of the definitions (except IPCC), the group does not think that incorporating the concept of resilience into existing definitions is really useful.
However in some cases of heavy damage to a forest it might be possible to conclude that a threshold has been reached and that resilience of the ecosystem is partially lost.

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Option 2 (chapter 4.5.5)

Recommendation: The concept of resilience is important to the overall comprehension of forest degradation but because in most cases the threshold values are not known or not predictable or not measurable at country level, it brings **little added value to existing definitions** of forest degradation.

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Option 3 (chapter 4.5.5)

Choice of spatial scale is related to the objectives and the choice of indicators (i.e. runoff / water catchment).

Recommendation: Forest degradation should ideally be assessed at the stand level but under certain circumstances (i.e. fragmented forests) it can only be assessed at the FMU or landscape level.

Recommendation: No need for explicit references to spatial scale in the definitions.

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Option 4 (chapter 4.5.5)

Developing a composite index is an interesting research question but doesn't seem to be an operational solution. If however necessary raw data would be available it could as well be used directly. The question of the relative weights in a possible index is also a wicked one.

Forest naturalness as reference point seems inadequate: (i) it is difficult if not impossible to define objectively naturalness; (ii) attributes of forest are not intrinsically linked to naturalness.

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Working Group 2

Supporting terms

Forest rehabilitation: The process of restoring the capacity of a forest to produce goods and services again. This forest is not identical as it was before degradation.

Forest restoration: The process of restoring a forest as it was before degradation (same functions, same structure, same composition)

Forest improvement = opposite of forest degradation (see generic definition of forest degradation)

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Working Group 2

It is considered necessary to check on the actual reporting requirements of countries for international purposes in regard to forest degradation in order to further suggest useful harmonization.

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Working Group 2

Supporting term: Forest Fragmentation

No need for harmonization as only one international definition exists (see CBD/SBSTTA 2001).

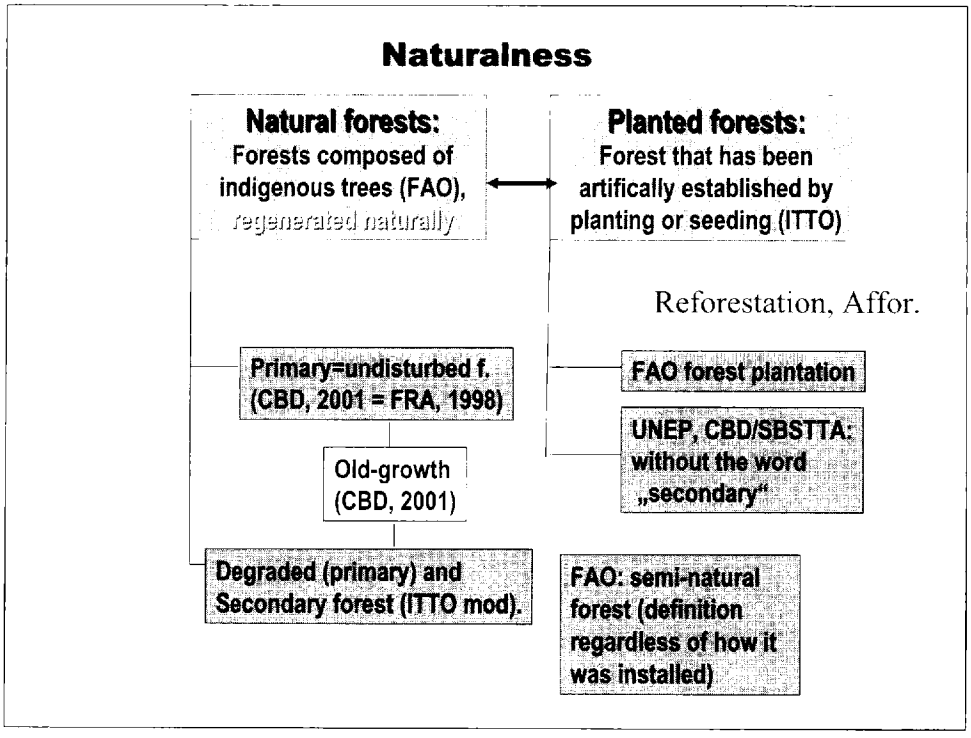
Certain concepts such as habitat fragmentation and administrative fragmentation are considered not to be adequately covered.

Working Group 3: Forest Management and Forest Condition

WORKING GROUP 3:

Management of Forests
Managed, Unmanaged forests

Forest conditions
Natural forest, undisturbed forest, primary forest, old-growth forests, secondary forest, semi-natural forest degraded forest, forest plantation



Natural forest (page 30)

Definition:
Forests composed of indigenous trees
(FAO), regenerated naturally
(avoid negative quotation „not planted")

Options, Discussion:
• definition at stand level: Forest stands composed...
• term indigenous necessary? Definition in the sake of a country, native (CBD) = indigenous (FAO)?
• regenerated naturally includes both, spontanous and assisted regeneration

Planted forest (page 30)

Definition (ITTO modified):
Forest that has been (artificially) established by planting or seeding.

includes a broad set of objectives: protection, production

Options, Discussion:
• Subsets of planted forests:
(i) forest plantation, plantation forest, ...
(ii) Extensively managed planted forests
• time scale, reversibility (to other land uses)
• Is all planted forest managed forests?

Forest Plantation/Plantation forest (page 30)

Options, Discussion:

- intensively managed planted forest for production
- FRA and CBD quite compatibel intensively managed
- FRA definition precise
- CBD definition: drop the word « secondary », not to confuse this with spontanous regeneration after disturb.
- Definition plantation forest page 30 and SBSTTA-Nov. 2001 (page 55 Jan. Report) not identical

Primary forest (page 39)

Definition:

Forest undisturbed (directly) by man.
Primary forest (CBD) = undisturbed forest (FRA)

CBD definition:

Options, Discussion:

- Issue: Disturbance by non native animals
- ITTO definition of primary forest need to be considered
- CBD definition on page 39 not exactly the same than in the SBSTTA-Nov. 2001 (page 55 Jan. Report)

Old-growth forest (page 39)

Definition:

CBD definition ok

Options, Discussion:

- Issue: does it include secondary as well as primary forest?
- Important concept in several countries

Secondary forest (page 40)

Definition:

ITTO definition modified:
Woody vegetation regenerated naturally on land that was totally cleared of its previous forest vegetation.

Options, Discussion:

- CBD definition not appropriate to describe the concept of „secondary forests"
- CBD definition is broader, included both, degraded (primary) and secondary forests
- Primary plus secondary forests do not cover all natural forests
- None of the definitions proposed include the notion of forest condition resulting from supression of natural fire regime

Semi-natural forest (page 30)

Definition:

FRA: several definitions the one here is:
Managed forests modified by man through silviculture and assisted regeneration.

Where is the term indigenous/native in this respect?

Options, Discussion:

- Syn. For managed natural forests? The most natural part in planted forests?
- Term with regional importance (Europe)
- Gray zone: is it a subset of planted or natural forests
- Is the term useful to describe plantations which take on more natural characteristics over time?
- Hard to identify on field level (planted or naturally regenerated)

Degraded (primary) forest (page 40)

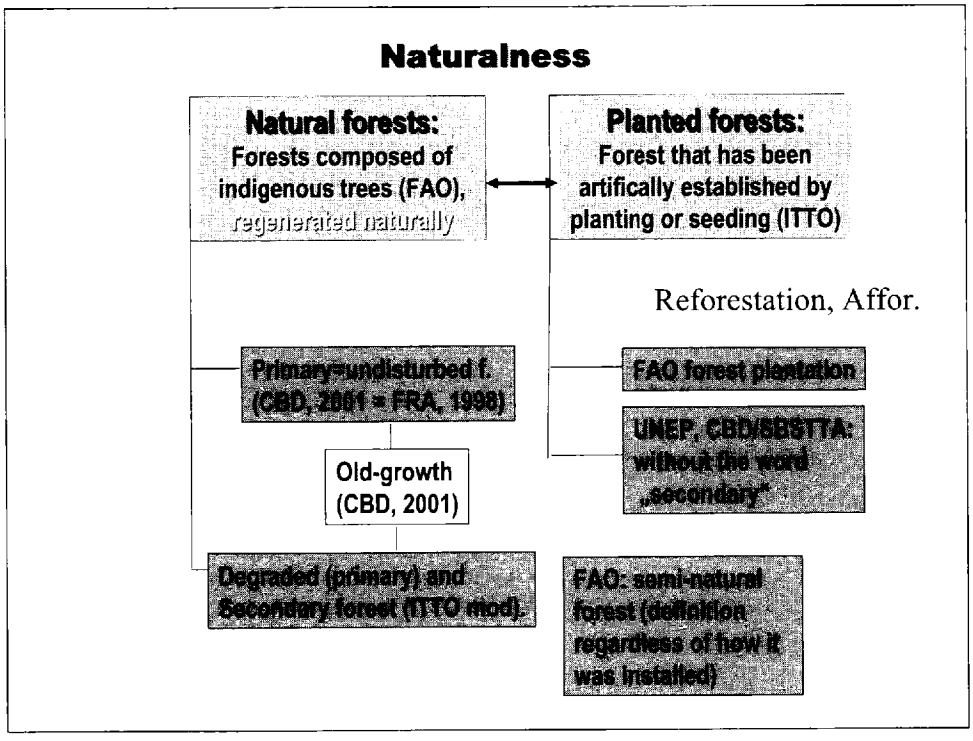
Definition (ITTO modified):

Simplified definition: delete references to primary, old-growth. Important concept to consider:

Beyond the elastic capacity (recovery) of the forest ecosystem...

Options, Discussion:

- Refer to group degradation: degraded forest as a distinct forest condition to secondary forests
- Time factor
- Degraded/Natural forest disturbed by man (FRA): concept needed?
- Distinction between modified and degraded forest?



FOREST MANAGEMENT

Options, Discussion:

Different levels:

- National planning (decision making)
- FMU level planning (mangement plan)
- Interventions (actions, activities, operations
- Be aware:
  Different concepts (including different approaches) in different parts of the world

Managed vs unmanaged

- Unmanaged
  - Strictly unmanaged
  - In national planning no managment
  - In nat. and local planning, no interventions
- Managed (sustainable)
  - Managed acc. To formal plan
  - Managed acc. To informal plan
  - Traditional use
- ?Managed? (unsustainable)
  - Intensive uncontrolled use
  - Illegal logging

Further discussion re: MANAGED vs. UNMANAGED FORESTS

1. Managed Forests are lands subject to forest management? Globally, nearly all forests have been subject to some form of human decision-making with regard to their management?

2. We generally support this definition which is slightly modified from UNFCCC (2001):

   "Forest management is 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.

   For example, this can include production of wood and non-wood forest products, biodiversity conservation, soil conservation or watershed protection."

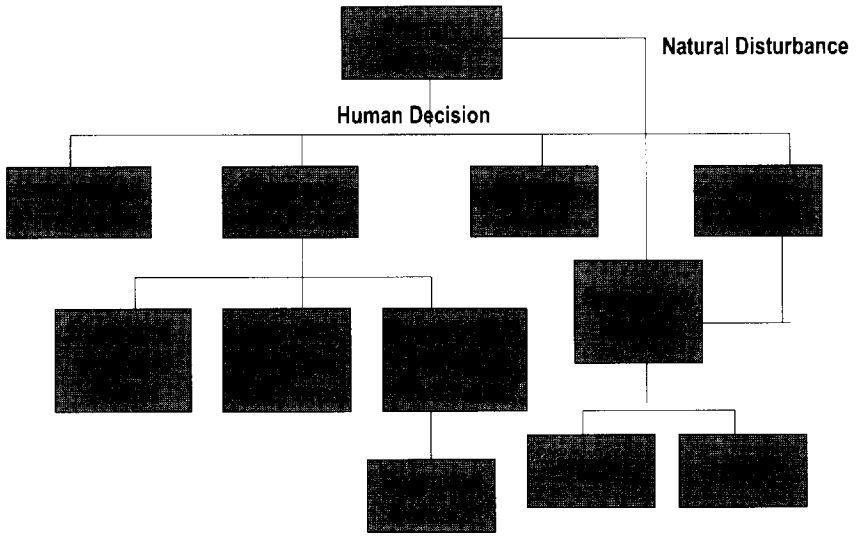
Further discussion
re: MANAGED vs. UNMANAGED FORESTS

3. The word sustainable should be added to the UNFCCC definition of forest management if the UNFCCC does not change their definition to conform the item 2.

4. FRA should develop a typology for management objectives as a basis for reporting on the status of areas under different levels of forest management.

5. FRA should consider adopting item 2 definition.

Pathway relating to „managed and unmanaged forests"



LOGBOOK 1 - First Session 9/11/02

Introductory comments

- Objectives
- Options for harmonizing forest-related definitions are recommended
- Etc per handout

Agree

- Use Draft Analytical Paper as starting point – do not reinvent the wheel
- Also have Gyde Lund's papers as reference – newly compiled
- #3 – OK – Assess applicability
- #4 – Recommend…look at later
- Prefer to stay together as single group rather than subgroup

How to approach our task

- Find relevant terms in document
- Start with a hierarchy
- See Buchwald paper: Denmark example Appendix 1
  - is a continuum – borders hard to determine – overlaps evident
  - are political obligations attached to words already – do not create new problems
  - obligations: Rio to European
  - natural (primary and plantation)

Notes/Questions/Comments

- is degradation a topic here? Yes, due to various reasons
- envision three dimensional framework with management, naturalness and degradation as axes
- second working group may already be discussing this
- managed versus unmanaged – ideas regarding decision making, planning measures, managing for what (i.e. for watershed, biodiversity, forest products, area management, planning)
- legal aspect: in some areas need legal status to define a managed area
- if no approved plan, then is "unmanaged"
- do not invent new terms!

Begin: Term by Term

Discuss the management terms first: Natural Forest, Undisturbed Forest, Primary Forest, Old Growth Forest, Secondary Forest, Semi-Natural Forest, Degraded Forest, Forest Plantation

I. NATURAL FOREST - SEMI-NATURAL FOREST - PLANTATION CONTINUUM

1. Natural Forest: page 30, 39, 40

Discussion Issues

- where the breakpoints are
- whether terms are applied at forest or stand level
- whether species need to be indigenous or not
- whether assisted regeneration is included in natural forest definition, along with "natural" regeneration

Discussion Points

Is it a natural forest if a mid-succession stage is maintained? For example: Is a climax beech forest but maintain the oak? Does this differ from a man-made (plantation) versus natural?

Most general definition: "indigenous trees not planted by man" page 30

- may not know, or be able to determine
- more generally, is used simply to differentiate versus plantation
- but in Europe, where is the boundary
- differentiate between natural, natural planted, semi-natural versus plantation
- can also plant indigenous trees
- does naturalness equal unmanaged?

Need a reason for the definition first

- so far, this repeats prior debates: FAO, WB, Rio looked to the origin
- natural seed fall versus planted
- if planted, is not a natural forest anymore
- plantation associated only with afforestation? i.e. newly forested lands?
- confusions: naturalness, management, degradation

Why is definition of natural needed?

- to distinguish versus plantations
- continuum within natural: e.g. old-growth is highly managed, but still natural
- The is political aspect: natural implies "better"?

Should we keep the idea of semi-natural?

- example European: 200 year old plantations now considered "natural"; has biodiversity, and more natural characteristics
- tropical: plantations distinct – but also have enrichment planting

Native forest versus natural forest: differentiates between native species or not

- Planted forests may now have conservation status and value

Natural: to include indigenous species plus natural processes of regeneration dominate

- Natural regeneration – guided or non-guided - with human-intervention is still natural

Don't lose track of objective

- Recall Appendix 1 (Buchwald) document – point is to distinguish from plantations
- Recall FAO: Indigenous trees, not planted by man – i.e. forests excluding plantations
- Recall use of definition for reporting purposes: Task is to examine the range, and comment on the utility of the term for general international reporting. In terms of data collection, is complicated. Should this definition be used for reporting?
    - plantations connote wood production, little biodiversity
    - needed in climate context
    - huge range in natural forest: only need more specificity for CBD

2. Forest Plantation

Discussion Issues

- Plantations are a subset of planted forests
- What management objectives are included in plantation definitions: Just for wood products, or for other products (e.g. oil palm), or also for environmental services (wind breaks, soil stabilization etc.)
- How to categorize more mature plantations – Do we need the term "semi-natural" for plantations that take on more natural characteristics over time

Discussion Points

- Try discussion from the other direction: Definition of "plantation" – page 30
    - FAO
    - ITTO
    - UNEP
- Continue to think in terms of three dimensions
    - Naturalness
    - Management
    - Degradation

Notes/Questions/Comments

- Distinguish between planted forests versus plantations
- Plantation: connotes structure (e.g. even aged, even spacing, 1 - 2 species per FAO);
- is a subset of planted forests
- "Management intent": should it be included?
- is plantation just for wood production? Or also for watershed protection?
- is it worth reporting? Hard to determine
- plantations may have several good functions: e.g. planting for land stabilization vs. sliding, downstream community protection; could be introduced species
- similarly: plantations for dune stabilization;
- But: primary intent is not wood production, so would not fall under FAO
- Better: leave management intent as a subset of plantation
- "Secondary Forest" concept needed? (in UNEP definition)
- but this definition is different from how used elsewhere
- little value added
- Suggest: CBD adopt FAO definition
    - and FAO add ITTO concept
    - ITTO broader, shorter, more open to interpretation
    - would be useful to have distinction between plantations for "wood production" versus other uses; recognizing that is more difficult to report
- FRA has gaps
- FAO includes afforestation and reforestation, which are loaded terms – but aren't all plantations either afforestation or reforestation anyway?

3. Semi-Natural Forest

Notes/Questions/Comments

- "Semi-natural" – is included again in FAO
- Do we really need to retain this term?
- Natural: indigenous, natural processes of regeneration, even if with human intervention
- Forget about semi-natural
- But: old plantations take on characteristics of natural over time, so need to keep the intermediate category. For example France: keeps 40 yrs as definition of plantation, after that is considered "semi-natural"
- Problem: the term semi-natural becomes a catchall – only Great Britain and France use it consistently. Problematic when used globally
- FRA: uses semi-natural within natural – but only sometimes....need another word?
- Age class system of categorizing is diminishing
- Clearcutting is phasing out in Europe, so don't get age class system anymore
- Boreal systems: is natural regeneration through fire – so clearcutting would mimic the fire process
- Keep semi-natural to imply human intervention?

Hierarchy Options

- Natural
- Semi-natural
- Plantation

Or

- Natural
  - Untouched
  - Semi-natural
- Plantation

Or

- Planted – ITTO
- Natural – FAO and FRA

- Discussion: Re: "secondary forest" concept (according to CBD)? – probably not at this point; can leave out here and it reads the same way
- *So, leave out word "secondary" in CBD? Stay with the FAO plantation
- Enrichment?
- "Natural" still retains natural regeneration at core

Recommendation

- Add to FAO: natural forests are (dominated by) naturally regenerated forests (largely or solely/uniquely composed?) of indigenous (define?) trees. (Still needs work)
- leave out "secondary" concept in CBD; Stay with the FAO plantation definition

(But: this is yet another definition)

- Land use aspects: If clearcut for agriculture, versus for wood production, and the forest comes back naturally, is it a "natural secondary forest"?
- secondary forest is clearly a natural forest

Conclusion

- Do need natural versus planted distinction:
- Reason: CBD needs it
- For KP: Is it still a question. The risk is replacement of natural stands with fast growing plantations
- But need to revisit under discussion of managed versus natural

Page 39- 41 - Primary, Undisturbed, Old Growth, Secondary, Degraded Primary

See: Figure 3 Blaser paper- largely appropriate structure

But – need separate evaluation of fire adapted systems. Fire not always a negative impact. Definitions need to address issue of forest condition when the natural fire regime is suppressed. Fuel build-up, excess stems per acre lead to "unnatural" conditions

Return to page 39:
1. *Old Growth:*
- where is it used in international conventions? Is it useful to CBD? No requirement to report at this time
- has political implications
- has biodiversity connotations
- is a specific successional state; other successional states also have value
- is it included within Primary?
- is it needed as specific class if only calls out certain characteristics, and alone does not sustain the ecosystem
- is it needed as a subset?
- there are some very good definitions that exist

2. *"Primary versus Secondary"*
- What about "Managed Primary"? (no)
- if primary = undisturbed by man, then there's not much of it

See: ITTO definitions – Blaser Table 1 as relevant to tropical forests

If we have a definition of "primary" forest, do we need a separate definition for "natural" forest?
- time dimension of 60 years?
- FRA page 39 "natural undisturbed by man" is equivalent for primary and old growth?
- Traditional lifestyles
- Don't need distinction between undisturbed and primary

Summary

- undisturbed and primary – don't need distinction
- primary forest is a subset of natural forests
- primary can be any age if disturbed by natural processes, i.e. not affected by human intervention
- old growth – is a subset of primary forest

Homework

- still need primary versus secondary discussion
- old growth as a subset?
- forest condition: do we need degradation?
- look at pg. 40-41
- management, degradation and naturalness as dimensions
- then tackle managed versus non-managed
- review Erik's table

Use three dimensions to assess these definitions: naturalness, management, and degradation

1. *Natural, semi-natural and plantation terms*
- Natural versus planted forests
- Preferred definitions of each:
- FRA: for "natural forests" with some modifications (bring text)

Planted forest definitions of ITTO
These are largely compatible

2. *Still need the concept of "semi-natural" forest*
- Concept of naturalness is related to regeneration
- Within planted forests: allow for semi-natural versus more intensively managed plantation

3. *Dealt with primary, undisturbed – essentially equivalent*

4. *Old growth:* See as subset of primary but needs more thinking as to what level to consider – in some counties is important and should not be lost, even if hard to apply

Summary

- undisturbed and primary – don't need distinction
- primary forest is a subset of natural forests
- primary can be any age if disturbed by natural processes, i.e. not affected by human intervention
- old growth – is a subset of primary forest

LOGBOOK 2 - September 12, 2002

1. Review proposed Framework – structure for management terms starting with natural versus planted

2. Review: Definitions related to degraded forests versus secondary – page 41

Discussion Issues

- What is the relationship between degradation and secondary forests
- Important concept in defining degradation involves resilience and elastic capacity to return to prior conditions. However, as noted by other Working Groups, resilience is operationally very difficult to measure

Discussion Points

- ITTO: degraded primary versus secondary forest (secondary = new succession)
- CBD: old forest etc - not that different
- Q: is secondary always related to some form of degradation?
- depends on forest type: heavy logging may not end up in degradation, but others could be – at least within reasonable time
- depends on definition of degradation: in soil type? In biodiversity? For example in Europe forests have been simplified
- look at work in prior meetings re degradation: pages 19 - 23 – do not revisit – related to provision of services
- ITTO: distinguishes between sustainable versus non sustainable, and relates to stand conditions and functions
- figure A: Useful construction (p. 41)
- Split FRA along lines of the ITTO definition
- Need box within FRA reflecting sustainable mgmt

Notes/Questions/Comments

- Box 4.5 (p. 19): CBD suggests if regeneration after large natural fire – is not degraded; versus forest that has been logged
- Also not valid: p 40 CBD "Secondary forest logged and recovered naturally or artificially"
- Secondary forest more used in tropical context
- Suggest: CBD use existing definitions elsewhere for Secondary, not invent new one
- semi-natural concept may be more useful
- Example of cleared for agriculture, abandoned, then forest recovered = Secondary
- And: Existing forest, logged, then regenerates to same type = Case A
  Existing, logged, then regenerates to different type = Case B
- CBD developed the definition to relate to biodiversity, but could be substituted for a better definition
- Q: In ITTO Secondary definition: Woody vegetation "re-growing"on land... ← Implies natural, not artificial. Would be a "planted" forest
- Aerial seeding with native seeds = still is Natural Forest in Australia – but is grey zone?
- Q: Can "regrowing" be enhanced by human activities
- is distinction bet management versus restoration of degraded forest

- in Secondary, do intervene – example balsa: work towards goal of maintaining it – but do not plant.
- Use natural regeneration capacity of the vegetation

Recommend

- that CBD use the ITTO Secondary definition. But instead of "re-growing", substitute "regenerated naturally" – to read:

  "Secondary forest = woody vegetation regenerated naturally on land that was totally (or at least 90%) cleared of its original forest vegetation
  - why not delete "totally"

Primary + secondary = natural
Versus Managed

- Not sure how UNEP 2001 fits with p. 54 January definition: did it change? Different generations of 2001 work?
- e.g. logged versus widely disturbed
- Q: does secondary forest derive only from primary forest? What about former plantation moving to secondary? Is there a time dimension?
- A: no, derives from any type of forest
- Secondary is predominantly used and appropriate in tropical context; time not important. Species composition is key.
- "regrowth forests" used in boreal
- Secondary tends to be even aged

See ITTO: **Table 1**: Major differences between the three major categories of degraded and secondary forests

- Use degraded primary and secondary columns
- Place into our framework in the natural forest column
- Still need to deal with managed column
- But secondary can also be managed
- Q: is age a factor?
- A key factor in secondary is species composition? But not as relevant as how it was established
- Differentiate with primary: example tropical dominated by wildfire and regenerated in native species
- ITTO primary versus secondary: Are not consistent with other conventions which use human disturbance as determinant – How far does primary extend?
- FRA: reports on forest destroyed per year – but what about regrowth? So, used concept of Secondary

3. Visit terms related to MANAGED FORESTS vs. UNMANAGED: p. 23 in Draft Analytical Framework

See: Table 4.3 of parameters (this topic more developed in draft analytical framework than others)

- First: be clear what you're managing for: wood products, biodiversity, watershed protection, soil stabilization, managing the "forest"
- Suggest: We're talking about managing the "forest"

Box 4.6: Different viewpoints:

- Don't see major inconsistencies bet. FAO, ITTO,UNFCC, IPCC – vary only by depth of detail
    - ITTO – OK
    - FAO: adds other wooded land
    - ITTO: adds changes in species composition

- On forest management question: are we talking about management for wood? Or mgmt of forest land to provide a range of goods and services – e.g. a range of biodiversity functions
    - ITTO: doesn't address management of planted forest
    - IPCC: more process oriented, not status
    - Differentiate bet Sustainable versus Unsustainable management

- ITTO: Implies some degree of degradation and spp change "have resulted in changes to forest structure and spp composition": but could retain the same spp composition and still be managed
- Need a time dimension: clearcut and no followup – is that "management"
  FAO – no reference to sustainability; ITTO does

- What about Management Planning: Is this management? Or, just focus on forest management that produces products? Eg National parks not "managed for products"- but do have a management Plan designating uses and activities (e.g. recreation, fire protection)
  Response: There are 2 schools – we won't answer this issue here

ITTO takes Primary first, then defines Mgmt of other services like wildlife –
If Primary vs. Managed: always have change in structure
e.g. Chilean forests: are mapped, have the information to start management, but haven't started yet.

- For what purpose are we classifying? To focus on the fact of a decision being made with some objective? Or the physical alteration itself?
- In carbon context: Definition related to establishing a credit. UNFCC definition is meant to be neutral (?)
  ITTO – focuses only on natural forest mgmt

- Forest Management versus Managed Forests
  - also possible subcategory: "Forest available for wood supply" = area used for timber production
  - Public wants to know this
  - Managed forest is land subject to forest management as described in UNFCCC

- If UNFCC is chosen, then foresters will still need their terms for forest operations and mgmt planning. Can do forest operations without a systematic, adopted plan.
- Propose: similar to existing framework approach: divide into management with vs. without a plan, and where logging can take place
- Legality an aspect: for loan, certification, incentives – need to have a legally approved plan first to qualify.
- In German: the word Management doesn't exist – relationship to "Administration" term; French and Spanish too: e.g. gestion vs. manejo. FAO allows for formal versus informal plan
- Carbon credit context: Only when improvement in carbon? (No baseline in 1st commitment period). All managed forests can be considered for carbon credit, but need an improvement If consider parks with no logging, can still result in increase in carbon stock – so broad definition of mgmt is acceptable
- In attempt to harmonize and simplify: If UNFCCC is good definition, then can do away with the others. Still need to consider whether sustainability dimension is included.
- Still need to define "unmanaged" and "protected areas"; also good idea, "area availability for wood supply" – and for recreation, wildlife.... at a second and third level
- Reporting: protected areas were reported separately
- Possible dimensions in terms of framework: Unmanaged versus Mgmt – then subdivisions within management. Still have the 2 schools: with a plan, with or without planting, etc Secondary can be managed or unmanaged; protected area management; carbon mgmt; adoption of formal versus informal plan (legality aspect); tropics versus non-tropics; is extensive fuelwood extraction management;
- Unmanaged? Free-range, communal forest (=unmanaged or managed?) vs. forest protected by law.
- Include dimension of Formal versus informal planning – traditional community/family plan versus formally adopted, administrative plan – what counts? Eg France: 42%formal plan versus 70%informal plan. But "informal plan" casts a big net

4. Consider now: UNMANAGED term

- Do we need a definition of unmanaged? It makes no sense. There is nothing left that is "unmanaged" – decisions are made for almost all areas of globe -
- Area with no management = only remote areas of boreal Russia or Canada left
- Adding term "sustainable" just adds a "straight jacket" – can never agree on a definition
- Obligations for this term come from context of carbon: There were attempts to define categories of management, but was abandoned, and this was final compromise. One of countries wanting an Unmanaged term was related to problem of fires – didn't want to be responsible for that impact
- Is it possible to change UNFCCC to deal with sustainable term? How and when to assess sustainability?

Challenge: formulating and formalizing relationships across categories
-e.g. is all planted forest managed?

5. Still struggling with "Managed Forests"

Proposal: Are all planted forests Managed Forests?
Review ITTO graphic Figure 3 re Formation of Forest types

- Management refers to some series of activities
- Is timber extraction a managed forest? May be unsustainable or not

Issue: UNFCCC concepts
- supposed to be a neutral objective
- Good Practice Guidance needs to show how to implement in practice
- Countries will need to determine individually if practices are sustainable in their own terms
- Here we could ID issues left for resolution

Options:
- Should Notion of Sustainability be incorporated into Management definition?

Nested concept

Scheme 1

-Managed versus Unmanaged = Intervention versus Non intervention
Managed with plan vs. without plan
Managed only for wood versus other environmental services
-Sustainable versus non-sustainable

Another scheme:

Intervention (= Management?) = Suite of Practices?
Unplanned, uncontrolled versus Planned, Controlled
But is there such a thing as an "unplanned intervention" – since have made a decision with forethought
e.g.: community fruit taking in forests; cork oak in Portugal - traditional

Still the fundamental issue of the Planning dimension – does taking a decision mean it is managed?; and, do you need to have a person as a manager?

Kyoto context:
"Forest land management is parallel to crop land management is parallel to grazing land management"
But: there is issue that "Forest Land" (as a legal designation) is not necessarily = "Forested Land" (relating to tree cover) –
So, we abandoned this path

Back to Options, pg. 24
-can management include non-intervention or not
Still stuck on fundamental issue

Keenan Scheme: See easel graphic "Proposal 1"
Buchwald Scheme: See easel graphic "Proposal 2"

How does FAO FRA deal with issue of "Management"?

Peter Holmgren's comments:
- "Managed or not" is no longer a very useful concept:
- Essentially, all forests now left in world have had some sort of a management decision made about them

More useful construct: What is the management objective?
-then, What kind of plan is it, esp. in terms of wood production? Formal versus informal plan; approved or not approved by some authority; written by RPF vs. small landowner plan in his head; - varies by locality. Existence of plan is critical

-then, FRA wants to use the Criteria to subdivide:
e.g. How much is managed for protective functions, production functions, and social functions
And what is the trend over time?
And is it sustainably managed or not?
Illegal logging then is "management" – but not good management; not consistent
Consider Reporting feasibility:
-Make use of 50-80 years of existing data

Proposal: Recommend a new definition for the FRA that is reasonably consistent with UNFCCC (Keenan suggestion)
Proposal:
Forest management is the process of evaluating options, deciding, and implementing practices for {stewardship and <-- in Kyoto} use of forest aimed at fulfilling {relevant ← in Kyoto} ecological, economic and social functions of the forest.
For example, this can include production of wood and non-wood forest products, biodiversity conservation, soil conservation or watershed protection.
{ Management can be controlled and undertaken in accordance with an agreed code of practice or certification process, or uncontrolled where the continued flow of goods and services may not be sustained.}

Options
- eliminate second paragraph
- or expand to include more exhaustive list
- Insert: "the process for evaluating options",
- FRA: includes unsustainable management
- UNFCCC: does not include " "
- Message: Management is controlled or uncontrolled
- Watershed protection versus protective?
- {} – include or not
- Is it possible to determine if management is sustainable or not when doing reporting?
- Add in "goods and services"
- Montreal, Pan European, ITTO versions.... FAO didn't have one

Another Proposal: ITTO version – Relevant to Tropical Forests
Definition of Managed Forests
- Managed Forests: Land subject to forest management (UNFCCC 2001)
- Forest management is the process of considering options, deciding and implementing practices for stewardship and multiple use of forest aimed at fulfilling relevant ecological, economic and social functions of the forest.

- Forest Management:
Forest management is the process of managing forest to achieve one or more clearly specified objectives with regard to the production of ~~a continuous flow of~~ desired forest goods and services.

We need to harmonize our own proposals: basic goal is to define the Area of management

Summary Comments:

- We still disagree on the issue of whether or not "Managed versus Unmanaged" is a useful concept

- Peter's approach: Managed or not is no longer a very useful concept:
- Essentially, all forests now left in world have had some sort of a management decision made about them

- But the concept of "Managed vs. Unmanaged" is ingrained and has strong defenders

- Need 3 classes

1) Unmanaged, undisturbed by man
2) Sustainably managed - monitoring component may be important
3) Disturbed by humans, but cannot say if is sustainably managed or not

- Need the concept of Planning Actions
  - -The existence of planned intentions characterizes a Managed forest
  - -Plan can be either a written and registered document – or in a landowners head (FRA says formal or informal plan)
  - -Planned actions must be "legal" to be considered as management

<u>Issues raised by Other Workgroups</u>

1. Plantations-Plantations are forests – yes or no
2. Degraded Forest

- Degraded forests don't exist – yes or no - since elastic capacity of forest ecosystem has been altered cannot restore original condition/regenerate to
- Term of "degradation" denotes process, but is not very useful for forest, they are a continuum (undisturbed, modified etc)

ITTO Box B pg. 40: Degraded primary forest refers to a specific situation with reference

- Replacement of endemic species is an indicator of degradation

RECOMMENDATIONS re: MANAGED vs. UNMANAGED FORESTS

1. Managed Forests are lands subject to forest management. Globally, nearly all forests have been subject to some form of human decision-making with regard to their management.

2. We generally support this definition which is slightly modified from UNFCCC (2001): "Forest management is 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. (Add from ITTO): For example, this can include production of wood and non-wood forest products, biodiversity conservation, soil conservation or watershed protection."

-Also include? Does this clarify?:
"Planning involves identifying goals and objectives, evaluating options, and deciding etc…
"Management can be sustainable or unsustainable. Ideally, all forests should be managed sustainably. Management can be controlled and undertaken in accordance with an agreed code of

practice or certification process, or uncontrolled where the continued flow of goods and services may not be sustained."

3. The word Sustainable should be added to the UNFCCC definition of Forest Management if UNFCC does not change their definition to conform to Recommendation #2

4. FRA should develop a typology for Management Objectives as a basis for reporting on the status of areas under different kinds of forest management

5. FRA should consider adopting Recommendation #2 definition

ANNEX 1

Box 1: Categories of Forests in the Tropics[28]

PRIMARY FOREST[29]
(virgin forest, old-growth forest, closed forest, pristine forest)
Forest which has never been subject to human disturbance, or has been so little affected by hunting, gathering and tree cutting that its natural structure, functions and dynamics have not undergone any changes that exceed the elastic capacity of the ecosystem.

MODIFIED NATURAL FOREST
Primary forests managed or exploited for wood and/or non-wood forest products, for wildlife or other purposes. The more intensive the use, the more the structure and composition is altered from that of the primary forests. Ecologically, the change often represents a change to an earlier successional stage. Two major categories can be distinguished:

MANAGED PRIMARY FOREST:
Primary forest in which sustainable wood and non-wood harvesting (e.g. through integrated harvesting and silvicultural treatments), wildlife management and other uses have resulted in changes of forest structure and species composition. All major goods and service functions are maintained intact.

DEGRADED AND SECONDARY FORESTS:
A generic term comprising all those forests or forest lands that have been altered beyond the normal effects of natural processes through unsustainable use through human activities or natural disasters such as fire, landslides, etc. Three different conditions can be distinguished:

- DEGRADED PRIMARY FOREST:
The initial forest structure, productivity and species diversity of the primary forest has been affected by excessive and wood extraction and/or by such an intensity of harvesting of non-wood forest products that its capacity to provide goods and services has been impaired.
- SECONDARY FOREST:
Woody vegetation spontaneously regrowing on land that was largely cleared of its original forest vegetation.
- DEGRADED FOREST LAND:
Former forest land severely damaged by excessive harvesting of wood and/or non-wood forest products, poor management, repeated fire, grazing or other disturbances and land uses that damage soil and vegetation to a degree which inhibits or severely delays forest re-growth after abandonment.

PLANTED FOREST
A forest stand that has been artificially established by planting or seeding:

- Afforestation: establishment of a planted forest on non-forested land.
- Reforestation: re-establishment of trees and understorey plants at a site immediately after removal of natural forest cover.
- Enrichment planting (assisted regeneration, complementary regeneration): planting of desired tree species in a modified natural forest or secondary forest or woodland with the objective of creating a high-forest dominated by the desired species, often local and/or of high-value.

[28] The terms used in these Guidelines are based on ITTO forest categories (see also Appendix 8).
[29] Forests that are used by indigenous and local communities with traditional lifestyles consistent with the conservation and sustainable use of biological diversity are included in this category (Convention on Biological Diversity).

Table 1: Major differences between the three major categories of degraded and secondary forests

	Degraded primary forest	Secondary forest	Degraded forest land
Intensity of disturbance	▪ Slight to moderate intensity within a range of common natural disturbances	▪ Severe intensity, caused by the clearing of at least 90% of the original forest cover	▪ Drastic and repeated intensity with complete removal of the forest stand, loss of topsoil, and change in microclimate
Common causes of disturbance (human-induced or natural)	▪ Excessive wood exploitation, ▪ Over-harvesting of NWFP ▪ Destructive natural disturbances such as forest fires, storms ▪ Over-Grazing	▪ Clear-cutting, burning and subsequent abandonment of area ▪ Catastrophic large-scale natural disturbances: fire, flooding, storms, landslides.	▪ Repeated over-use, repeated fire, grazing, or ecological mismanagement on fragile soils ▪ Soil erosion
Vegetation development process	▪ Relatively small changes in processes, growth and regeneration dynamics except where over-grazing prevents natural regeneration ▪ Relic trees are often damaged (crown, stem), or are potential "losers" unable to achieve dynamic regrowth or are phenotypically inferior ▪ Recovery mainly through autogenous and spontaneous cycle replacement regeneration, usually complemented by coppice and seed bank ▪ Species composition change with over-exploitation of timber ▪ Successional changes are limited to more intensively affected areas	▪ A sequence of successional changes takes place after the perturbation. In this process several phases or stages with specific floristic, structural and dynamic characteristics can be distinguished. Plant species composition changes in dominance gradually from early to late successional species ▪ Start of a highly dynamic growth process, with high rates of carbon assimilation and biomass aggregation	▪ There is only very sluggish successional development after the cessation of the main disturbance. ▪ The process generally leads directly from forest cover to grassland or bushland, or, in extreme cases, to barren soil surfaces.
Characteristics:	▪ Forest structure not significantly damaged ▪ In forests subject of over-grazing, poor understorey development and absence of young age classes of the canopy species ▪ Light-demanding species regenerating after the disturbance are usually similar to those in the original forest stand	▪ Regrowing forest differs in species composition and in physiognomy from primary forest. Species are highly light demanding	▪ Forest vegetation is lacking; single or small groups of pioneer trees and shrubs may or may not occur

ANNEX 2

RELATED DEFINITIONS FROM OTHER ORGANIZATIONS AND PROCESSES

Primary forest

UNEP/CBD/SBSTTA 2001	A forest that has never been directly disturbed by humans and has developed following natural disturbance and under natural processes, regardless of its age. The term includes forests used inconsequentially by indigenous and local communities living traditional lifestyles. ["Direct human disturbance" means the intentional clearing of forest by any means (including fire) to manage or alter the forest for human use].
FAO 1998	*Natural forest undisturbed by man* – Forest which shows natural forest dynamics such as natural species composition, occurrence of dead wood, natural age structure and natural regeneration processes, the area of which is large enough to maintain its natural characteristics and where there has been no known human intervention or where the last significant human intervention was long enough ago to have allowed the natural species composition and processes to have become re-established.

Old-growth forest

US Forest Service	Is an ecosystem distinguished by old trees and related structural attributes? Old-growth encompasses the later stages of stand development that typically differ from earlier stages in a variety of characteristics, which may include tree size, accumulations of dead woody material, the number of canopy layers, species composition, and ecosystem function. Old-growth is not necessarily synonymous with virgin or primeval, and could develop following human disturbance.
UNEP/CBD/SBSTTA 2001	Is a primary or a secondary forest which has achieved an age at which structures and species normally associated with old primary forests of that type have sufficiently accumulated to act as a forest ecosystem distinct from any younger age class?

Degraded (primary) forest

UNEP/CBD/SBSTTA 2001	A secondary forest which has permanently lost, or is unlikely to regain, the structure, function, species composition, or productivity normally associated with a natural forest type expected on that site. Hence a degraded forest delivers a reduced supply of goods and services from the given site and maintains only limited biological diversity.
FAO 1998	Natural forest disturbed by man – Includes (i) logged-over forests associated with various intensity of logging, (ii) various forms of secondary forest, resulting from logging or abandoned cultivation.

Secondary forest

UNEP/CBD/SBSTTA 2001	A forest that has been directly disturbed by humans and has recovered naturally or artificially.
Chokkalingam & de Jong 2001	Forests regenerating largely through natural processes after significant human and/or natural disturbance of the original forest vegetation at a single point in time or over an extended period, and displaying a major change in forest structure and canopy species composition.

Degraded forest land

Brown & Lugo 1994	Lands are described as degraded when their edaphic conditions and/or biotic richness have been reduced by human activity to such a degree that their ability to satisfy particular uses has declined.

Forest degradation

FAO 2000	A reduction of the canopy cover or stocking within the forest through logging, fire, windfelling or other events, provided that the canopy cover stays above 10%. In a more general sense, forest degradation is the long-term reduction of the overall potential supply of benefits from the forest, which includes wood, biodiversity and any other product or service.
UNEP/CBD/ SBSTTA 2001	A *degraded forest* is a secondary forest that has lost, through human activities, the structure, function, species composition or productivity normally associated with a natural forest type expected on that site. Hence, a degraded forest delivers a reduced supply of goods and services from the given site and maintains only limited biological diversity.
Lamb 2001	A loss of forest structure, productivity, and native species diversity. A degraded site might still contain trees (i.e., a degraded site is not necessarily deforested) but it has lost at least some of its former ecological integrity.

Deforestation

FAO 2000	The conversion of forest to another land use or the long-term reduction of tree canopy cover below the 10% threshold.
FCCC 2001	The direct human-induced conversion of forested land to non-forested land.

Reforestation

FAO 2000 (UNEP/CBD/ SBSTTA 2001)	The re-establishment of forests after a temporary (<10years) condition with less than 10% canopy cover due to human-induced or natural perturbations.
FCCC 2001	The direct human-induced conversion of non-forested land to forested land through planting, seedling and/or the human-induced promotion of natural seed sources, on land that was forested but that has been converted top non-forested land.
Lamb 2001	The reestablishment of trees and understory plants at a site previously occupied by forest cover.

Afforestation

FAO 2000 (= UNEP/CBD/ SBSTTA 2001)	The conversion from other land uses into forest, or the increase of the canopy cover to above the 10% threshold.
FCCC 2001	The direct human-induced conversion of land that has not been forested for a period of at least 50 years to forest land through planting, seeding and/or the human-induced promotion of natural seed sources.

Forest improvement

FAO 2000	The increase of the canopy cover or stocking (FAO 2001) of the forest through growth. In a more general sense (cf. forest degradation) forest improvement is the long-term increase of the overall potential supply of benefits from the forest, which includes wood, biodiversity and any other product or service.

Working Group 4: Forest Classification and the International Process

There is a great variety of forests worldwide. To study, assess or manage them many classifications have been, or continue to be developed. They depend on the objectives and geographic levels (from global to local) of the study/assessment/management of forests and on the tools being used (e.g. remote sensing).

With regard to the ongoing international processes two main issues related to forest classification are identified:

1. do these processes need differentiated definitions (incl. thresholds) of the core terms (forests, afforestation, reforestation, deforestation, degradation) per forest class (yes (Y) or no (N) in the third column of the matrix below); and,
2. do these processes need forest classification systems for their implementation (yes (Y) or no (N) in the forth column of the matrix below).

It is recognised that for the sake of reporting consistency among countries and over time, and to facilitate data compilation, there should be one global definition for each core term (with the possible exception of degradation; see also footnote 3), but countries are/should be free to report on more disaggregated levels. It is also recognised that different processes may need, in addition to the global definition, qualifiers to describe aspects specific to their objectives. In choosing classification systems and definitions the feasibility for countries to collect and analyse the data required should be taken into account.

Re. 1: the third column of the matrix shows there is no need for differentiation of the definitions of the core terms by forest class for the various processes, with the possible exception of the term degradation (see footnote 3 in the matrix).

Re. 2: currently some of the international processes use forest classification systems in their work. In the forth column it is indicated that there is scope for *all* processes to use forest classifications. Conclusions and recommendations on the general use of forest classifications by the international processes (as distinct from the specific use for differentiation of definitions) are:

4. All processes to use as a first order classification the FAO global ecological zoning, which is based on a higher hierarchical level on domains (tropical, subtropical, temperate, boreal, polar).
5. A further breakdown in forest types may be desirable for some of the processes but is not necessary for others.
6. A possible additional level or classification could be based on forest function: production, protection, ecology, social, historic, spiritual.

Matrix

	Objective (see also table 3.1)	Do these processes need differentiated definitions per forest class, incl. thresholds?[a]	Do these processes need forest classification systems?[30]
FRA	stock-taking and estimate goods and services from forests (economic, social and environmental).	N	Y
CCD[31]	combating land degradation	N?	Y?
CBD	conserve biodiversity[32]	N?[33]	Y
FCCC[34]	mitigate and adapt to climate change (more than just carbon stocks)	N?	Y
UNFF[35]	sustainable forest management	N	Y[36]
IUFRO[37]	promotion of research on forests and trees and exchange of information	n.a.	n.a.

[a] For instance: the minimum crown cover for tropical rainforest is X% and for boreal coniferous forest Y%.

Two additional more specific recommendations were identified.

a) Currently in the FRA areas that are "temporarily unstocked" (for whatever reason) are included in the area statistics for different land categories. However, such areas can be significant. Therefore, ideally such figures should be provided separately; and,
b) Original country data and definitions provided in national reporting should be used in synthesis reports and data sources should be available to illustrate where the processed data come from.

Follow-up steps

- Request the UNFF, FAO, CCD, CBD, and FCCC to jointly explore the possibility of adopting one common first order forest classification system as the basis for reporting.

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30 For instance, within one forest domain various carbon content values could/should be available for the different forest vegetation structures within that domain.

31 As far as the CCD is concerned no systematic reporting on land degradation seems to be contemplated at this stage; only general guidelines on information collection, analysis and exchange are provided in article 16.

32 In the analytical framework document it is stated that the CBD uses definition of ecosystem but that this is hard to apply as basis for forest classification.

33 No clear view whether a definition for degradation would call for differentiation of this definition per forest class.

34 Definitions are set for the first commitment period (2008-2012) when or if the Kyoto Protocol comes into force. This question is answered with possible future commitment periods in mind.

35 Country reporting is voluntary and the process of monitoring, assessment and reporting is not clearly defined yet.

36 Yes, when using C&I.

37 IUFRO has no reporting obligation but has a mandate to harmonise research terminology using concept-oriented approach.

- In doing so, contributions could be made by CPF members and other international/regional organisations and/or bodies such as IUFRO, IPCC, etc.
- Feed the outcome of this harmonization process into the various processes, not just by circulating the brief but by organising session in the margins of e.g. negotiation sessions.
- Requests Parties to the international processes through their own appropriate communication channels to ensure good coordination at the national level between stakeholders of all the international processes.
- Request the secretariat of the harmonization process to be involved in the work of the various processes on the issue of degradation to ensure appropriate consideration of the concerns expressed in the meeting.
- Request all Parties to the FCCC, through the secretariat of the FCCC, to invite comments on the drafts of the Good Practice Guidance and Inventory Guidelines, due December 2002 and spring 2003, of representatives of the other international processes to ensure that this document does not preclude or impair the harmonization process.

Suggestions to the organizers in preparing their report

- Terms used in the report of the meeting should be clearly referenced, explained, described, defined (provide glossary).
- Have a separate short and concise summary brief in addition to the proceedings of the meeting.
- Circulate reports extensively amongst workshop participant before finalizing them.

Working Group 5: Forest Definitions - Special needs and requirements of countries with low forest cover and unique types of forest (LFCCs)[38]

- General forest definitions agreed upon as applicable to all countries and types of forest will also apply to LFCCs. For example, FAO definitions applied in FRA would apply equally to LFCCs

- Trees outside forests (TOF) play a large and significant role in LFCCs. Therefore special attention should be given to the inclusion of TOF in national forest assessments in LFCCs. Failing to do so would give a wrong picture of the importance of woody vegetation in terms of energy, biological diversity, carbon sequestration, contribution to sustainable livelihoods, etc.

- The classification (labelling) of a country as a low forest cover country may have political implications that cannot be foreseen at the moment. For example, if a country is labelled as a LFCC would this lead to restrictions for the international marketing of forest products including non-timber forest products (NWFPs), would it increase chances of receiving financial and/or technical assistance, would it increase/reduce opportunities for support from the GEF, the World Bank, The Clean Development Mechanism (CDM) of the Kyoto Protocol, etc.

- Until further clarification is gained on the above and as a "working definition" LFCCs have generally accepted that if forest cover – as defined by FRA2000 – is less than 10% of the country's territory, then the country can be considered a LFCC.

- Forest classifications according to Ecological Domain, Ecological Zones, and Forest Types are valid also for LFCCs. However, because in many cases there will be very little forest left to actually manage, it is essential to introduce a further dimension, i.e. Process. The "process" classification would describe the reasons for the present situation, and could include the following: desertification (due to human impact or climate change); urbanization; overuse (overgrazing, overcutting, etc.); regeneration; migration; etc.

- There is a need to consider fragile ecosystems (arid lands, mountains) in LFCCs as well as unique types of forests.

- The working group considers that there is a need for further work on forest definitions in relation to LFCCs both in the context of follow-up to the Second Expert Meeting and in the context of the Tehran Process.

[38] With reference to the Tehran Process and the Tehran Declaration, Tehran, October 1999.

ANNEX VII
BACKGROUD DOCUMENTS

I. Published Definitions of Forest and Land Use/Cover and Related Terms

Gyde Lund

A collection of definitions on Aggradation, Cropland, Degradation, Degraded, Desertification, Devegetated/Devegetation, Disturbance/Disturbed, Forestry, Fragmentation, Grassland, Improvement, Land Cover, Land Use, Natural Forest, Non-forest, Old Growth Forest, Plantation Forest, Primary Forest, Rangeland, Reclamation, Regeneration, Rehabilitate/Rehabilitation, Reinstate, Restoration, Restore/Restored, Revegetate, Revegetation, Secondary Forest, Semi-natural Forest, Stocking, Sustainable Forest Management, and Woodland.

AGGRADATION

1. **(Land)** - Building up of land surfaces by sedimentation or deposition of mineral matter. The depositional process itself. The growth of a permafrost area.
   http://courses.washington.edu/esc110a/environmentalglossary.html
2. **(Streambed)** - A progressive buildup or raising of the channel bed and floodplain due to sediment deposition. The geologic process by which streambeds are raised in elevation and flood plains are formed. Aggradation indicates that stream discharge and/or bed-load characteristics are changing. Opposite of degradation.
   http://www.tpwd.state.tx.us/texaswater/rivers/glossaryleft.htm
3. **(Streambed)** - The process of building up surfaces, such as stream-beds or floodplains, by the deposition of sediment and/or colluvium. http://140.211.62.101/streamwatch/glossary.htm

CROPLAND

1. A *Land cover/use* category that includes areas used for the production of adapted crops for harvest. Two subcategories of cropland are recognized: cultivated and noncultivated. Cultivated cropland comprises land in *row crops* or *close-grown crops* and also other cultivated cropland, for example, hayland or pastureland that is in a rotation with row or close-grown crops. Noncultivated cropland includes permanent *hayland* and *horticultural c.*
   http://www.wv.nrcs.usda.gov/nri/glossary.html
2. An area that has been tilled for the planting of crops.
   http://www.terraindata.com/Pages/definitions.html
3. Includes harvested cropland, land with failed crops (some cropland not harvested due to lack of labor or low market prices is also considered as crop failure), cultivated summer fallow, cropland used only for pasture, and idled cropland.
   http://www.us-ecosystems.org/croplands/extent/technotes.html
4. Includes: All land from which crops were harvested or hay was cut. All land in orchards, citrus groves, vineyards and nursery and greenhouse crops. Land in rotational pasture and grazing land that could have been used for crops without additional improvements. Land used for cover crops, legumes, and soil improvement grasses, but not harvested and not pastured. Land on which crops failed. Land in cultivated summer fallow.
   http://www.assessor-blm.com/farm_property_assessment_complaint.pdf

5. Land covered with agricultural crops.
http://www.eapap.unep.org/lc/cd/html/training/module1.html

6. Land currently tilled, including cropland harvested, land on which crops have failed, summer fallowed land, idle cropland, cropland planted in cover crops or soil improvement crops not harvested or pastured, rotation pasture, and cropland being prepared for crops, or newly seeded cropland. Cropland also includes land planted in vegetables and fruits, including those grown on farms for home use. All cultivated (tame) hay is included as cropland. Wild hay is excluded from cropland and included in pasture and range. www.state.nv.us/cnr/ndwp/wat-plan/pt2-sec6.pdf

7. Land devoted to the production of cultivated crops. May be used to produce forage crops (cf. forage crop, I.2.).
http://www.forages.css.orst.edu/Topics/Pastures/Grazing/Terminology/grazterm_body.html#I

8. Land devoted to the production of cultivated crops. May be used to produce forage crops for mechanical harvest or grazing. (cf.) forage crop (2.1.3.).
http://www.pwrc.usgs.gov/brd/DefLandTerms.htm

9. Land under cultivation within the past 24 months, including orchards and land in soil-improving crops but excluding land cultivated in developing improved pasture. Also includes idle farmland.
http://www.srs.fs.fed.us/sustain/report/appendix/glossary.htm

10. Land used for the production of adapted crops for harvest, alone or in rotation with grasses and legumes, and includes row crops, small grain crops, hay crops, nursery crops, orchard crops and other similar specialty crops. Land use for facilities in support of cropland farming operations which are adjacent to or an integral part of these operations is also included for purposes of these land use categories. http://dnr.state.il.us/mines/lrd/guides/citrec7.htm

11. Land used primarily for the production of row crops, close-growing crops, and fruit and nut crops. It includes cultivated and noncultivated acreage, but not land enrolled in the Conservation Reserve Program http://www.nasda.org/joint/farmbill/dictionary.html

12. Cropland and Pasture - Those ecosystems that are modified or created by man to produce agricultural crops (e.g., corn, wheat, soybean) and/or to be used for pasture. This includes harvested cropland, cultivated summer-fallow and idle cropland, land on which crop failure occurs, cropland in soil-improvement grasses and legumes, cropland used only for pasture in rotation with crops, and pasture on land more or less permanently used for that purpose. (Definition Source: A Land Use and Land Cover Classification System for Use with Remote Sensing Data) http://www.hq.nasa.gov/iwgsdi/Agricultural_Land.html

DEGRADATION

1. A decline to a lower condition, quality, or level.
http://www.dictionary.com/cgi-bin/dict.pl?term=degradation

2. A decrease in value for a designated use.
http://www.tpwd.state.tx.us/texaswater/rivers/glossaryleft.htm

3. A worsening of quality or condition. http://www.sitesalive.com/admin/glossary/sectD.html

4. Changing to a lower state (a less respected state).
http://lookwayup.com/lwu.exe/lwu/d?s=f&w=degradation

5. Diminution or reduction of strength, efficacy, or value; degeneration; deterioration. http://www.mso.anu.edu.au/~ralph/OPTED/v003/wb1913_d.html
6. The act or process of degrading (lowering to an inferior level) WWWebster Dictionary.
7. The process by which something is made worse, especially the quality of land. http://dictionary.cambridge.org/define.asp?key=degradation*1+0
8. The process of degeneration. http://www.gn.apc.org/LivingEarth/RainforestDB/glossary.a-e.html#climax_forest
9. The reduction in grade, quality, yield, etc. http://www.forestry.utoronto.ca/ac_staff/emeritus/My%20Webs/english.htm
10. To spoil or destroy the beauty or quality of. http://dictionary.cambridge.org/define.asp?key=degrade*2+0
11. **(Biological)** - A type of soil degradation consisting of the mineralization of humus and an increase in the activity of micro-organisms responsible for organic decay, resulting in an overall decrease in organic matter. http://www.unu.edu/env/plec/l-degrade/index-toc.html
12. **(Biological)** - The diminution of biological productivity or diversity. (Sargent and Lowcock 1991)
13. **(Chemical)** - A number of types of soil degradation that may involve one or more of the following processes: leaching of nutritive elements; acidification; toxicities, other than excess of salts. http://www.unu.edu/env/plec/l-degrade/index-toc.html
14. **(Ecosystem)** - Any process or activity that removes or lessens the viability of ecosystem functions and processes, and hence biodiversity. Dunster & Dunster 1996.
15. **(Ecosystem)** - Processes or activities that weaken an ecosystem, adversely affecting biological diversity. http://www.nature.nps.gov/nrbib/HTML%20files/32.htm#3152
16. **(Environmental)** - Exhaustion or destruction of a potentially renewable resource such as air, water, forest, or wildlife by consuming it at a rate faster than it is naturally renewed. If such use continues, the resource can become nonrenewable or nonexistent on a human time scale. Also see sustainable yield. http://www.geog.ouc.bc.ca/conted/onlinecourses/enviroglos/e.html
17. **(Environmental)** - The process by which the environment is progressively contaminated overexploited and destroyed. (Source: RRDA) http://oaspub.epa.gov/trs/trs_proc_qry.alphabet?p_term_nm=D
18. **(Forest - Semi-natural)** - A subset of semi-natural forests with some of the principle characteristics and key components of native ecosystems; a return to a semi-natural forest is unlikely to occur in a reasonable amount of time (i.e., decades) without human intervention. http://www.fscus.org/html/about_fsc/who_we_are/glossary_of_terms.html#d
19. **(Forest)** - A long-term reduction of tree crown cover towards but not exceeding the minimum accepted 'forest' threshold. IPCC (draft version developed by a Task Force) FAO. 2002. Draft Analytical Framework on Forest-Related Definitions.
20. **(Forest)** - A reduction of the canopy cover or stocking within the forest. Explanatory note: For the purpose of having a harmonized set of forest and forest change definitions, that also is measurable with conventional techniques, forest degradation is assumed to be indicated by the

reduction of canopy cover and/or stocking of the forest through logging, fire, windfelling or other events, provided that the canopy cover stays above 10% (cf. definition of forest). FAO 2000

21. **(Forest)** - A reduction of the canopy cover or stocking within the forest through logging, fire, windfelling or other events, provided that the canopy cover stays above 10%. In a more general sense, forest degradation is the long-term reduction of the overall potential supply of benefits from the forest, which includes wood, biodiversity and any other product or service. FRA 2000. FAO. 2002. Draft Analytical Framework on Forest-Related Definitions.

22. **(Forest)** - Biological, chemical or physical processes which result in the loss of the productive potential of natural resources in areas covered by forests and/or used by agriculture. Degradation may be permanent, although some forest areas may recover naturally or with human assistance http://europa.eu.int/comm/dg08/forests/en/en4_6.htm and http://yahwood.com/glossary_uk.htm

23. **(Forest)** - Change of forest class (from closed to open forest) which negatively affects the stand or site and lowers production capacity. Degradation is not reflected in the estimates of deforestation http://europa.eu.int/comm/dg08/forests/en/en4_6.htm

24. **(Forest)** - Changes within the forest class which negatively affect the stand or site and, in particular, lower the production capacity. Thus degradation is not reflected in the estimates of deforestation. http://faov02.fao.org:70/0gopher_root%3a[fao.fra]def_uk.txt

25. **(Forest)** - Changes within the forest class, for example, from closed to open forest, which negatively affect the stand or site and, in particular, lower the production capacity. These lands are considered apart from deforestation. FAO 1997.

26. **(Forest)** - Generally defined as a reduction in tree density and/or increased disturbance to the forest that results in the loss of forest products and forest-derived ecological services. http://www.wri.org/pdf/indoforest_glossary.pdf

27. **(Forest)** - Temporary or permanent reduction in the density, structure, species composition or productivity of vegetation cover. Grainger 1996.

28. **(Forest)** - The degradation of forest environments, through processes such as destructive logging, burning, or invasion of disturbed habitats by weedy or less useful exotic species. http://www.spcforests.org/Library/usestatus/usestatus.htm

29. **(Forest)** - The degradation or impoverishment of forests, measured in terms of loss of biodiversity (which includes genetic, species and ecosystem diversity) and economic, cultural and ecological utility and stability, resulting from the selective removal of trees or other forest plant and animal species. http://www.spcforests.org/Library/usestatus/usestatus.htm

30. **(Forest)** - The ecologically deleterious depletion by human activity of standing woody biomass and organic matter in forests, often associated with over-utilization of the forest for fuel or timber.
http://www.usask.ca/agriculture/caedac/dbases/glossary.htm,
http://www.climateservices.com/glossary.htm,
http://www.undp.org/seed/forest/pdf/InnovatForesFinanc.pdf,
http://www.teleport.com/~taa/glossary.htm

31. **(Forest)** - The long-term reduction of the overall potential supply of benefits from the forest, which includes wood, biodiversity and any other product or service._FAO 2000

32. **(Forest)** ***(Bolivia)*** -Degradación: Proceso que consiste la transformación de un sistema, orden, estructura o sustancia compleja, a un nivel inferior. así tenemos la degradación biológica, de los bosques. Source: Luis Castello faopaf@caoba.entelnet.bo Adjunto sírvase encontrar la versión no oficial y premilinar del Glosario Forestal elaborado por el Proyecto de Apoyo a la Coordinación e Implementación del Plan de Acción Forestal para Bolivia.

33. **(Forest)** ***(Canada - BC)*** - The diminution of biological productivity or diversity. http://www.for.gov.bc.ca/pab/publctns/glossary/glossary.htm

34. **(Forest)** ***(Italy)*** -Degradation concerns only human induced damages or site alterations. The origin of these damages become by ongoing or made in the past human actions and refers to irrational forest harvesting, fire, grazing, etc., which usually reduce permanently the site index and may negatively affect the stand. Castellani, C., et al 1983.

35. **(Forest)** ***(Morocco and Yemen)*** - An aggression on the forest as ecosystem, leading to a negative change in all its biotope (fauna, flora, soil, micro/meso climate). The productivity of the whole ecosystem is lower. Degradation could lead to erosion, drought, desertification and other calamities. Mohammed Ellatifi, m.ellatifi@ellatifi.8m.com

36. **(Genetic)** - Deleterious change in a native taxon's gene pool due to addition of non-local genes. The gene source can be plants of a) the same genus or species, but a non-local Californian taxon, ecotype or cultivar; b) the same genus, but a foreign taxon. http://www.cnps.org/archives/landscaping.htm

37. **(Land)** - A human induced or natural process which negatively affects the land to function effectively within an ecosystem, by accepting, storing and recycling water, energy, and nutrients. http://www.nrcs.usda.gov/technical/worldsoils/landdeg/degredation.html

38. **(Land)** - Any form of deterioration of the natural potential of land that affect ecosystem integrity either in terms of reducing its sustainable ecological productivity or in terms of its native biological richness and maintenance of resilience. www.gefweb.org/COUNCIL/GEF_C14/gef_c14_inf15.doc

39. **(Land)** – Reduction or loss of the biological or economic productivity and complexity of rain-fed cropland, irrigated cropland, or range, pasture, forest or woodlands resulting from natural processes, land uses or other human activities and habitation patterns such as land contamination, soil erosion and the destruction of the vegetation cover. http://www.nscb.gov.ph/peenra/Publications/Compendium/glossary.PDF

40. **(Land)** - The decline in condition or quality of the land as a consequence of misuse or overuse, involving changes to soil, flora, fauna, water quality and quantity, visual quality and production levels by humans. http://www.epa.nsw.gov.au/soe/95/28.htm

41. **(Land)** - The decline in condition or quality of the land as a consequence of human activities. http://www.emrc.org.au/res/glossary.html#terms

42. **(Land)** - The deterioration or total loss of the productive capacity of land for present and future use. Such loss occurs mainly because of various forms of soil erosion (by wind and water) and of chemical and physical deterioration. http://www.adb.org/projects/PRC_GEF_Partnership/LD_definition.pdf

43. **(Land)** - The erosional removal of materials from one place to another, which lowers the elevation of streambeds and floodplains. Dunster & Dunster. 1996.

44. **(Land)** - The temporary or permanent lowering of the productive capacity of land. http://www.unu.edu/env/plec/l-degrade/index-toc.html

45. **(Land)** -The "reduction or loss, in arid, semi-arid and dry sub-humid areas, of the biological or economic productivity and complexity of rainfed cropland, irrigated cropland, or range, pasture, forest and woodlands resulting from land uses or from a process or combination of processes, including processes arising from human activities and habitation patterns, such as: (i) soil erosion caused by wind and/or water; (ii) deterioration of the physical, chemical and biological or economic properties of soil; and (iii) long-term loss of natural vegetation." http://yahwood.com/glossary_uk.htm

46. **(Log)** - Any defect that lowers the grade or quality of a log. http://forestry.about.com/library/glossary/blforgld.htm and http://www.pfmt.org/glossary/d.htm.

47. **(Natural Habitat)** - Modifications which substantially reduce a habitat's ability to maintain viable populations of its native species. http://www.ifc.org/enviro/enviro/Review_Procedure_Main/Review_Procedure/Glossary_of_Terms/glossary.htm

48. **(Natural Resources)** - Any decline in the quality of natural resources commonly caused by human activities. http://www.emrc.org.au/res/glossary.html#terms and http://www.epa.nsw.gov.au/soe/95/28.htm

49. **(Natural Resources)** - Any decline in the quality of natural resources or the viability of ecosystems, caused directly or indirectly by human activities. http://www.contacttrust.org.za/BiodiversityNetwork/webpage/docs/glossary.htm

50. **(Natural Resources)** – The result of the cumulative activities of farmers, households, and industries, all trying to improve their socio-economic well being. http://oaspub.epa.gov/trs/trs_proc_qry.alphabet?p_term_nm=D

51. **(Range)** - The degeneration of a site caused by biotic or abiotic factors, which results in a lowered successional status to the point that ecological potential is changed. www.plant-materials.nrcs.usda.gov/pubs/idpmctn280101.pdf http://www.roseworthy.adelaide.edu.au/~icooper/glossary/r.htm

52. **(Soil)** - A decrease in soil quality as measured by changes in soil properties and processes, and the consequent decline in productivity in terms of immediate and future production. http://www.unu.edu/env/plec/l-degrade/index-toc.html

53. **(Soil)** - A set of types of soil degradation involving one or more of the following processes: loss of soil physical structure; sealing and crusting of soil surface; reduction in permeability; compaction of depth; increase in macroporosity; limitations to rooting. http://www.unu.edu/env/plec/l-degrade/index-toc.html

54. **(Soil)** - Any significant reduction in the fertility of a soil. http://fwie.fw.vt.edu/rhgiles/appendices/glossd.htm

55. **(Soil)** - General lowering of land surfaces by erosion. http://fwie.fw.vt.edu/rhgiles/appendices/glossd.htm

56. **(Soil)** - Loss of friability or fertility of soil resulting from leaching http://glossary.gardenweb.com/glossary/nphind.cgi?scrug=16677&k=degradation&b=and&r=whole&s=terms

57. **(Soil)** - The decline in a soil's fertility as a result of loss of organic matter, erosion by wind or water, compaction, salinization, contamination, or acidification. http://museum.gov.ns.ca/mnh/nature/nhns2/glossary.htm

58. **(Soil)** -The changing of a soil to a more highly leached and weathered state, usually accompanied by morphological changes such as the development of an eluviated, light-coloured A (Ae) horizon. http://sis.agr.gc.ca/cansis/glossary/degradation.html

59. **(Species)** - The state or condition of a species or group which exhibits degraded forms; degeneration. http://www.mso.anu.edu.au/~ralph/OPTED/v003/wb1913_d.html

60. **(Streambed)** - A progressive lowering of the channel bed due to scour. Degradation is an indicator that the stream's discharge and/or sediment load is changing. The opposite of aggradation. http://www.tpwd.state.tx.us/texaswater/rivers/glossaryleft.htm

61. **(Streambed)** - The general lowing of the streambed by erosive processes, such as scouring by flowing water. http://www.orst.edu/Dept/owrri/directory/glossary.htm#~D~

62. **(Water)** - Deterioration in water quality due to contamination or pollution; makes water unsuitable for other desirable purposes. http://www.mhhe.com/biosci/pae/glossary/glossaryd.mhtml

63. **(Wood)** - Reduction in wood quality resulting from insect damage, fungal decay or fungal staining. http://216.239.51.100/search?q=cache:GlSJPPoeSDUC:www.nre.vic.gov.au/web/root/domino/inf.series/infsheet.nsf/ec560317440956e24a2568e3000bb3d9/5d033a7c16fbff3c4a25679c002137f4/%24FILE/AG0798.pdf+degrade+forest+glossary&hl=en

DEGRADED

1. **(Degraded and secondary forests)** - Include all those forests and forest lands that have been altered beyond the normal effects of natural processes through unsustainable use. ITTO 2002 (adopted UNEP/CBD/SBSTTA). FAO. 2002. Draft Analytical Framework on Forest-Related Definitions.

2. **(Forest)** - A secondary forest that has lost, through human activities, the structure, function, species composition or productivity normally associated with a natural forest type expected on that site. Hence, a degraded forest delivers a reduced supply of goods and services from the given site and maintains only limited biological diversity. Biological diversity of degraded forests includes many non-tree components, which may dominate in the under canopy vegetation. http://www.biodiv.org/programmes/areas/forest/definitions.asp and UNEP/CBD/SBSTTA 2001. FAO. 2002. Draft Analytical Framework on Forest-Related Definitions.

3. **(Forest)** - *Natural forest disturbed by man.* Includes (i) logged over forests associated with various intensity of logging (ii) various forms of secondary forests, resulting from logging or abandoned cultivation. FRA, 2000. FAO. 2002. Draft Analytical Framework on Forest-Related Definitions.

4. **(Forest) (*Africa only*)** - Degraded forests are areas in Africa where human activity is visible. Due to the land use patterns, including selective logging, differentiation between deforestation/revegetation/agriculture is not currently possible. Generally discernible from

natural forest, the true extent may only be determined through ground verification. http://www.geog.umd.edu/tropical/per80v141README

5. **(Forest) (*Slovenia)*** - Forest in which the growth rate, or the fertility of forest land, is reduced, or other possibilities for it to perform its function as a forest are reduced by negative outside influences. Slovenian LAW ON FORESTS - Milan SINKO milan.sinko@UNI-LJ.SI via "Maksym Polyakov" mpoliak@pcomp.usau.kiev.ua

6. **(Forest Land)** -Former forest land severely damaged by excessive timber and NWFP harvesting, poor management, repeated fire, grazing or other disturbances and land uses that damaged soil and vegetation to a degree which inhibited or severely delayed forest regrowth after abandonment ITTO 2002. FAO. 2002. Draft Analytical Framework on Forest-Related Definitions.

7. **(Forest Stand)** - A forest stand that has suffered damage to natural composition, structures, and functions to such an extent that population levels and diversity of organisms have been changed in an unnatural manner, or where structures required for ecological processes and populations in later temporal phases have been removed and/or will not be regenerated due to human disturbance. http://www.web.net/~fscca/standard.htm#anchor88641

8. **(Primary forest)** - The initial forest cover of a primary, old-growth or managed forest has been affected by unsustainable, excessive timber and wood exploitation or by such intensity of extraction of non-wood forest products, that its structure, processes, functions and dynamics are altered beyond the elastic capacity of the forest ecosystems. ITTO, 2002. FAO. 2002. Draft Analytical Framework on Forest-Related Definitions.

9. **(Wetland)** – A wetland which has been altered by man through impairment of some physical property and in which the alteration has resulted in a reduction of biological complexity in terms of species diversity of wetland-associated species which previously existed in the wetland areas. http://www.wsu.edu/pmc_nrcs/glossary/ddd.htm#D

DESERTIFICATION

1. A fertile region that has been made barren by the activities of human societies http://campus.murraystate.edu/academic/faculty/frank.elwell/Prob3/glossary/gloss1.htm#DECARCERATION

2. A process by which fragile, semiarid ecosystems lose productivity because of loss of plant cover, soil erosion, salinization, or waterlogging. Usually associated with human misuse. http://www.mhhe.com/biosci/pae/glossary/glossaryd.mhtml

3. A process of land degradation initiated by human activity, particularly in the zones along the margins of deserts http://www.ge-at.iastate.edu/courses/Geol_100/glossary.v2.html

4. Conversion of rangeland, rain-fed cropland to desert-like land, with a drop in agricultural productivity of 10% or more. It is usually caused by a combination of overgrazing, soil erosion, prolonged drought, and climate change. http://ecology.org/biod/library/glos_index.html

5. Dry land becoming desert, either through a change in climate or through the actions of humans. Intensive farming and clearing trees and other vegetation can make desertification worse. http://www.oxfam.org.uk/coolplanet/glossary.htm

6. Land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities. www.asia-tpn1.net/glossary.html and http://www.nyo.unep.org/action/ap1.htm
7. Land degradation in arid, semi-arid and dry sub-humid areas resulting mainly from adverse human impact (and climatic variations), and is therefore a sub-set of land degradation in countries that have additional climate zones. http://www.adb.org/projects/PRC_GEF_Partnership/LD_definition.pdf
8. Land degradation in arid, semi-arid, and dry sub-humid areas resulting mainly from adverse human impact. http://www.gps.caltech.edu/~arid/desert/desert.html
9. Land degradation occurring in the arid, semiarid and dry subhumid areas of the world. These susceptible drylands cover 40 percent of the earth's surface and puts at risk more than 1 billion people who are dependent on these lands for survival. http://www.nrcs.usda.gov/technical/worldsoils/landdeg/degredation.html
10. Progressive destruction or degradation of existing vegetative cover to form desert. This can occur due to overgrazing, deforestation, drought, and the burning of extensive areas. http://www.hwwa.de/Projekte/Forsch_Schwerpunkte/FS/Klimapolitik/PDFDokumente/Michaelowa,%20Koch%20(2001).pdf
11. The conversion of ecosystems into barren land. http://www.hq.nasa.gov/iwgsdi/ISS_SDI_Climate.html
12. The diminution or destruction of the biological potential of the land, (which) can lead ultimately to desert-like conditions. UN Secretariat 1977
13. The diminution or destruction of the biological potential of land, and can lead ultimately to desert-like conditions http://www.gps.caltech.edu/~arid/desert/desert.html
14. The extension of the desert into another ecological system such as into tropical grasslands. http://www.kgv.edu.hk/eden/glossary.php
15. The man-made or natural formation of desert from usable land. http://www.casde.unl.edu/vn/glossary/earth_d.htm#desertification http://asd-www.larc.nasa.gov/asd_over/glossary/d.html http://earthobservatory.nasa.gov:81/Library/glossary.php3?mode=alpha&seg=d
16. The spread or encroachment of a desert environment into arid or semiarid regions, caused by climatic changes, human influence, or both. http://www.britannica.com/eb/article?eu=30548&tocid=0
17. The transformation of once-productive arid and semi-arid areas into deserts through prolonged drought or continued mismanagement of land and water resources.http://www.nrcan.gc.ca/cfs-scf/science/prodserv/glossary_e.html#23 and http://www.fnfp.gc.ca/rep99/gloss-e.htm
18. When an area begins to develop desert-like conditions due to lack of water, deforestation, overgrazing and over cropping. http://www.dnr.state.sc.us/climate/sercc/education/glossary/#d
19. The (usually) slow and progressive degradation of land towards a desert state. http://www.rbgkew.org.uk/aboutus/annualreport/sect5.pdf
20. The degradation of terrestrial ecosystems as a result of deforestation, overgrazing, poor soil, and irrigation management. http://www.orst.edu/Dept/owrri/directory/glossary.htm#~D~

21. The process by which an area or region becomes more and through loss of soil and vegetative cover. The process is often accelerated by excessive continuous overstocking and drought. http://www.roseworthy.adelaide.edu.au/~icooper/glossary/d.htm

22. The process by which lands not formerly deserts become deserts, because of changes in temperature and rainfall http://www.solutions-site.org/reference/glossary.htm

23. The process by which once productive land is turned into a desert by processes such as overstocking or removal of protective vegetation. http://www.epa.nsw.gov.au/soe/95/28.htm

24. The process of a non-desert ecosystem taking on the characteristics of a desert (arid, seemingly barren) as a result of land mismanagement or climate change. http://www.pbs.org/earthonedge/glossary.html

25. The process of becoming arid land or desert (as from land mismanagement or climate change). http://sol.crest.org/renewables/SJ/glossary/D.html

26. The process of desert spread. http://www.learn.co.uk/default.asp?WCI=Unit&WCU=7568

27. The process of land degradation which leads to a drastic reduction of land productivity. Land is rendered unsuitable for any productive activity. It is prevalent in arid and semi-arid areas. Its causes are both natural (dry climate, low rainfall, water shortage) as well as anthropogenic (overgrazing, deforestation, fires, intensive cultivation). http://www.rri.wvu.edu/WebBook/Briassoulis/glossaryterms.htm

28. The process through which a desert takes over a formerly non-desert area. When a region begins to undergo desertification, the new conditions typically include a significantly lowered water table, a reduced supply of surface water, increased salinity in natural waters and soils, progressive destruction of native vegetation, and an accelerated rate of erosion. http://www.iversonsoftware.com/geology/d/desertification.htm

29. The process through which once usable land is turned into desert because of overgrazing, harmful agricultural practices, or deforestation. http://cwabacon.pearsoned.com/bookbind/pubbooks/social_ab/chapter4/custom1/deluxe-content.html#desertification

30. The progressive destruction or degradation of existing vegetative cover to form desert. http://edugreen.teri.res.in/explore/glossary.htm#d http://www.ciel.org/Publications/climatechangeglossary.pdf

31. The progressive destruction or degradation of existing vegetative cover to form desert. This can occur due to overgrazing, deforestation, drought and the burning of extensive areas. Once formed, desert can only support a sparse range of vegetation. Climatic effects associated with this phenomenon include increased albedo, reduced atmospheric humidity and greater atmospheric dust loading, which can cause wind erosion and/or atmospheric pollution. http://www.ccasia.teri.res.in/gloss/glossary.htm

32. The spread of deserts. http://mac01.eps.pitt.edu/harbbook/other/Glossary.html

DEVEGETATED/DEVEGETATION

1. **Devegetated** - Having removed the vegetation from an area. Lund 2002

2. **Devegetation** - Destruction of vegetation (by fire, human impact). http://www.nature.nps.gov/nrbib/HTML%20files/33.htm#3259

3. **Devegetation** -The removal of vegetation and exposure of bare soil throughout at least one growing season. Lund 1998

DISTURBANCE/DISTURBED

1. **Disturbance (Forest)** - Any discrete force, for instance fire, wind, disease, insects, or logging, that significantly alters forest composition, structure, and/or functioning. Natural disturbances include all historical disturbances that influenced forests prior to European contact, including those resulting from First Nations' use. http://www.silvafor.org/ecocert/sffstandardsforbc.pdf
2. **Disturbed forest** - A forest that has changed or been degraded due to human impact. http://ohia.com/ohia/roadshows/sky/glossary.htm

FORESTRY

1. (Morocco) Forestry (Arabic: 'Ilm Al Ghabat, French: Foresterie/Sciences forestière, Spanish: Ciencias de bosques) - Field of all the different discilines related to forestry aspects, such as reproduction, cultivation, caring, protection, development, etc. Mohammed Ellatifi, m.ellatifi@ellatifi.8m.com
2. (Yemen) Forestry (Arabic: 'Ilm Al Ghabat, French: Foresterie/Sciences forestière, Spanish: Ciencias de bosques) - Field of all the different discilines related to forestry aspects, such as reproduction, cultivation, caring, protection, development, etc. Mohammed Ellatifi, m.ellatifi@ellatifi.8m.com
3. Forest Management - The practical application of scientific, economic and social principles to the administration and working of a forest for specified objectives. Particularly, that branch of forestry concerned with the overall administrative, economic, legal and social aspects and with the essentially scientific and technical aspects, especially silviculture, protection and forest regulation. (2) http://www.ncfcnfr.net/glossary.html
4. The art, science, and practice of managing forest landscapes to provide a sustained production of a variety of goods and services for society. http://www.forestinfo.org/Discover/glossary.htm
5. The science of developing, caring for, or cultivating forest. The management of growing timber (WWWebster)
6. The science of planting, managing and protecting forest http://ifdn.com/teacher/glossary.htm#d
7. The scientific field of forest management: http://nhd.heinle.com/nhd-bin/searchNHD.pl

FRAGMENTATION

1. "Forest Fragmentation" is what happens when large contiguous patches of forests are fragmented, or split up, into several smaller patches. These remaining patches are separated by what is defined here as the "matrix" which is just anything other than mature forest and may include clear cuts, development or young plantation forests. http://www.environmentalsciences.homestead.com/aboutfragmentation.html

2. A break up of a continuous landscape containing large patches into smaller, usually more numerous and less-connected patches. http://ndis.nrel.colostate.edu/davet/pubs%5Cfragtools.htm
3. A detaching or separation of expansive tracts into spatially segmented corridors or fragments. http://www.studentcentral.co.uk/coursework/University_Essays/Geography/
4. A forest condition where human disturbance is distributed in such a fashion as to separate habitats into unnaturally small or extremely dispersed pieces. http://www.mnr.gov.on.ca/MNR/temagami/SECTION5.html
5. A formerly continuous forest that has been broken up into smaller pieces. http://www.epa.gov/ceisweb1/ceishome/atlas/maiaatlas/forest_fragmentation.html
6. Any process that results in the conversion of formerly continuous forest into patches of forest separated by non-forested lands. http://www.biodiv.org/programmes/areas/forest/definitions.asp
7. Breaking up a specific habitat into smaller unconnected areas. A habitat area that is too small may not provide enough space to maintain a breeding population of the species. http://www.anr.state.vt.us/champ/atlas/html/glossary.htm#h
8. Breaking up large areas of continuous natural habitat into smaller patches of natural habitat isolated from each other by human-altered habitat. http://www.northern.edu/natsource/BIRDS/Conser1.htm
9. Breaking up of contiguous areas into progressively smaller patches of increasing degrees of isolation from each other. http://www.fs.fed.us/r9/cnnf/natres/plan/glossary.html#[%20F%20]
10. Creating smaller areas of habitat from a large continuous habitat tract, such as removing a block of trees from a forested area. The road built through the prairie resulted in **fragmentation** of the habitat. http://www.inhs.uiuc.edu/chf/pub/virtualbird/glossary.html
11. Cutting swaths and patches out of the forest. http://www.epa.gov/maia/html/lessons.html
12. Division of a large forested area into smaller patches separated by areas converted to a different land use. http://www.state.vt.us/anr/fpr/forestry/ucf/glossary.htm
13. Forest landscapes that are broken and not continuous. http://www.wildlandsprojectrevealed.org/htm/glossary.htm
14. Fragmentation of forest types http://www.hq.nasa.gov/iwgsdi/ISS_SDI_Biodiversity.html
15. Islands of forest habitat that persist on the land when the intervening forest has been removed. http://depts.clemson.edu/extfor/publications/fortp19/definitions.htm
16. Occurs when a large area of a particular habitat is broken up into smaller patches (fragments) by human activities. http://www.mered.org.uk/saraweb/refs/glossary.htm
17. Occurs when large continuous forest **patches** are converted into one or more smaller patches surrounded by naturally disturbed or **developed** areas. http://www.for.gov.bc.ca/hfp/Planning/RPGLOSS/F.htm
18. Patchwork conversion and development of forest sites (usually the most accessible or most productive ones) that leave the remaining forest in stands of varying sizes and degrees of isolation http://www.npwrc.usgs.gov/resource/literatr/avian/avian.htm#f
19. Process of changing a large forested area into an area of forest patches. http://www.dsisd.k12.mi.us/mff/Environment/EcologyForests.htm

20. Subdivision of a forest (or other habitat) into isolated patches, reducing the size and connectivity of stands that compose a forest or landscape.
http://fscus.org/html/about_fsc/who_we_are/glossary_of_terms.html#f

21. The breaking up of an organism's habitat into discontinuous chunks, particularly for organisms that have difficulty moving from one of those chunks to another. Fragmentation can be caused by removal of vegetation over large areas for human development, or even by small roads breaking up the habitat of (for example) amphibians that are resistant to crossing roads or are frequently killed when crossing roads. Power lines can fragment sage grouse habitat by providing convenient perches for predators such as hawks and ravens.
http://www.state.nv.us/nvnhp/ecology/glossary.htm

22. The breaking up of extensive landscape features into disjunct, isolated, or semi-isolated patches as a result of land-use changes http://bch-cbd.naturalsciences.be/belgium/glossary/glos_f.htm

23. The breaking up of habitat into discrete islands through modification or conversion of habitat by management activities. http://www.streamnet.org/pub-ed/ff/Glossary/glossaryhabitat.html

24. The breaking up of large habitats into smaller, isolated chunks.
http://www.internet.ve/wildlife/glosario.htm
http://www.nationalgeographic.com/wildworld/glossary.html

25. The breaking up of something into small, separated pieces.
http://www.museum.state.il.us/muslink/forest/htmls/con_frag.html

26. The breaking up of the forest into isolated patches through agriculture and urban development.
http://www.unbf.ca/forestry/centers/cwru/soc/gloss.htm

27. The break-up of a large land area (such as a forest) into smaller patches isolated by areas converted to a different land type. The opposite of connectivity.
http://roadless.fs.fed.us/documents/feis/glossary.shtml

28. The break-up of continuous habitat by roads, development, or other physical or biological barriers. http://www.nps.gov/olym/edgloss.htm

29. The break-up of extensive habitats into small, isolated patches that are too limited to maintain their species stocks into the indefinite future. http://www.ameteam.ca/glossary.html

30. The change in the forest landscape, from extensive and continuous forests of old-growth to mosaic of younger stand conditions.
http://www.streamnet.org/pub-ed/ff/Glossary/glossaryforest.html

31. The disintegration, collapse, or breakdown of the norms.
http://www.chias.org/www/edu/cse/owpglo.html

32. The disruption of extensive habitats into isolated and small patches. Fragmentation has two negative components of biota: loss of total habitat area, and smaller, more isolated remaining habitat patches.
https://osiris.cso.uiuc.edu/denix/Public/ES-Programs/Conservation/Biodiversity/glossary.html

33. The division of a continuous block of forest or other wildlife habitat into disconnected units as a result of human or natural disturbances. http://www.nrcan.gc.ca/cfs/proj/ppiab/ci/gloss_e.html

34. The insularization of habitat on a landscape. http://www.srs.fs.fed.us/sustain/report/terra1/terra1-10.htm

35. The phenomenon of large forested landscapes being broken into separate ownerships and often developed. http://www.forestsystems.com/glossary/glossary.htm

36. The process of reducing size and connectivity of stands that compose a forest. http://www.streamnet.org/pub-ed/ff/Glossary/glossaryforest.html

37. The process of spatial segregation among entities that need to be together in order to function optimally. http://themes.eea.eu.int/Sectors_and_activities/transport/indicators/consequences/fragmentation/Fragmentation_TERM_2001.doc.pdf

38. The process of transforming large continuous forest patches into one or more smaller patches surrounded by disturbed areas. This occurs naturally through such agents as fire, landslides, windthrow and insect attack. In managed forests timber harvesting and related activities have been the dominant disturbance agents. http://www.borealforest.org/nwgloss4.htm and http://typhoon.sdsu.edu/nasa_lcluc/forest.html

39. The process whereby a large patch of habitat is broken down into many smaller patches of habitat, resulting in a loss in the amount and quality of habitat. http://chesapeake.towson.edu/landscape/forestfrag/glossary.asp

40. The segmentation of a large tract or continuous tracts of forest to smaller patches often isolated from each other by nonforest habitat. Results from the collective impact of residential and commercial development, highway, and utility construction, and other piecemeal land use changes http://www.pfmt.org/glossary/f.htm

41. The spatial arrangement of successional stages across the landscape as the result of disturbance; often used to refer specifically to the process of reducing the size and connectivity of late successional or old-growth forests. http://www.lwvwa.org/forest_study/dynamic/glossary.htm

42. The splitting of forestlands into smaller, detached areas as a result of road building, farming, suburban development, and other activities. http://www.sfrc.ufl.edu/Extension/ssfor11.htm

43. The subdivision of large natural landscapes into smaller, more isolated fragments. http://www.dnr.state.md.us/forests/gloss.html

GRASSLAND

1. (Grassland Pasture and Range) - Grassland pasture and range consists of all open land used primarily for pasture and grazing. It includes shrub and brush land types of pasture and grazing land such as sagebrush and scattered mesquite; all tame and native grasses; legumes; and other forage used for pasture or grazing. No single agency, other than ERS, accounts for all public and private land used for pasture and range. The estimates in this report are composites of data from the Census of Agriculture, Bureau of Land Management, U.S. Forest Service, Natural Resource Conservation Service and several other Federal agencies. http://www.ers.usda.gov/data/majorlanduses/glossary.htm#grassland

2. (UNEP) - Land covered with herbaceous plants with less than 10% tree and shrub cover. http://www.eapap.unep.org/lc/cd/html/training/module1.html

3. A dry terrestrial habitat predominated by grasses, legumes, and flowers. Grasslands have few-if any-trees. In a grassland, the rainfall is not enough to enable tree growth but is sufficient to prevent the formation of a desert. http://animals.about.com/library/glossary/bldef-grassland.htm

4. A grassy, windy, partly-dry biome, a sea of grass. Almost one-fourth of the Earth's land area is grassland. In many areas, grasslands separate forests from deserts. Deep-rooted grasses dominate the flora in a grassland; there are very few trees and shrubs in a grassland, less than one tree per acre. There are many different words for grassland environments around the world, including savannas, pampas, campos, plains, steppes, prairies and veldts. http://www.enchantedlearning.com/subjects/rainforest/glossary/indexg.shtml

5. An administrative unit of the U.S. Forest Service (more frequently "National Grassland"). www.southernregion.fs.fed.us/texas/NEPA/Reforestation/FEIS_appendix_e_glossary.doc

6. An area composed of uncultured plants which have little or no woody tissue. http://www.terraindata.com/Pages/definitions.html

7. An area covered with grass and grass-like vegetation. See also: steppe, prairie, pampas, meadow, veld, campos, savanna. http://glossary.gardenweb.com/glossary/grassland.html

8. Biome found in regions where moderate annual average precipitation (25 to 76 centimeters, or 10 to 30 inches) is enough to support the growth of grass and small plants, but not enough to support large stands of trees. http://www.gsu.edu/~mstnrhx/ecogloss.htm

9. Comunidad de gramíneas que se establece naturalmente por efecto del clima, tipo de suelo y biota en general./*Community of naturally occurring grasses, established as a result of climate, soil type and biota in general* (CONABIO, 2000). http://www.cec.org/files/pdf/BIODIVERSITY/Chihuahua_Meeting_Final_report-Reporte_final.PDF

10. Comunidades vegetales en que el papel preponderante corresponde a las gramineas. Son comunes en las regiones semiáridas y en zonas planas./*Vegetation community in which the main role corresponds to the grasses found therein. Commonly found in subhumid to semi arid climate in areas with relatively little topographic relief* (Rzedowski 33, 1988:215-216; CEC 34, 1997:26). http://www.cec.org/files/pdf/BIODIVERSITY/Chihuahua_Meeting_Final_report-Reporte_final.PDF

11. In their natural state, Grasslands are those landscapes that were largely dominated by xeric types of flora and fauna, light to dark brown chernozemic soils, and dry warm summers (generally occurring in relatively flat to gently rolling areas). Today, grasslands would more commonly be called farmlands and ranch lands, and be characterized by farming and ranching practices. /*En su estado natural, los pastizales son aquellos paisajes que fueron dominados por tipos xericos de fauna y flora, con suelos* chernozem color café claro y veranos cálidos y secos (generalmente presentes en areas desde relativamente planas hasta lomeríos someros). Actualmente, los pastizales serían llamados areas de cultivo y se caracterizarían por actividades agrícolas y ganaderas (Ed Wiken, Wildlife Habitat Canada). http://www.cec.org/files/pdf/BIODIVERSITY/Chihuahua_Meeting_Final_report-Reporte_final.PDF

12. Includes areas covered by grasslands and herbaceous plants. May contain up to one third shrubs and/or tree cover. Areas may be small to extensive and range from regular to irregular in shape. These areas are often found between agricultural land and more heavily wooded areas, along right-of-ways and drains. Some areas may be used as pastures and be mowed or grazed, and may range in appearance from very smooth to quite mottled. Included are fields which show evidence of past tillage but now appear to be abandoned and grown to native vegetation or planted to a cover crop. http://deli.dnr.state.mn.us/metadata/tables/lusatra3_tab.html

13. Includes land s covered by natural and managed herbaceous cover. Historically, grassland has been defined as land where the potential natural vegetation is predominantly grasses, grasslike plants, and forbs, and where natural herbivory was an important influence in its pre-civilization state. Anderson et al. (1976) state 'Some grasslands have been or may be seeded to introduce or domesticate plant species. The Grassland (Herbaceous) category contains both managed and unmanaged or natural herbaceous cover.' The C-CAP category includes lands with herbaceous cover at time of observation regardless of origin or potential. Pastures, hayfields, and natural rangelands are included. Also included are lawns and other managed grassy areas such as parks, cemeteries, golf courses, road rights-of-way, and other herbaceous-covered, landscaped areas. (Dobson, et al., 1995). Large estate lawns and smaller lawns are interspersed as Grasslands throughout Low Intensity Developed Lands in the Long Island C-CAP data set. http://www.dos.state.ny.us/cstl/Final_Draft_HTML/Tech_Report_HTM/Land_Cover/Appendices 1_LC.htm

14. It is simply a plant community, in which the structural dominants are grasses. http://home.vicnet.net.au/~iffa/GPCconf/McDougall.pdf

15. Land covered with grasses and other herbaceous species. Woody plants may be present, but if so, they do not cover more than 10% of the ground. There are many different types of grassland designated by ecozone, topography, climate, soil conditions, and so on. Derived grassland is maintained in that condition by regular burning; edaphic grassland arises on particular soil types, for example, those found in or around permanent or seasonal swamps. See also rangeland, veld http://www.bugwood.org/glossary/html/glossary-g.html

16. Land on which the vegetation is dominated by grasses. (cf.) Pastureland (1.2.2.), Rangeland (1.2.4.). Comment: 'Grassland' is defined as an ecological land type and is not considered to be synonymous with rangeland or pastureland although it is often used this way in the literature. Neither rangeland nor pastureland has to be dominated by grasses although they can be. Meadow, prairie, savanna, and steppe are different kinds of grasslands. http://www.pwrc.usgs.gov/brd/DefLandTerms.htm

17. Land reserved for pasturage or mowing. Land in which grasses are the predominant vegetation. http://home.gdbc.gov.bc.ca/TRIM/IDM_Project_Riparian_Zone_specs.pdf

18. Plant communities whose potential natural and dominant vegetation is grasses or grasslike plants. www.southernregion.fs.fed.us/texas/NEPA/Reforestation/FEIS_appendix_e_glossary.doc

19. Region in which the climate is dry for long periods of the summer, and freezes in the winter. Grasslands are characterized by grasses and other erect herbs, usually without trees or shrubs. Grasslands occur in the dry temperate interiors of continents. http://earthobservatory.nasa.gov:81/Library/glossary.php3?xref=grassland

20. Relatively low relief landscapes with upland vegetation dominated by perennial grasses as a result of natural drought, grazing and/or fire regimes. Commonly found in regions with subhumid to semi arid climate within temperate and sub-tropical zones./ *Paisajes con relieve relativamete bajo y con vegetación dominada por pastos perennes, como resultado de sequías anturale, pastoreo, y/o regímenes de fuego Son communes dentro de las zonas templadas y subtropicales en regiones con clima subhumedo a semiárido* (Darcy Henderson,University of Alberta, pers. comm.). http://www.cec.org/files/pdf/BIODIVERSITY/Chihuahua_Meeting_Final_report-Reporte_final.PDF
21. Vegetation where the tallest vegetation is grasses. http://www.dlwc.nsw.gov.au/care/veg/pdfs/clearing_vegtypes_mar02.pdf

IMPROVEMENT

1. **(Forest)** - The increase of the canopy cover or stocking within a forest. Explanatory note: For the purpose of having a harmonized set of forest and forest change definitions, that also is measurable with conventional techniques, forest improvement is assumed to be indicated by the increase of canopy cover and/or stocking of the forest through growth. In a more general sense forest improvement is the long-term increase of the overall potential supply of benefits from the forest, which includes wood, biodiversity and any other product or service. FRA 2000. FAO. 2002. Draft Analytical Framework on Forest-Related Definitions.
2. **(Land)** – Alteration in the qualities of land that improves its potential for land use. http://www.nscb.gov.ph/peenra/Publications/Compendium/glossary.PDF

LAND COVER

1. A (bio)physical description of the earth's surface. It is that which overlays or currently covers the ground. This description enables various biophysical categories to be distinguished - basically, areas of vegetation (trees, bushes, fields, lawns), bare soil, hard surfaces (rocks, buildings) and wet areas and bodies of water (watercourses, wetlands). http://europa.eu.int/comm/agriculture/publi/landscape/gloss.htm
2. Land-cover change describes differences in the area occupied by cover types through time. http://biology.usgs.gov/s+t/SNT/noframe/lu106.htm
3. That which overlays or currently covers the ground, especially vegetation, permanent snow and ice fields, water bodies, or structures. Barren land is also considered a 'land cover' although technically it is lack of cover. The term land cover can be thought of as applying to the setting in which action (one or more different land uses) takes place (USDA Forest Service 1989).
4. The actual distribution of vegetation, water, desert, ice, and other physical features of the land, including those created by human activities. http://ww2.iai.int/eblw1.htm
5. The biophysical state of the earth's surface and immediate subsurface. http://www.idg.suny.edu/HO%20submit%20SensitiveSens%2012%2017Porro.htm
6. The composition of the features of the earth's surface. (Cihlar and Jansen 2001).
7. The ecological state and physical appearance of the land surface (e.g., closed forests, open forests, or grasslands) (Turner and Meyer 1994).

8. The habitat or vegetation type present, such as forest, agriculture, and grassland. http://biology.usgs.gov/s+t/SNT/noframe/lu106.htm

9. The natural landscape recorded as surface components: forest, water, wetlands, urban, etc. Land cover can be documented by analyzing spectral signatures of satellite and aerial imagery. http://www.csc.noaa.gov/crs/lca/faq_data.html#LULC

10. The observed (bio) physical cover on the earth's surface. Also aspects describing land itself rather than land cover have been included (e.g. bare areas, waterbodies, etc.) because in practice the scientific community is used to describe those aspects under the term land cover (Di Gregorio and Jansen 1997, 1998, Jansen and Di Gregorio 1998).

11. The observed physical and biological cover of the Earth's land as vegetation or man-made features.
http://www.ipcc.ch/pub/SPM_SRLULUCF.pdf and
http://www.bib.fsagx.ac.be/coste21/glossary.html

12. The physical attributes of the land that can be seen readily as opposed to the land use which describes a pattern of human activities undertaken within a social and economic context. http://www.eapap.unep.org/lc/cd/html/training/module1.html

13. The type of surface layer of the specific land area, including vegetation, barren land, open water bodies and artificial surfaces, that can be observed in the field and recorded by aerial or satellite remote sensing. (Kalensky et al. 2002)

14. The vegetation or other kind of material that covers the land surface.
http://199.156.157.191/nri/blcu.htm and http://www.wv.nrcs.usda.gov/nri/blcu.htm

15. Usually used to denote the nature of the Earth's surface in areas where the natural environment is dominant. http://surf.tstc.edu/~rcozby/GPS/ap_terms.htm#L

16. Land cover classification - A process of stratification and systematic grouping of land cover into multi-level, mutually exclusive classes according to selected criteria. It is independent of map scale, data source and geographic area. (Kalensky et al. 2002).

17. Land cover map legend - A subset of land cover classes compatible with the map scale, map type (forest map, forest change map, agricultural land map, land degradation map, etc.) and map accuracy requirements. Furthermore, the map legend is specific to a geographic area of the map. (Kalensky et al. 2002).

LAND USE

1. A particular manner of using land, such as for residences or recreation.
http://ohia.com/ohia/roadshows/sky/glossary.htm

2. A term used to describe the various ways in which human beings make use of the land and its resources, including farming, mining, building, or grazing sheep and cattle.
http://www.enviroliteracy.org/landuse.html

3. Involves both the manner in which the biophysical attributes of the land are manipulated and the intent underlying that manipulation.
http://www.idg.suny.edu/HO%20submit%20SensitiveSens%2012%2017Porro.htm

4. Man's activities on land of which settlements, forestry, agriculture, mining, grazing and water use are the most predominant http://www.nscb.gov.ph/ru12/DEFINE/DEF-ENV.HTM
5. Man's activities on land which are directly related to land. (Anderson et al. 1976).
6. Specific use or management-related activity, rather than the vegetation or cover of the land. The categories of and use are cropland, developed water resource, fish and wildlife habitat, forestry, industrial/commercial, pastureland (or land occasionally cut for hay), recreation, residential, and undeveloped land. http://dnr.state.il.us/mines/lrd/guides/farm6.htm
7. The arrangements, activities and inputs people undertake in a certain land cover type to produce, change or maintain it (Di Gregorio and Jansen 1997, 1998, Jansen and Di Gregorio 1998). A given land use may take place on one, or more than one, piece of land and several land uses may occur on the same piece of land. Definition of land use in this way provides a basis for precise and quantitative economic and environmental impact analysis and permits precise distinctions between land uses, if required. Lands may be devoid of forest cover, but may be used for forestry purposes. Similarly, lands may have tree cover, but not used for forestry use – i.e. "urban forests."
8. The documentation of human uses of the landscape: residential, commercial, agricultural, etc. Land use can be inferred but not explicitly derived from satellite and aerial imagery. There is no spectral basis for land use determination in satellite imagery. http://www.csc.noaa.gov/crs/lca/faq_data.html#LULC
9. The employment of a site or holding so as to derive revenue or other benefits from it; the delineation by a governing authority of the utilization of the land within a particular jurisdiction so as to promote the most advantageous development of the community such as industrial, residential, commercial, recreational and other uses under a plan. (HUDCC). http://www.nscb.gov.ph/peenra/Publications/Compendium/glossary.PDF
10. The human activity that is associated with a specific land unit, in terms of utilization, impacts or management practices (Thompson 1996).
11. The human employment of the land (Meyer and Turner 1992).
12. The intent and management strategy placed on a land cover type (Turner, et al. 1995).
13. The nature of the Earth's surface in areas where the human imprint upon land is dominant. http://surf.tstc.edu/~rcozby/GPS/ap_terms.htm#L
14. The predominant purpose for which an area is employed (USDA Forest Service 1989).
15. The purpose for which a specific land area is used by people; the socio-economic function of such an area. (Kalnensky et al. 2002).
16. The purpose of human activity on the land; it is usually, but not always, related to land cover. http://199.156.157.191/nri/blcu.htm and http://www.wv.nrcs.usda.gov/nri/blcu.htm
17. The purpose to which land is put by humans (e.g., protected areas, forestry for timber products, plantations, row-crop agriculture, pastures, or human settlements) (Turner and Meyer 1994). Change in land use may or may not cause a significant change in land cover. For example, change from selectively harvested forest to protected forest will not cause much discernible cover change in the short term, but change to cultivated land will cause a large change in cover.

18. The social and economic purposes for which land is managed (e.g., grazing, timber extraction, conservation). http://www.bib.fsagx.ac.be/coste21/glossary.html and http://www.ipcc.ch/pub/SPM_SRLULUCF.pdf

19. The socio-economic description (functional dimension) of areas: areas used for residential, industrial or commercial purposes, for farming or forestry, for recreational or conservation purposes, etc. Links with land cover are possible; it may be possible to infer land use from land cover and conversely. But situations are often complicated and the link is not so evident. Contrary to land cover, land use is difficult to "observe". For example, it is often difficult to decide if grasslands are used or not for agricultural purposes. Distinctions between land use and land cover and their definition have impacts on the development of classification systems, data collection and information systems in general. http://europa.eu.int/comm/agriculture/publi/landscape/gloss.htm

20. The total of arrangements, activities, and inputs undertaken in a certain land cover type (a set of human actions). http://www.bib.fsagx.ac.be/coste21/glossary.html and http://www.ipcc.ch/pub/SPM_SRLULUCF.pdf

21. The type of human activity taking place at or near the earth's surface. (Cihlar and Jansen 2001).

22. The way in which, and the purposes for which, humans employ the land and its resources (Meyer 1995).

23. The way land is developed and used in terms of the kinds of activities allowed (agriculture, residences, industries, etc.) and the size of buildings and structures permitted. http://www.abag.ca.gov/bayarea/sfep/reports/soe/soegloss.htm

NATURAL FOREST (OR WOODLAND)

1. Natural - being in accordance with or determined by nature b: having or constituting a classification based on features existing in nature (http://www.m-w.com/dictionary)

2. Nature - the inherent character or basic constitution of a person or thing: essence b: disposition, temperment. 2 a: a creative and controlling force in the universe b: an inner force or the sum of such forces in an individual. 3: a kind or class usually distinguished by fundamental or essential characteristics <documents of a confidential nature <acts of a ceremonial nature 4: the physical constitution or drives of an organism; especially: an excretory organ or function - used in phrases like the call of nature 5: a spontaneous attitude (as of generosity) 6: the external world in its entirety (http://www.m-w.com/dictionary)

3. (EU) Forests composed of tree species indigenous to the area. http://europa.eu.int/comm/dg08/forests/en/en4_6.htm

4. (Iran) It is substantiated naturally, without mans' interference. "M.Zobeiri" zobeiri@nrf.ut.ac.ir

5. (Nicaragua) - Draft - Bosque Natural. Agrupamiento vegetal con predominio de especies arbóreas conocidas como autóctonas de la zona, asociadas generalmente a una fauna silvestre y condiciones de suelos naturales con ninguna o escasa intervención humana www.nicarao.org.ni/ja (see Borrador de la ley, CAPITULO II DEFINICIONES) Harrie <harnic@ibw.com.ni>

6. (UN-FRA 2000) Natural forests are forests composed of indigenous trees, not planted by man. Or in other words forests excluding plantations. (UN/ECE-FAO 1997, FAO 1998).

7. (Vietnam) Natural forests comprise all timberlands and bamboo groves of all ages, not excluding young regrowth under rehabilitation. http://coombs.anu.edu.au/~vern/luat/english/CoM-17HDBT-forest-pro.txt Hanoi, January 17th 1992

8. A forest composed primarily of naturally established indigenous species (by opposition to plantation) http://www.biodiv.org/Forests/Glossary.html

9. A forest ecosystem with most of the principal characteristics and key elements of native ecosystems such as complexity, structure and diversity. Natural forests lack the abundance of mature trees and freedom from human disturbance that characterize primary forests. http://www.fscstandards.org/regions/southeast/glossary.html

10. A forest or forest remnant comprising indigenous species of plants (i.e., plant species which are native to a specified area or region in the country). The forest may include naturalized species (i.e., exotic species introduced into or naturally colonized in a region so as to appear native or wild), provided they are not sufficiently abundant or physiognomically dominant so as to alter the general character of the original forest. Natural forest includes unaltered virgin upland and lowland indigenous forest, indigenous forest which has been slightly or significantly modified by human activity but which retains part or most of the general composition or character of the original forest, or indigenous forest which is being managed or exploited primarily for the commercial production of wood. From: *New Zealand Forestry Statistics 1997* (Ministry of Agriculture and Forestry, Wellington, 1998)

11. A forest that has evolved and reproduced itself naturally from organisms previously established, and that has not been significantly altered by human activity. A natural forest may include, but is not equivalent to, an "old-growth forest."
http://www.forestry.utoronto.ca/ac_staff/emeritus/My%20Webs/english.htm

12. A stand of trees resulting from natural seed fall or sprouting.
http://msucares.com/pubs/pub1250.htm

13. A woodland comprising trees that have not been planted by humans, and where no human interference has occurred (Allaby 1994).
Helene M Cleveland CCMAIL hmclevel@aec.apgea.army.mil

14. An area with an existing stand of naturally grown trees of dipterocarp, premium, and other classified commercial species, as well as other naturally associated forest flora and fauna http://www.bwf.org/laws/DAO_97-04.html

15. An ecosystem with a hyperbolic distribution of age classes of trees, including a minimum of 10% mature trees.
http://fscus.org/html/standards_policies/us_regional_standards/archives/ozark_ouachita4.html

16. Ecosystems dominated by trees or shrubs in an original or nearly original fashion through natural generation. This definition includes mangroves. http://www.af.nfr.no/andre-doc/alternativ-agenda/Forests.html,http://nativenet.uthscsa.edu/archive/nl/9208/0081.html
and http://www.igc.org/habitat/treaties/at-27.htm

17. Floresta Natural - Formação florestal composta por espécies de ocorrência típica de determinada região, cuja composição obedeça às características próprias da sucessão vegetal. http://www.suzano.com.br/docs/recursos/maneucal/glossar.html

18. Forest area(s) being managed to protect, maintain, or restore natural composition, structures, and functioning. http://www.silvafor.org/ecocert/sffstandardsforbc.pdf

19. Forest areas where most of the principal characteristics and key elements of native ecosystems such as complexity, structure and diversity are present as defined by FSC-approved national and regional standards of forest management. http://www.canadian-forests.com/fsc-glossary.html and FSC glossary, printed in the Principles and Criteria document and http://forests.org/ric/good_wood/glossary.htm#anchor975359

20. Forest areas, including primary forest, where most or all of the principal characteristics and key elements of native ecosystems, such as complexity, structure, and diversity, are present given the physical parameters of climate, geology, hydrology and successional patterns. http://www.canadian-forests.com/fsc-glossary.html and additional FSC terms proposed in the December, 1996 FSC newsletter.

21. Natural forests contain only the original patterns of biodiversity, the native species occurring in established seral patterns. These formations and processes have not been impacted by humans with a frequency or intensity to change established seral patterns. Ranil Senanayake 100232.3435@CompuServe.COM

22. Natural forests are forests naturally grown but not planted, either virgin forests without any human disturbance or secondary forests with natural generation. www.iges.or.jp/fc/ir99/4-10-lu.pdf

23. Natural regeneration - The natural establishment of trees and other vegetation with at least 400 woody, free-to-grow seedlings per acre, which are capable of reaching a height of at least 20 feet at maturity. http://pilot.wash.lib.md.us/washco/forestcn.html

NON-FOREST

1. **Non-forest** - Land not primarily intended for growing or supporting forest. Includes alpine, rock, slide, non-productive burn, non-productive brush, swamp or muskeg, cultivated, cleared, urban, open range, wild hay meadow, clay bank, gravel bar, and other categories. http://srmwww.gov.bc.ca/tib/reports/glossary/glossary.htm#n.htm

2. **Non-forest ecosystem** - Grasslands, shrublands, chaparral, wetlands, deserts, etc., where trees are not the dominant life form, although they may be present as scattered individuals or in patches. See forest ecosystem.
http://legacy.ca.gov/pub_docs/CCRISP_ResourceAssessmentMethodologyCaseStudies.pdf and
http://www.eman-rese.ca/eman/ecotools/protocols/terrestrial/vegetation/glossary.html

3. **Non-forest land** - Land not primarily intended for growing or supporting a forest. http://www.babineefmpp.com/glossary/N.html
http://www.swp.bc.ca/myw/html/21_Glossary.htm

4. **Unforested** [adj.] Not covered with forest; "unforested lands."

OLD-GROWTH FOREST

1. Future old growth forest: Forests contiguous to old growth forests that: (1) exhibits some but not all old growth characteristics, (2) occurs in direct association with and as an integral part of an old growth forest, and (3) has the capacity to protect old growth forest areas because of their forest characteristics and location. http://www.massforesters.org/old.htm
2. **(Canada - BC)** - Forests on the coast > 250 years old; and forests in the interior > 140 years old for most tree species, and > 120 years old for lodgepole pine and deciduous species. http://www.natareas.org/abstr18.htm
3. **(Canada - BC)** Forest that contains live and dead trees of various sizes, species composition and age class structure that are part of a slowly changing but dynamic ecosystem. Old growth forests include climax forests, but do not exclude sub-climax or even mid-seral forests. The age and structure of old growth varies significantly by forest type and from one biogeoclimatic zone to another. (Wells, et al. 1998)
4. **(Canada)** A stand dominated by mature or overmature trees that has not been significantly influenced by human activity. The stand can contain various ages and species of vegetation. http://www.nrcan.gc.ca/cfs/proj/sci-tech/arena/gloss_e.html#26
5. **(Finland)** A forest stand exceeding the regular cycle by 20 years. Lauri Karvonen 24.4.2000. Guidelines for Landscape Ecological Planning.
6. **(Foret ancienne, rodal maduro).** A forest dominated by mature organisms that have originated naturally from those endemic to the forest or its surrounds, in which the genetic, species and structural diversity have not been significantly changed by human activity. Forestry Chronicle 70(6):669 1994.
7. **(Philippines)** Forest predominantly stocked with mature trees with less than 25 percent of the mature stand volume removed by cutting. http://www.nscb.gov.ph/ru12/DEFINE/DEF-ENV.HTM
8. **(Primary, Original)** Forests that have never been clear cut and that have little or no evidence of past human activity. Such forests may have been grazed, experienced limited exploitation of valuable tree species, and their floors may have been burned by Amerindians and European colonists (Duffy and Meier 1992).
9. **(Timber)** - Timber from a mature, naturally established forest (Georgia Forestry Commission).
10. **(USA - USFS - Monongahela NF)** - Stands with large, mature, or overmature trees comprising a plurality of the stocking... usually having a multi-layered canopy in trees of various age classes... includ[ing] dead trees and relatively large amounts of decaying material on the forest floor. USDA FS Monongahela National Forest, West Virginia (1986). http://wvnvm.wvnet.edu/~rlanden/oldgrth.htm
11. **(USA-Massachusetts)** - An area of contiguous forest that (1) shows no evidence of significant human, post-European disturbance that originated on site, (2) has a significant component of older trees that are greater than fifty percent of the maximum longevity for that particular species, (3) is at least five acres in size, and (4) has the capacity for self-perpetuation, or (5) has the characteristics of a forest which, when found in combination together, are indicative of an old growth forest and which otherwise meets the criteria established by regulation by the Secretary. http://www.massforesters.org/old.htm

12. **(USA-Nevada)** "Old growth" refers to stands of essentially undisturbed virgin timber on which less than 25 percent of the volume has been removed by cutting, fire or other causes. Source: NRS 528.019 http://www.leg.state.nv.us/web/99NRS/NRS-528.html

13. **(USA-USFS)** The USFS has developed Old-Growth definitions for each of the major forest types found in the United States. These are available from the Regional Offices of the US Forest Service. A generic definition is as follows: Ecosystems distinguished by old trees and related structural attributes. Old growth encompasses the later stages of stand development that typically differ from earlier stages in a variety of characteristics which may include tree size, accumulations of large dead woody material, number of canopy layers, species composition, and ecosystem function. Description - The age at which old-growth develops and the specific structural attributes that characterize old growth will vary widely according to forest type, climate, site conditions, and disturbance regime. For example, old-growth in fire-dependent forest types may not differ from younger forests in the number of canopy layers or accumulation of down woody material. However, old-growth is typically distinguished from younger growth by several of the following attributes: 1) large trees for species and site, 2) wide variation in tree sizes and spacing, 3) accumulations of large-size dead standing and fallen trees that are high relative to earlier stages, 4) decadence in the form of broken or deformed tops or bole and root decay, 5) multiple canopy layers, and 6) canopy gaps and understory patchiness. Old-growth is not necessarily "virgin" or "primeval." Old-growth could develop following human disturbances. USFS 1989.

14. **(USA-Vermont)** A forest stand in which natural processes and succession have occurred over time undisturbed by human intervention http://www.state.vt.us/anr/fpr/forestry/ucf/glossary.htm Vermont Forest Resource Plan.

15. **(Russia)** Old-growth forests are forests originated through natural successions and have not experienced significant human impact over a long period of time. Under significant human impact we understand: clearcutting or intensive selective logging; large scale human-induced fires; intensive and regular application of chemicals such as pesticides, herbicide, fertilizers, etc.; severe industrial pollution; forest reclamation; intensive recreation, etc. Under the long period of time we understand the time, which exceeds the lifetime of the dominant tree species for a particular forest type. http://www.forest.ru/eng/old-growth/index.html

16. **(Victorian forests)** - Forest which contains significant amounts of its oldest growth stage in its upper stratum and has been subjected to any disturbance, the effect of which is now negligible. http://www.rfa.gov.au/documents/oldgrowth/oldgrow.html#E11E3 (Woodgate et al. (1994).

17. A classification of forest stands that describes an ecologically mature ecosystem. Where information is not available for ecological classification, age or size of dominant trees, or both, are used. (Bolsinger and Waddell 1993)

18. A climax forest that has never been disturbed by man. The old growth forests can be classified as per the age and disturbance criteria. http://www.biodiv.org/Forests/Glossary.html

19. A forest characterized by growth displaying successional stages that occur only after a relatively long period of time without a catastrophic disturbance. In Minnesota, old-growth forests probably develop after 125-150 years without a catastrophic disturbance (adapted from *Old-growth Forests in Minnesota. A Preliminary Report*, Minnesota DNR Natural Heritage Program). http://www.greatplains.org/resource/1999/natural/natural.pdf

20. A forest dominated by mature organisms that have originated naturally from those endemic to the forest or its surrounds, in which the genetic, species and structural diversity have not been significantly changed by human activity.
http://www.forestry.utoronto.ca/ac_staff/emeritus/My%20Webs/english.htm

21. A forest dominated by mature trees that has not been significantly influenced by human activity" (CCFM 1997: 124).
http://www.fraserinstitute.ca/publications/critical_issues/2000/env_indic/section_07.html

22. A forest or stand that (1) contains at least one, preferably several, tree species that have attained an average age of 150 years or more in the mature specimens; (2) has gone undisturbed by human activity for a time interval sufficient for the establishment of old-growth characteristics, and; (3) contains a density of at least 8 mature trees in the 150 year-old age bracket per acre. Leverett (1991). http://wvnvm.wvnet.edu/~rlanden/oldgrth.htm

23. A forest relatively old and relatively undisturbed. NOTE: (1) The term "old" varies by the species or group of species in a stand. (2) Some individuals believe old growth to be an uncut, virgin forest with very little man-made disturbance, while other individuals believe an old growth forest can be created by limiting future disturbance and creating certain characteristics evident in uncut virgin stands and thus termed a managed old growth forest.
http://weber.u.washington.edu/~robh/S-7/EcolGlos.html

24. A forest stand usually at least 180-220 years old with moderate to high canopy closure; a multi-layered, multi-species canopy dominated by large overstory trees; high incidence of large trees, some with broken tops and other indications of old and decaying wood ("decadence"); numerous large snags; and heavy accumulations of wood, including large logs on the ground. From: Kathy_Jope@nps.gov (Kathy Jope) also http://www.studyweb.com/Agriculture/

25. A forest that contains live and dead trees of various sizes, species, composition, and age class structure. Old-growth forests, as part of a slowly changing but dynamic ecosystem, include climax forests but not sub-climax or mid-seral forests. The age and structure of old growth varies significantly by forest type and from one biogeoclimatic zone to another.
http://www.for.gov.bc.ca/pab/publctns/glossary/O.htm
http://www.for.gov.bc.ca/pab/publctns/frrra/app-c.htm

26. A forest that contains live and dead trees of various sizes, species, composition and age-class structure. The age and structure of old growth varies significantly by forest type and from one biogeoclimatic zone to another. http://www.interfor.com/glossary/glossary24.html

27. A forest that has not undergone a stand-replacing disturbance such as logging or fire, such that succession has not occurred. http://www.eresourcesystems.com/Help/Glossary/glossary.html

28. A forest that is ecologically mature and has been subjected to negligible unnatural disturbance such as logging, roading or clearing. http://www.rfa.gov.au/dfa/other_info/attachd.html

29. A late stage of forest succession. Although the specific characteristics of old-growth stands vary with species composition and history, some commonly expected attributes in mesic forests on productive sites include–an abundance of large trees at least 180 to 200 years old; a multi-layered, multi-species canopy dominated by large overstory trees with moderate to high closure; numerous trees with broken tops, snags, and large logs.
http://www.rmrs.nau.edu/publications/rm_gtr_295/glossary.html

30. A mature forest which has not been disturbed by human activity. Also known as virgin forest. An increasingly rare, and increasingly valued, element of the wilderness. The lumbermen see it as something else, as evidenced in this not-so-subtle definition from an industry web site: Old Growth Forest: Forest stands in which the dominant cover types are mature or over-mature trees that have reached their maximum size. No harvest has occurred among these large, old trees and dead and fallen trees are as common as standing trees. Boundary Waters Compendium Glossary. http://www.rook.org/earl/bwca/lists/glossary/

31. A natural progression of forest growth without evidence of man's influence. Sydney Haskell, Carmanah Forestry Society. (Wells, et al. 1998)

32. A post-rotational forest http://www.ameteam.ca/glossary.htm

33. A primary or a secondary forest which has achieved an age at which structures and species normally associated with old primary forests of that type have sufficiently accumulated to act as a forest ecosystem distinct from any younger age class. UNEP/CBD/SBSTTA 2001

34. A stand of mature or overmature trees relatively uninfluenced by human activity. The stand can contain multiple layers of tree canopies, and various ages and species of vegetation. http://www-env.ccm.emr.ca/schoolnet/issues/borealnet/n_glos/glos.htm and http://atlas.gc.ca/legacy/schoolnet/issues/borealnet/n_glos/glos.htm

35. A very old and complex forest community, usually at least 200 years old, characterized by a mixture of species, trees of varied size and age, snags, and extensive amounts of wood on the forest floor. http://www.nps.gov/olym/edgloss.htm

36. An ecosystem distinguished by the presence of populations of old trees that is not necessarily in late successional condition or tree from evidence of human activity (Spies 1997).

37. An undisturbed forest with trees that are more than 200 years old. It is characterized by fallen trees, trees with broken tops and mature and dying trees. http://www.nbs.gov/features/kidscorner/glossary.html and http://biology.usgs.gov/features/kidscorner/glossary.html

38. Ancient forests. http://www.nrdc.org/sitings/lookup/teraa.html

39. Any ecosystem composed of dominant and codominant trees that are mature. http://fscus.org/html/standards_policies/us_regional_standards/archives/ozark_ouachita4.html

40. Ecologically mature and have been subjected to negligible human-induced disturbance such as logging, roading and clearing or, if subject to any disturbance, the effect of which is now negligible. Oldgrowth forests are usually dominated by trees which exhibit late-mature or senescent growth stages in the upper stratum. http://www.rfa.gov.au/rfa/vic/east/raa/esfm/gloss1.html

41. Ecologically mature forest that has been subject to negligible levels of disturbance such as logging, roading and clearing. The definition focuses on forest in which the upper stratum or overstorey is in the late mature or overmature growth phase. http://www.rfa.gov.au/dfa/other_info/glossary.html

42. Ecologically mature forest where the effects of disturbances are now negligible. http://www.rfa.gov.au/documents/oldgrowth/oldgrow.html#E11E3

43. Ecosystems distinguished by old trees and related structural attributes. Specific attributes vary according to forest type, climate, site conditions, and disturbance regime. http://www.safc.org/resources/glossary.htm#definitions

44. Ecosystems distinguish by old trees and related structural attributes. Old-growth forests are characterized by larger tree size, high accumulations of large dead woody material, multiple canopy layers, species composition, and ecosystem function. The structure and function of an old-growth ecosystem will be influenced by its stand size and landscape position and context. www.superiornationalforest.org/july4thstorm1999/Appendix%20B.doc

45. Forest conditions often including multiple canopy layers, variety in tree sizes and species, variety of tree ages including mature trees, and standing and dead woody material. http://www.ci.boulder.co.us/bmp/Plan/glossary.htm

46. Forest having the following structural characteristics: 1. An abundance of old trees, recognizable by the asymmetrical shapes, relatively long trunks free of low branches (i.e., in-forest as opposed to open-grown shapes), deeply furrowed or plated bark, signs of heartwood decay, large prominent root structures, flattened crowns with protruding dead limbs, large thick limbs, and trunks often showing a twist that develops with age; 2. Fallen logs in all stages of decomposition, crisscrossing the forest floor and lying in and across stream beds, covered by moss and lichens; 3. Plentiful snags (standing dead trees); 4. Canopy gaps, large and small, formed from trees that have fallen; 5. Undulating forest floor, expressed in randomly scattered pits and mounds where trees have fallen over and decomposed; 6. Majority of tree species that fall into the late successional class and a conspicuous absence of multiple-stemed trees; 7. Minimal of signs of human disturbance. http://www.canadian-forests.com/fsc-glossary.html and Eastern Old-Growth Forests: Prospects for Rediscovery and Recovery (M.B. Davis (Ed.) 1996. Island Press, Washington, DC).

47. Forest in which the upper stratum is ecologically mature and has been subjected to negligible unnatural disturbance such as logging, road-building and clearing. http://www.epa.nsw.gov.au/soe/95/28.htm

48. Forest stand dominated by trees reaching natural death; the last stage in forest succession. http://biotech.chem.indiana.edu/search/dict-search.phtml

49. Forest stand dominated by trees reaching natural senescence; the last stage in forest succession. http://www.habitat-restoration.com/paeglos.htm

50. Forest stands well beyond the rotation age for managed forests. Canadian Pacific Forest Products Ltd. (Wells, et al. 1998).

51. Forest that contains live and dead trees of various sizes, species, composition and age class structures. Old growth forests, as part of a slowly changing but dynamic ecosystem, including climax forests but not sub-climax or mid-seral forests. http://www.luco.gov.bc.ca/lrmp/diamond.htm#60

52. Forest that has a significant proportion of the oldest discernible growth stage(s) in its overstory and negligible structural evidence of disturbances. http://www.privateforestry.org.au/glos_o-z.htm

53. Forest that is ecologically mature and has been subjected to negligible unnatural disturbance such as logging, roading and clearing. The definition focuses on forest in which the upper stratum or overstory is in the late mature to overmature growth phases. (The National Forest Policy Statement (Commonwealth of Australia 1992) identified. http://www.rfa.gov.au/documents/oldgrowth/oldgrow.html#E11E3)

54. Forest which has not had significant unnatural disturbances altering its content or structure since European settlement. http://www.schools.wafa.org.au/terms.htm

55. Forest with uninterrupted growth of more than 175 years (mid-latitudes). http://www.yorku.ca/faculty/academic/cblanche/nats2200/n22oldgrowth.html

56. Forests having a long, uninterrupted period of development...substantially free of human influences or natural disturbances... Whitney (1987). http://wvnvm.wvnet.edu/~rlanden/oldgrth.htm

57. Forests that either have never been cut or have not been cut for many decades. Forests characterized by a large percentage of mature trees. http://outreach.missouri.edu/mowin/Resources/glossary/glossaryo.html

58. Forests which have never been logged or developed. http://www.themouth.org/forest/oldgro.html

59. Forests with some very old trees. These forests have not been disturbed by major hurricanes, fires, or human actions in the last 200 to 250 year. http://omega.cc.umb.edu/~conne/joel/definition.htm

60. Generally, a forest stand that has reached a stage of extreme maturity. http://www.dnr.state.mi.us/wildlife/Landowners_Guide/Introduction/Glossary.htm

61. Individual trees that are beyond the age of biological maturity, or stands that contain old growth trees as well as some large snags, and logs on the ground. http://www.sfrc.ufl.edu/Extension/ssfor11.htm

62. Later stages in forest development that are often compositionally and always structurally distinct from earlier successional stages. Franklin and Spies 1991.

63. Later stages of forest development that are often compositionally and always structurally distinct from earlier stages. Old-growth forests contain trees that are large for their species on a site. In addition, old growth is usually charactertized by a variety of tree sizes, abundant large snags and logs, and a developed, but patchy understory. Old-growth typically exhibits high diversity in structural attributes due to varied stand disturbance histories, variable plant species mixes among sites, and interactions with adjacent stands. Structural characteristics are dynamic and old-growth stands do not always contain all of the attributes used to describe them. However, forests that most clearly match the full range of structural features for old-growth will most likely provide the full array of associated functional characteristics. (Mike Chapel, California Board of Forestry) Source: Beardsley_Debby/r6pnw_portland@fs.fed.us

64. Mixed-mesophytic old-growth, includes large trees, basal area, diverse (native) understories, windthrow mounds, snags, woody debris, etc. Martin (1992). http://wvnvm.wvnet.edu/~rlanden/oldgrth.htm

65. Old forests often containing several canopy layers, variety in tree sizes and species, trees at least 180 to 220 years old, and standing and dead woody material (http://www.umpqua-watersheds.org/glossary/gloss_o.html)

66. Old forests valuable in nature conservation terms have usually greatly exceeded the regeneration ages stipulated in forestry data. The trees are normally of varying sizes and species, and form multiple canopy layers, although spruce forest at a late successional stage also qualifies. Old stumps or other minor traces of human activity do not necessarily reduce the conservation value of a forest. Old age and competition have increased the amount of natural removal, and often also the amount of damage naturally suffered by the trees. The Working Group on the Protection of Old Forests on State Lands in Southern Finland

67. Old forests which often contain several canopy layers, variety in tree sizes and species, decadent old trees, and standing and dead woody material. http://www.ci.boulder.co.us/openspace/Forest/forestgloss.htm

68. Old growth and ancient forests are essentially the same thing. "Ron Muir" muir@forestry.auburn.edu

69. Old growth forests can be loosely described as forests that look largely as they would appear if Europeans had not settled North America. They are forests that have suffered little or no logging or grazing. http://www.earthisland.org/oldgrowth/faq.html

70. Old growth, virgin forest -- (forest or woodland having a mature or overmature ecosystem more or less uninfluenced by human activity) http://www.notredame.ac.jp/cgi-bin/wn?forestForests which have never been logged or developed. http://www.taconic.net/sequoiainternet/forest/oldgro.htm

71. Old multi-story forest - a forest stand with moderate to high canopy closure—a multi-leveled and multi-species canopy dominated by large overstory trees; high incidence of large trees, some with broken tops and other indications of old and decaying wood; numerous large snags; and heavy accumulations of wood, including large logs on the ground. http://roadless.fs.fed.us/documents/feis/glossary.shtml

72. Old-growth forests are ecologically mature and have been roading and clearing or, if subject to any disturbance, the effect of which is now negligible. Oldgrowth forests are usually dominated by trees which exhibit late-mature or senescent growth stages in the upper stratum. http://www.rfa.gov.au/rfa/vic/east/raa/esfm/gloss2.html

73. Old single story forest – single canopy layer consisting of large or old trees. Understory trees are often absent, or present in randomly spaced patches. It generally consists of widely spaced, shade-intolerant species, such as ponderosa pine and western larch, and high frequency fire regimes. http://roadless.fs.fed.us/documents/feis/glossary.shtml

74. Old-growth forest i.e. ancient forest means a natural-state (or close) forest where the amount of dead wood is tens of cubic meters per hectare. Ilkka Hanski (1999) Helsingin Sanomat

75. Old-growth forests are natural forests with pronounced variations in the ages of the trees, multiple-layered vegetation, and a great abundance of old trees and large pieces of dead wood in different stages of decay. Swedish FSC standard

76. Old-growth forests contain threatened ecosystems and species, or endemic species. They can also be large landscape-level forests capable of supporting natural ecological patterns. The Taiga Rescue Network

77. Old-growth stands must include at least six trees per acre that are more than 30 to 32" in diameter and more than 200 years in age. The stands must have multilayered canopies (except within

mixed evergreen forests) and hold minimal amounts of large standing snags more than 20 " in diameter and fallen logs at least 24" in diameter. 1986 Old-Growth Definition Task Force of the Forest Service interim definition.
http://www.woodrow.org/teachers/biology/institutes/1992/old_growth.html

78. Old-growth tree. The closest scientific description is that it's a tree that is beyond its pathological rotation age--or simply a tree living beyond its maturity.
http://www.accessatlanta.com/news/business/old_definition.html

79. Original, intact forest land that has not yet been significantly degraded by people.
http://www.ran.org/ran/info_center/factsheets/basicfacts.html

80. Relatively old and relatively undisturbed by humans. Hunter (1989).
http://wvnvm.wvnet.edu/~rlanden/oldgrth.htm

81. Stands in primary or secondary forests that have developed the structures and species normally associated with old primary forest of that type have sufficiently accumulated to act as a forest ecosystem distinct from any younger age class.
http://www.biodiv.org/programmes/areas/forest/definitions.asp

82. Stands in which the relic trees have died and which consist entirely of trees which grew from beneath the canopy. Oliver and Larson 1996.

83. Stands in which the relic trees have died and which consist entirely of trees which grew from beneath... and which have developed in the absence of allogenic processes". Transition old-growth "contains some trees which began after the initial disturbance and also large and numerous younger trees of allogenic origin". Oliver and Larson (1996) and Leverett (1996).
http://wvnvm.wvnet.edu/~rlanden/oldgrth.htm

84. Stands regenerated by natural succession, with a substantial amount of old trees and deadwood, and often with an uneven age structure. http://www.forest.ru/eng/old-growth/definitions.html

85. Stands that are "overmature, past the point of maximum growth, etc. Leverett (1996).
http://wvnvm.wvnet.edu/~rlanden/oldgrth.htm

86. Stands with a high percentage (>50%) of the canopy trees over half of the maximum life span of the representative trees, a few trees near the maximum life span, no recorded history or discernible signs of human disturbance, a "late successionary" species composition, and a set of characteristics associated with mature, nature-managed forests. Leverett (1996).
http://wvnvm.wvnet.edu/~rlanden/oldgrth.htm

87. Stands with canopy trees usually 150 years old or older but no fixed percentage, trees need not be near maximum life span, but forest must possess a set of characteristics associated with mature forest. Leverett (1996). http://wvnvm.wvnet.edu/~rlanden/oldgrth.htm

88. The (usually) late successional stage of forest development. note 1 - old-growth forests are defined in many ways; generally, structural characteristics used to describe old-growth forests include (a) live trees; number and minimum size of both seral and climax dominants, (b) canopy conditions: commonly including multilayering, (c) snags: minimum number of specific size, and (d) down logs and coarse woody debris: minimum tonnage and numbers of pieces of specific size. note 2 - old-growth forests generally contain trees that are large for their species and site and sometimes decadent (overmature) with broken tops, often a variety of tree sizes, large snags and logs, and a developed and often patchy understory. note 3 - stand age, although a useful

indicator of old growth, is often considered less important than structure because (a) the rate of stand development depends more on environment and stand history than age alone, and (b) dominants are often multiaged. note 4 - due to large differences in forest type, climate, site quality, and natural disturbance history (e.g. fire, wind, and disease and insect epidemics), old-growth forests vary extensively in tree size, age classes, presence and abundance of structural elements, stability and presence of understory. note 5 - the minimum area needed for an old-growth forest to be a functional ecological unit depends on the nature and management of surrounding areas; small areas often do not contain all old-growth elements. note 6 - an old-growth forest is commonly perceived as an uncut, virgin forest with very little human-caused disturbance; some believe that the time taken for stands to develop old-growth structure can be shortened by silvicultural treatments which the area occupied by each species per unit area is estimated by eye. note - this method is contrasted with the weight method - synonym ocular plot estimate, plot estimate method, square-foot method (Helms 1998). From: tnygren@juno.com (Harold T Nygren)

89. The forest-state that stretches from the time of dominant stand height growth cessation, through to and including the stable forest climax. Western Canada Wilderness Committee. (Wells, et al. 1998).

90. The old growth forests have been described by the adjective primeval, ancient, wilderness, virgin, pristine while in forester's terminology they are called as over-matured, decadent, and senescent, old growth. The old growth forests may be defined as a climax forest that has never been disturbed by man. The old growth forests can be classified as per the age and disturbance criteria. http://glossary.eea.eu.int/EEAGlossary/O/old-growth_forest

91. The seral stage after mature, which is the potential plant community capable of existing on a site, given the frequency of natural disturbance events. In forests of the Pacific region, old growth often begins around age 200 and continues until a stand replacing event takes place. Depending on the frequency and intensity of disturbances, and site conditions, old-growth forest will have different structures, species compositions, and age distributions. http://fscus.org/html/standards_policies/us_regional_standards/archives/pacificnorthwest3.html

92. Those mature and over-mature forests which occupy sites which have not previously been impacted by the hand of man. Fletcher Challenge Ltd. (Wells, et al. 1998).

93. Timber stands with the following characteristics: large mature and over-mature trees in the overstory, snags, dead and decaying logs on the ground, and a multi-layered canopy with trees of several age classes. http://rredc.nrel.gov/biomass/states/bio_glossary/glossary.html and http://www.eren.doe.gov/biopower/glossary.html#F and http://bioenergy.ornl.gov/faqs/glossary.html#T

94. To most people "old growth" means big trees. The U.S. Forest Service definition is "a forest with trees 200 years or older, snags (standing dead trees), and down woody debris on the forest floor." http://www.forestinfo.org/Glossary.htm

95. Uncut virgin forest; a forest that has not undergone a stand-replacing disturbance such as logging or a crown fire, such that succession has not occurred. http://www.fw.vt.edu/zedaker/3364/ecolterms.html

96. Undisturbed primary forest, typically diverse in species and age of constituents, and is a result of competition and long-time natural selection International Dendrological Research Institute Glossary - http://world.std.com/~jegan/idriglossary.html

97. Virgin and old, second-growth forests containing trees that are often hundreds, sometimes thousands, or years old. http://www.gsu.edu/~mstnrhx/ecogloss.htm and http://ecology.org/biod/library/glos_NS.html

98. Virgin timber. http://rredc.nrel.gov/biomass/forest/tim_glossary/t_glossary.html#O

PLANTATION FORESTS (FOREST CULTURES)

1. **(Artificial crop, artificial stand ~ man-made forest)** - A stand raised artificially, either by planting or by direct sowing (South 1998).

2. **(Colombia)** Plantación Forestal: Es el bosque originado por la intervención directa del hombre. (Decreto 1791 octubre 4 de 1996. Ministerio del Medio Ambiente). "Gerardo Lozano" <glozano@impsat.net.co

3. **(EU)** Forest crop established by seeding or planting nursery-raised stock http://www.google.com/search?q=cache:europa.eu.int/comm/dg08/forests/en/en4_6.htm and http://europa.eu.int/comm/development/forests/en/en4_6.htm

4. **(FAO)** A forest established by planting and/or seeding in the process of afforestation or reforestation. It consists of introduced species or, in some cases, indigenous species. http://www.fao.org/docrep/003/y0900e/y0900e11.htm#P1_7

5. **(UN-FRA 2000)** Forest stands established by planting and/or seeding in the process of afforestation or reforestation which 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 plantation, even age class, regular spacing. (UN/ECE-FAO 1997 and FAO 1998)

6. **(Georgia)** Stand of seeded or planted wood species. Source: Forest Code (June, 1999) Kate Metreveli, Head of the WB Forestry, Project Preparation Unit. kattimet@geo.net.ge

7. **(Great Lakes - St. Lawrence Region (Canada))** Tree-dominated vegetated areas in which human intervention, through planting or intensive silvicultural treatments, has yielded conditions in which only a few of the characteristics of the indigenous natural forest ecosystem remain. [Draft standards for the Great Lakes - St. Lawrence Region (Canada) http://www.web.net/fscca/s5.htm

8. **(Morocco and Yemen)** Plantation (Arabic : Ard Mushajjarah, French : Platation, Spanish: Plantacion) - Land planted artificially (by man) with forest trees (regular spacing) Mohammed Ellatifi, m.ellatifi@ellatifi.8m.com

9. **(Nicaragua)** - Draft - Bosque de Plantaciones: Son los que se realizan por medio de la reforestación. www.nicarao.org.ni/ja (see Borrador de la ley, CAPITULO II DEFINICIONES) Harrie harnic@ibw.com.ni

10. **(South Africa)** Single species (usually either pine or eucalyptus), regular spacing, even-aged stands. http://www.polity.org.za/govdocs/green_papers/forest1.html#t1.1

11. **(U.S. Pacific Coast region)** - Tree-dominated areas substantially lacking in natural forest attributes (e.g., structure, and species composition native to the area) and that usually require human intervention. A "planted forest" is not necessarily a "plantation," since it may attain natural forest attributes. In the Pacific Coast region, any of the following characteristics may indicate that a forest is a plantation (though not necessarily one that is certifiable): Cultivation of exotic species, Use of even-aged silviculture for forest types that do not regenerate naturally through stand-replacing events, Use of even-aged silviculture with rotations of less than 60 years, Use of even-aged regeneration units larger than those specified under criterion 9.2, Systematic use of and reliance on chemical herbicides, pesticides, and fertilizers, Single-species plantings on sites normally occupied by multiple-species forests, and Regular, periodic stand treatments intended to eliminate natural ingrowth of native trees and associated ground vegetation. [Draft standards for the Pacific Coast Region (US) From: David South <dsouth@sofserv.forestry.auburn.edu Date: Wed, 17 Jun 1998 16:45:07 -0500]

12. **(UK)** Woodland where the current trees have been planted. Often includes naturally regenerating trees as well. Includes former semi-natural woodlands restocked by planting [Source: THE UK FORESTRY STANDARD. The Government's Approach to Sustainable Forestry, EDINBURGH: FORESTRY COMMISSION, 1998 http://www.forestry.gov.uk/standard.html and http://www.forestry.gov.uk/standard.pdf

13. **(Ukraine)** Forest stands created by planting of seedlings, saplings of trees or shrubs or by sowing of their seeds", i.e. it here this means only origination of stands, not intensity of management. [Source: State Standard of Ukraine, DSTU 2980-95 ``Forest plantations. Terms and definitions", being in force since 01.01.96. From: "Maksym Polyakov" mpoliak@pcomp.usau.kiev.ua Date: Sat, 28 Mar 1998 21:09:08 +0200 (UKR)]

14. **(USA)** Areas dominated by trees planted on a regular and generally consistent row and plant spacing. Stands are planted for the purpose of producing a crop of timber, Christmas trees, or other products. Examples include planted hardwood and softwood timber stands. [Source: http://biology.usgs.gov/fgdc.veg/standards/appendix3.htm]

15. A forest crop established by artificial, either by sowing or planting. Canadian Council of Forest Ministers.

16. A forest stand established by the planting of trees either native or exotic species elected for their wood-producing properties and managed intensively for timber. http://www.rfa.gov.au/rfa/vic/east/raa/esfm/gloss2.html

17. A forest that has been planted as a crop for eventual harvest. Most plantation forests are replanted following harvest for second and subsequent rotations in perpetuity. http://www.forestenterprises.co.nz/cfi/investmentstructure.htm

18. A forest which has been planted by people with species occurring naturally (native species plantation) or not (exotic species plantation) in that country. http://www.biodiv.org/Forests/Glossary.html

19. A group of planted trees grown in the form of an agricultural crop. http://www.nafi.com.au/k12/ourforests/glossary.html

20. A large area of trees usually planted specifically for harvesting. http://www.timberlands.co.nz/environment/manual/chap_16.pdf

21. A plantation forest may be afforested land or a secondary forest established by planting or direct seeding. A gradient exists among plantation forests from even-aged, single species monocultures of will probably also reflect the capability of the plantation forest to maintain "normal" local biological diversity. http://www.biodiv.org/programmes/areas/forest/definitions.asp

22. A planted forest of either native or exotic species. Small plantation may be called blocks or woodlots. http://www.nre.vic.gov.au/web/root/domino/infseries/infsheet.nsf/3b1939c497704dc14a25652e0039a43b/962f757481adad504a25679c000c7c44?OpenDocument

23. An area of managed forest where the trees have been planted, rather than grown naturally through regeneration (NGGIC 1997). http://www.greenhouse.gov.au/ncas/files/strategic/glossary.html

24. An artificially forested area established by planting or direct seeding. It is usually made up of a single species. http://msucares.com/pubs/pub1250.htm

25. Crops of trees artificially established, primarily for specific commercial purposes. http://www.af.nfr.no/andre-doc/alternativ-agenda/Forests.html, http://www.igc.org/habitat/treaties/at-27.htm, http://nativenet.uthscsa.edu/archive/nl/9208/0081.html

26. Floresta Plantada - Formação florestal composta por espécies exóticas e/ou nativas, plantadas com objetivos específicos. http://www.suzano.com.br/docs/recursos/maneucal/glossar.html

27. Forest areas lacking most of the principal characteristics and key elements of native ecosystems as defined by the Forest Stewardship Council -approved national and regional standards of forest stewardship, which result from the human activities of either planting, sowing or intensive silvicultural treatments (South 1998). http://www.metla.fi/archive/forest/1994/07/msg00035.html. PRINCIPLES AND CRITERIA FOR FOREST STEWARDSHIP. Revised March 1996, edited October 1996 and http://biodiversityeconomics.org/business/topics-101-07.htm

28. 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 plantation, even age class, regular spacing. Excludes: stands which were established as plantation but which have been without intensive management for a significant period of time. These should be considered semi-natural (UN-ECE/FAO 1997).

29. Forest stands that have been established artificially to produce a forest product crop. They are either on lands that previously have not supported forests for more than 50 years (afforestation), or on lands that have supported forests within the last 50 years and where the original crop has been replaced with a different one (reforestation) (Brown et al. 1986).

30. Forests established artificially, either by afforestation on land which has not carried forest within living memory or by reforestation of land which carried forest before but where the indigenous species are replaced with a new species or genetic variety. http://www.google.com/search?q=cache:europa.eu.int/comm/dg08/forests/en/en4_6.htm

31. Forests or woods that have been planted. http://www.forestry.gov.uk/forestry/hcou-4ubj75

32. Forests that are planted as a crop. http://www.forestenterprises.co.nz/cfi/investmentstructure.htm

33. Intensively managed stands of either native or exotic trees species, created by the regular placement of seedlings or seed. http://www.rfa.gov.au/dfa/other_info/glossary.html

34. Plantation: a usually large group of plants and especially trees under cultivation (http://www.m-w.com/dictionary)

35. PLANTED FORESTS - These forests have been established by planting or sowing on barren land, grassland, land cleared of secondary forest or scrub, land cleared of primary or modified forest. http://www.itto.or.jp/policy/pds4/page5.html

36. Planted stand of trees (WESTVACO)

37. Plot of land occupied by fast-growing or `technical' forest species with the aim of producing timber with short rotation or producing bark, (willow) withes, seeds, grafts etc. our term <[forest] plantation can be translated to English as - [forest] plantation, - seed orchard.... [From: "Maksym Polyakov" mpoliak@pcomp.usau.kiev.ua Date: Wed, 17 Jun 1998 11:20:37 +0300 (MSD)]

38. This category includes artificial forests created by sowing or planting trees and forest stands improved by introduction of valuable tree species. Forest plantations are divided into two categories: plantations with closed crown canopy (registered as forest), and plantations which did not yet form closed crown cover. (ref. Forest stock, Forest plantation which did not yet for closed crown cover). Minimum mapping unit 0.5 ha.
http://ewg.gecp.virginia.edu/ewg_forest_us/general/glossary.htm

39. (Timber) - The most intensive form of forest management. It is characterized by monocultures of fast-growing tree species (e.g. poplar, *Pinus radiata*, eucalyptus), short rotation lengths (< 60 years), stand regeneration by planting, application of soil fertilization and tillage, pest control and other measures aimed at increasing timber yields. Plantations are a transitional form between forestry and agricultural land use. Most afforestation takes the form of this type of management. http://www.awi-bremerhaven.de/WBGU/wbgu_sn1998_voll_engl.html

40. Tree Plantations, are simplified tree dominated ecosystems that have suppressed natural succession patterns. They have a poor capacity to mature into natural forest systems and lie on lands cleared of native vegetation. Often, they contain elements of exotic species. Tree plantations vary from the industrial monocultures to diverse home gardens. Tree plantations do not have the capacity to mature into natural forest systems. Ranil Senanayake 100232.3435@CompuServe.COM

41. Tree-dominated areas substantially lacking in natural forest attributes (e.g. structure and species composition native to the area) that usually require human intervention in order to be maintained. A "planted forest" is not necessarily a "plantation" since it may be part of a management regime that maintains most natural forest attributes indigenous to the area. The Pacific Coast Working Group of FSC-US

42. Tree-dominated vegetated areas in which human intervention, through planting or intensive silvicultural treatments, has yielded conditions in which only a few of the characteristics of the indigenous natural forest ecosystem remain. (defined by FSC A.C.) http://fscus.org/html/standards_policies/us_regional_standards/archives/pacificnorthwest3.html

43. Trees usually of a single species planted on cleared land for the purpose of growing a product such as wood. http://schools.wafa.org.au/terms.htm

PRIMARY (WOODLAND) FOREST

1. Primary - 1a: first in order of time or development: PRIMITIVE <the primary stage of civilization b: of or relating to formations of the Paleozoic and earlier periods 2a: of first rank, importance, or value: (http://www.m-w.com/dictionary)
2. (EU) Relatively intact natural forest which has remained essentially unmodified by human activity for the past 60-80 years http://europa.eu.int/comm/dg08/forests/en/en4_6.htm and http://europa.eu.int/comm/development/forests/en/en4_6.htm
3. (Nicaragua) - Draft - Bosque Primario: Bosque relativamente intacto que esencialmente no ha sido modificado por la actividad humana durante los últimos 60 a 80 años. www.nicarao.org.ni/ja (see Borrador de la ley, CAPITULO II DEFINICIONES) Harrie <harnic@ibw.com.ni>
4. (Thailand) Forest which are in a close or natural unidusturbed state. The report of Thailand's National Greenhouse Gas Inventory, 1990 "Wilailak Pangtawaong" wpangtaw@deqp.go.th
5. A climax forest comprising primary or climax species, i.e. a forest that either has not been severely disturbed or has fully recovered from disturbance by a secondary succession - John Morrison john.GISLAB@WWFUS.ORG
6. A forest ecosystem with the principal characteristics and key elements of native ecosystems such as complexity, structure, and diversity and an abundance of mature trees, relatively undisturbed by human activity. Human impacts in such forest areas have normally been limited to low levels of hunting, fishing and harvesting of forest products. Such ecosystems are also referred to as "mature," "old-growth," or "virgin" forests.
   http://www.fscstandards.org/regions/southeast/glossary.html
7. A forest in a mature succession phase whose structure and composition have resulted from unrestrained ecological processes rather than from human activity.
   http://iisd1.iisd.ca/wcfsd/wcfsdsummary.pdf
8. A forest largely undisturbed by human activities. http://www.wri.org/wri/biodiv/gbs-glos.html#OPQ
9. A forest occupying a site that has been continuously forested* even though it may have been clear-felled, provided that the clear-felling does not break the forest continuity (i.e. the forest regenerated or was replanted) (Allaby 1994).
10. A forest that has never been logged or disturbed.
    http://www.enchantedlearning.com/subjects/plants/glossary/indexp.shtml
11. A forest that has never been logged and has developed following natural disturbances and under natural processes, regardless of its age. It is referred to "direct human disturbance" as the intentional clearing of forest by any means (including fire) to manage or alter them for human use. Also included as primary, are forests that are used inconsequentially by indigenous and local communities living traditional lifestyles relevant for the conservation and sustainable use of biological diversity. In much of Europe, primary forest has a different connotation and refers to an area of forest land which has probably been continuously wooded at least throughout historical times (e.g., the last thousand years). It has not been completely cleared or converted to another land use for any period of time. However traditional human disturbances such as patch felling for shifting cultivation, coppicing, burning and also, more recently, selective/partial logging may have occurred, as well as natural disturbances. The present cover is normally relatively close to the natural composition and has arisen (predominantly) through natural

regeneration, but planted stands can also be found. However, the suggested definition above would include other forests, such as secondary forests.
http://www.biodiv.org/programmes/areas/forest/definitions.asp

12. An ecosystem characterized by an abundance of mature trees, relatively undisturbed by human activity. Human impacts in such forest areas have normally been limited to low levels of hunting, fishing and harvesting of forest products, and, in some cases, to low density, shifting agriculture with prolonged fallow periods. Such ecosystems are also referred to as "mature," "old-growth" or "virgin" forests. (further details will be addressed by FSC-approved national and regional standards of forest stewardship) PRINCIPLES AND CRITERIA FOR FOREST STEWARDSHIP. Revised March 1996, edited October 1996.
http://www.canadian-forests.com/fsc-glossary.html,
http://www.fscus.org/html/about_fsc/who_we_are/glossary_of_terms.html#p

13. An old-growth or ancient forest, that has kept recycling for thousands of years. http://www.geocities.com/RainForest/Canopy/5974/

14. Areas where the primary lot pattern consists of lots of record (as defined by the Multnomah County zoning code for Commercial Forest Use-zoned areas) in excess of 40 acres and where there are few existing residences. Primary forest lands may include smaller lots of record which do not by themselves meet the definition, but which are isolated from other smaller lots of record by lands which do meet the definition of primary forest lands. The second, which shall be designated as COMMERCIAL FOREST - 2, consists of the remainder of the Commercial forest Use-zoned areas. Secondary forest lands are defined as areas consisting of contiguous lots of record less than 40 acres, many of which have existing residences. Secondary forest lands may include larger lots of record which by themselves do not meet the definition, but which are isolated from other larger lots of record by lands which do meet the definition of secondary forest lands http://www.multnomah.lib.or.us/lup/WestHills/WHHome.html

15. Forest that has never been harvested or otherwise disturbed at a large scale by humans. http://www.dnr.state.wi.us/org/land/forestry/Look/assessment/11.pdf

16. Land which has never been anything other than woodland since the end of the last Ice Age, although it may have been regularly harvested.
http://www.woodland-trust.org.uk/glossary/indexfr.htm The Woodland Trust Glossary

17. Intact forest that has been essentially unmodified by human activity for the past sixty to eighty years. http://www.wrm.org.uy/actors/WB/1994policy.html

18. One that has not been disturbed by anthropogenic action such as grazing, logging, road building, chemical deposition, or by frequent fires. A "primary forest" is also of sufficient size that it is capable of regenerating all the endogenous species that inhabit or dwell there. From: John Foster "J. Foster" borealis@mail.wellsgray.net

19. PRIMARY FOREST (syn. pristine, virgin, or old growth forest) Forest which has never been subject to human disturbance, or has been so little affected by hunting and gathering that its natural structure, functions and dynamics have not undergone any unnatural change. http://www.itto.or.jp/policy/pds4/page5.html

20. Relatively intact forest that has been essentially unmodified by human activity for the past sixty to eighty years; an ecosystem characterized by an abundance of mature trees. Human impacts in such forests have been limited to low levels of artisanal hunting, fishing, and harvesting of forest products, and, in some cases, low density migratory agriculture (World Bank 1991).

21. Woodland occupying a site which has been continuously wooded (in Britain since the last ice advance) even though it may have been clear-felled, provided that the clear-felling does not break the woodland continuity [i.e. the woodland regenerated or was replanted] (Allaby 1994) Helene M Cleveland CCMAIL hmclevel@aec.apgea.army.mil
22. Woodland that has had continuous cover of native trees throughout history http://www.tnw.org.uk/Note17.html

RANGELAND

1. (Grazing land) - Any area of pasture, rangeland or other grassland available for stock to grazehttp://www.abs.gov.au/websitedbs/c311215.nsf/20564c23f3183fdaca25672100813ef1/b4a3c3fd558c2c7dca2569c80077855e!OpenDocument
2. (Grazing land) - Any vegetated land that is grazed of that has the potential to be grazed by animals. http://www.forages.css.orst.edu/Contents/Glossary/G.html
3. (Grazing land) - A collective term that includes all lands having plants harvestable by grazing without reference to land tenure, and other land uses, management, or treatment practices (Jacoby, 1989)
   http://www.tarleton.edu/~range/Introduction/grazing-land.htm,
   http://www.forages.css.orst.edu/Topics/Pastures/Grazing/Terminology/grazterm_body.html#I,
   and http://www.tarleton.edu/~range/Introduction/grazing-land.htm
4. (Grazing land) - Includes both grasslands and forest lands where the indigenous vegetation is actively managed for grazing, browsing or occasional hay production. Land used for facilities in support of ranching operations that are adjacent to or an integral part of these operations also is included. http://dnr.state.il.us/mines/lrd/guides/citrec7.htm
5. (Philippines) (Grazing Land) - Refers to that portion of the public domain which has been set aside, in view of the suitability of its topography and vegetation, for raising of livestock (PD 1559). http://www.nscb.gov.ph/peenra/Publications/Compendium/glossary.PDF
6. (Nepal) - The rangeland in Nepal includes grasslands, shrub lands, forest and other areas often used by grazing animals.
   http://www.fao.org/ag/AGP/AGPC/doc/pasture/peshawarproceedings/importantaspects.pdf
7. (Pasture) - A grass field used for grazing cattle, sheep or horses.
   http://mrw.wallonie.be/cgi/dgrne/sibw/eunis.glo.pl?WORD=pasture
8. (Pasture) - A meadow which cattle is grazing.
   http://www.educagri.fr/hedges/eng/glossary/detail.cfm?code=453
9. (Pasture) - A type of grazing management unit enclosed and separated from other areas by fencing or other barriers and devoted to the production of forage for harvest primarily by grazing.
   http://www.forages.css.orst.edu/Contents/Glossary/P.html
10. (Pasture) - Forage plants used as food by grazing animals.
    http://www.tamu.edu/classes/rang/rknight/rlem102/lecture3/rangeland-definitions.pdf
11. (Pasture) - A grazing area enclosed and separated from other areas by fence.
    http://www.tamu.edu/classes/rang/rknight/rlem102/lecture3/rangeland-definitions.pdf

12. (Pastureland) - A Land cover/use category of land managed primarily for the production of introduced forage plants for livestock grazing. Pastureland cover may consist of a single species in a pure stand, a grass mixture, or a grass-legume mixture. Management usually consists of cultural treatments: fertilization, weed control, reseeding or renovation, and control of grazing. For the NRI, includes land that has a vegetative cover of grasses, legumes, and/or forbs, regardless of whether or not it is being grazed by livestock. http://www.wv.nrcs.usda.gov/nri/glossary.html

13. (Pastureland) - This category includes all types of pastureland. It includes cropland used only for pasture or grazing, woodland pastured, and other pastureland and rangeland. http://www.nass.usda.gov/census/census97/atlas97/glos_int.pdf

14. (Prime) - All land comprised of soils classified as grass, oak-grass, and other soils that may produce feed at the rate of 40 acres or less per animal unit, and which qualifies for inclusion in an Agricultural Preserve Type II: http://www.co.mendocino.ca.us/planning/GenPlan/LandUse/GGlossary.pdf

15. (Range) - Embraces *rangelands* and also many *forest lands* which support an understory or periodic cover of herbaceous or shrubby vegetation amenable to certain range management principles or practices. Syn., *veld.* ct. *grazable woodland.* http://www.tamu.edu/classes/rang/rknight/rlem102/lecture3/rangeland-definitions.pdf

16. (Range) - Land supporting indigenous vegetation that is grazed or has the potential to be grazed, and is managed as a natural ecosystem. Includes grazable forestland and rangeland. http://www.forages.css.orst.edu/Contents/Glossary/R.html

17. (Range) - Land that produces primarily native forage suitable for grazing by livestock; also forest land producing forage. Usually relatively extensive areas of land suitable for grazing but not for cultivation, especially in arid, semi-arid or forested regions. A unit of grazing land used by an integral herd of livestock. http://www.bugwood.org/glossary/html/glossary-r.html

18. (Range) - Land, mostly grasslands, whose plants can provide food (i.e., forage) for grazing or browsing animals. EPA/Office of Policy: Inventory of U.S. Greenhouse Gas Emissions and Sinks. Annex T: Glossary *Term Detail.* http://oaspub.epa.gov/trs/trs_proc_qry.alphabet?p_term_nm=R

19. (Range) - Rangelands, forests, woodlands, and riparian zones that support an understory or periodic cover of herbaceous or shrubby vegetation amenable to rangeland management principles or practices http://www.lastgreatplaces.org/glossary.html

20. A broad category of land characterized by native plant communities that are often associated with grazing. Rangelands are managed by ecological rather than agronomic methods. http://www.for.gov.bc.ca/pab/publctns/glossary/R.htm

21. A kind of land on which the native vegetation, climax or natural potential, consists predominately of grasses, grasslike plants, forbs, or shrubs. Rangeland includes lands revegetated naturally or artificially to provide a plant cover that is managed like native vegetation. Rangelands may consist of natural grasslands, savannas, shrublands, most deserts, tundra, alpine communities, coastal marshes, and wet meadows http://www.nv.blm.gov/range/Glossary.htm (BLM), http://www.lastgreatplaces.org/glossary.html#R http://www.mtnvisions.com/Aurora/glossary.html#R

22. A land cover/use category on which the climax or potential plant cover is composed principally of native grasses, grasslike plants, forbs or shrubs suitable for grazing and browsing, and introduced forage species that are managed like rangeland. This would include areas where introduced hardy and persistent grasses, such as crested wheatgrass, are planted and such practices as deferred grazing, burning, chaining, and rotational grazing are used, with little or no chemicals or fertilizer being applied. Grasslands, savannas, many wetlands, some deserts, and tundra are considered to be rangeland. Certain communities of low forbs and shrubs, such as mesquite, chaparral, mountain shrub, and pinyon-juniper, are also included as rangeland. [NRI-97] http://www.nrcs.usda.gov/technical/land/meta/m5100.html

23. A large area of natural pasture land. http://www.pestmanagement.co.uk/library/glossqr1.html

24. A large open land area on which livestock wander and graze. The native vegetation is mainly grasses, forbs, and shrubs. http://www.cahe.nmsu.edu/news/aggloss.html#D

25. A specific kind of land that produces native grasses and other plants, and its best agricultural use is for grazing livestock. It also provides habitat for many kinds of wild animals. http://csd.unl.edu/csd/illustrations/ra5a/range.html

26. A type of land, not a use of land. They are not urban land and they are not agricultural land. They do include some forests, some woodlands and other vegetation types not usually associated with range, but primarily, rangelands are grasslands, shrublands and savannas, and grasslands with scattered trees and shrubs. http://ag.arizona.edu/OALS/agnic/introduction.html

27. All land producing naturalized or native forage for animal consumption, and lands that are revegetated naturally or artificially to provide a forage cover that is managed like naturalized or native vegetation. Generally considered as land that is not cultivated. It may include forestlands that support an understory or periodic cover of herbaceous or shrubby plants suitable for grazing without impairing other forest values. http://fwie.fw.vt.edu/rhgiles/appendices/glossr.htm

28. All land that is not urban or farmland in Arizona. 92% of Arizona is rangeland (SRM 1994). http://www.uni-frankfurt.de/fb11/didaktik/xprojekt/Water/glossary.htm

29. An area of shrub and/or grass receiving less than about 750 mm of annual rainfall. Within this definition rangeland may vary from mild sub-arid wooded savanna to desert. http://www.fao.org/docrep/R7488E/r7488e02.htm (FAO)

30. An area that provides vegetation for grazing animals.
http://www.oznet.ksu.edu/library/MISC2/SB661.PDF

31. An area where wild and domestic animals graze or browse on uncultivated vegetation. http://www.fao.org/DOCREP/003/X9137E/x9137e15.htm

32. An expanse of land suitable for livestock to wander and graze on.
http://www.dictionary.com/cgi-bin/dict.pl?term=rangeland
http://www.bartleby.com/61/0/R0040000.html

33. Any land supporting grazable or browsable vegetation and managed as a natural ecosystem; can include grasslands, forestlands, shrublands, and pasture. "Range" is not a land use. http://www.ext.colostate.edu/pubs/natres/06105.html

34. Any land supporting vegetation suitable for grazing including rangeland, grazable woodland and shurbland. Range is not a use. http://wfrec.ifas.ufl.edu/range/rangelands/glossary.htm

35. Any land supporting vegetation suitable for wildlife or domestic livestock grazing, including grasslands, woodlands, shrublands, and forest lands. http://www.luco.gov.bc.ca/lrmp/diamond.htm#60

36. Any land that provides food and habitat for animals, both wildlife and domestic livestock. http://srmwww.gov.bc.ca/sir/lrmp/okan/theplan/rangegmz.pdf

37. Any land unsuitable for cultivation for whatever reasons, and therefore suitable only for grazing. http://www.gunnisonbiodiversity.org/range_prog.html

38. Are broadly defined by a combination of climate, land use and geography. They vary from arid and semi-arid temperate areas to the tropics and include woodlands, shrublands, grasslands and tropical savannas. http://audit.ea.gov.au/ANRA/docs/summary_reports/tracking_changes/_TC_03.html

39. Areas of the globe that are in the 0 - 20 inch precipitation zone appear white, with no coloring or texture. These are predominately rangeland types. http://www.orst.edu/instruct/rng341/globe.htm

40. At least 50% of Latin America and the Caribbean is either too dry, too wet, too steep, too shallow, too infertile and/or too fragile to sustain cultivation or to support arborescent forests. These are the Region's rangelands defined by the Society for Range Management as, "Land on which the native vegetation (climax or natural potential) is predominantly grasses, grass-like plants, fortes, or shrubs. Includes lands revegetated naturally or artificially when routine management of that vegetation is accomplished mainly through manipulation of grazing" (SRM, 1989). There is no rangeland prototype because there are many different types. Rangelands in the Region include natural grasslands consisting of either tall, short, medium, annual or desert species; savannahs both wet and dry; shrub-lands of various characteristics; alpine communities; coastal marshes; wet meadows and most deserts. The commonalities between these are: (1) they produce a kind of vegetation that only animals can consume and convert into products beneficial to man; and (2) they are not suitable for sustained cultivation and they are incapable of supporting arborescent forests. However, many forests can be grazed without damage to the trees within the multiple-use concept and these are often called "woodland ranges". The objective is not to destroy the forest, but instead to use its resources for more than one product. http://www.fao.org/docrep/X5321E/x5321e03.htm# The rangeland resource and its importance.

41. Ecological sites are separated from forestland ecological sites based on the historic climax plant community that occupied the site before the arrival of European settlers. An Ecological Site Type of "Rangeland" is assigned where overstory tree production was not significant in the climax vegetation. Refer to the National Range and Pasture Handbook for details on rangeland ecological types. http://www.statlab.iastate.edu/soils/nssh/622.htm#09

42. Grasslands and open woodlands suitable for livestock grazing. http://www.mhhe.com/biosci/pae/glossary/glossaryr.mhtml

43. Include grasslands, shrublands and open forests. Aside from the obvious uses of rangeland for grazing livestock, these areas also function as haylands and valuable wildlife habitat while cleaning our water and enriching our soil. http://www.ext.nodak.edu/extpubs/ansci/wildlife/wl1000-2.htm

44. Land and native vegetation that is predominately grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing and present in sufficient quantity to justify grazing use. http://www.outsidepride.com/infoglossary.asp

45. Land on which at least 50% of the natural vegetation, on a proposed lease, consists of grasses or palatable forbs or; on land which is predominately forested, grass production is at least 1500 pounds per acre, less than 50% of the soil has classified as Class II or III, livestock can graze at least 3-4 months of the year, and other location factors do not warrant a higher use. http://www.google.com/search?q=cache:i5JB3DeIePcC:www.dnr.state.ak.us/land/kenap2/pdfs/appenda_glossary.pdf+rangeland+definition+glossary&hl=en&ie=ISO-8859-1

46. Land on which the climax or potential plant cover is composed principally of native grasses, grasslike plants, forbs or shrubs suitable for grazing and browsing, and introduced forage species that are managed like rangeland. This would include areas where introduced hardy and persistent grasses, such as crested wheatgrass, are planted and such practices as deferred grazing, burning, chaining, and rotational grazing are used, with little or no chemicals or fertilizer being applied. Grasslands, savannas, many wetlands, some deserts, and tundra are considered to be rangeland. Certain communities low forbs and shrubs, such as mesquite, chaparral, mountain, shrub, and pinyon-juniper, are also included in rangeland. http://www.in.gov/oca/ilrc/glossary/

47. Land on which the climax vegetation (potential natural plant community) is predominantly grasses, grasslike plants, forbs or shrubs suitable for grazing and browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundra and certain forb and shrub communities. It also includes areas seeded to native or adapted introduced species that are managed like native vegetation. [source: USDA-SCS 1982 NRI] (NRCS)

48. Land on which the existing vegetation, whether growing naturally or through management, is suitable for grazing and browsing. It includes any natural grasslands, savannas, shrublands, woodlands and wetlands which support a vegetative cover of native grasses, grass-like plants, forbs, shrubs or naturalized species; it is land dominated by vegetation other than trees. Many woodlands (e.g., chaparral and oak woodlands) are included because their response to range management principals and activities are similar to those of other shrubby ecosystems. http://www.co.mendocino.ca.us/planning/GenPlan/LandUse/GGlossary.pdf

49. Land on which the indigenous vegetation (climax or natural potential) is predominantly grasses grass-like plants, forbs, or shrubs and is managed as a natural ecosystem. If plants are introduced, they are managed as indigenous species. Provides basis for land use mapping unit. Rangelands include natural grasslands, savannas, shrublands, many deserts, tundras, alpine communities, marshes and meadows. http://www.forages.css.orst.edu/Topics/Pastures/Grazing/Terminology/grazterm_body.html#Vegetation and http://www.agry.purdue.edu/ext/forages/rotational/glossary.html

50. Land on which the native vegetation (climax or natural potential) is predominantly grasses, grasslike plants, forbs, or shrubs. It includes land that is revegetated naturally or artificially, as when routine management of the vegetation is accomplished, mainly through the management of grazing. Rangeland includes natural grassland, savannas, most deserts, tundra, alpine communities, shrub land, coastal marshes, and wet meadows. http://www.statlab.iastate.edu/soils/nssh/622.htm#09, http://www.state.wy.us/~land/racfinal.htm

51. Land on which the native vegetation (climax or natural potential) is predominantly grasses, grass-like plants, forbs, or shrubs. Includes lands revegetated naturally or artificially when routine management of that vegetation is accomplished mainly through manipulation of grazing. Range includes natural grasslands, savannas, shrublands, most deserts, tundra, alpine communities, coastal marshes, wet meadows, and riparian areas. http://www.epa.gov/owow/nps/MMGI/Chapter2/ch2-3.html

52. Land on which the native vegetation (climax or natural potential) is predominantly grasses, grass-like plants, forbs or shrubs suitable for grazing or browsing use. Includes land revegetated naturally or artificially to provide a forage cover that is managed like native vegetation. Rangelands include natural grasslands, savannahs, shrublands, most deserts, tundra, alpine communities, coastal marshes and wet meadows. ct. *range*. during the same season. Generally used on *tame pasture* or *cropland pasture.*
http://www.tamu.edu/classes/rang/rknight/rlem102/lecture3/rangeland-definitions.pdf

53. Land on which the native vegetation is predominantly grasses, grass-like plants, forbs or shrubs and is managed as a natural ecosystem. http://www.teachfree.com/ffyf/grazing.html

54. Land on which the native vegetation is predominately grasses, grass-like plants, forbs, or shrubs suitable for grazing or browsing use. http://www.fs.fed.us/pl/rpa/95rpa/glossary.htm (USFS)

55. Land on which the natural potential (climax) plant cover is principally native grasses, grasslike plants, and shrubs. It includes natural grasslands, savannahs, certain shrubs and grasslike lands, most deserts, tundra, alpine communities, coastal marshlands, and wet meadows. It also includes lands that are re-vegetated naturally or artificially and are managed like native vegetation. The United States has 399 million acres of non-federal rangeland, about 30% of all non-federal rural lands, according to the 1992 National Resources Inventory. The BLM manages approximately 167 million acres of federal rangelands, and the Forest Service manages approximately 95 million acres of federal rangelands http://agriculture.house.gov/secgloss/qr.htm (House of Rep.) and http://www.senate.gov/~dpc/crs/reports/ascii/97-905 (Senate)

56. Land on which the natural vegetation is predominantly native grasses, grasslike plants, forbs, or shrubs valuable for forage, not qualifying as timberland and not developed for another land use. Rangeland includes natural grassland and savannah.
http://www.srs.fs.fed.us/sustain/report/appendix/glossary.htm(USFS)

57. Land on which the vegetation (climax or natural potential) is predominantly grasses, grass-like plants, forage or shrubs suitable for grazing or browsing use. Rangelands include grassland, savannas, most deserts, tundra, alpine plant communities, coastal marshes, wet meadows and introduced plant communities managed like rangeland. http://hill.beef.org/policy/deofra.htm

58. Land on which vegetation is predominantly grasses, forbs, or shrubs suitable for grazing or browsing. Rangeland is generally and Shrubland, but may include some Treeland and Barren land. Agricultural land is excluded. Also included are areas seeded to native or adapted introduced species that are managed like native vegetation. Resource Inventory Coordination Task Group. 1989. Interim resource inventory glossary. Washington, DC: U.S. Department of Agriculture; Forest Service; June 14, 1989. 96p
http://forestry.about.com/library/glossary/blforglr.htm

59. Land suitable for grazing by domestic livestock. The vegetation consists mostly of native grasses, grasslike plants, forbs, shrubs. http://www.bugwood.org/glossary/html/glossary-r.html

60. Land suitable for grazing livestock, but rainfall is not sufficient to cultivate crops.
http://www.epa.nsw.gov.au/soe/95/28.htm

61. Land suitable for grazing livestock.
http://www.dictionary.com/cgi-bin/dict.pl?term=rangeland, http://www.freedictionary.org/cgi-bin/Dictionary?Form=Dictionary1&Strategy=*&Database=*&Query=rangeland,

http://www.rhymezone.com/r/rhyme.cgi?Word=RANGELAND,
http://www.ultralingua.net/dictionary/index.php3?letters=rangeland

62. Land supporting indigenous vegetation that is grazed or that has the potential to be grazed, and is managed as a natural ecosystem. Range includes grazable forestland and rangeland. http://www.agry.purdue.edu/ext/forages/rotational/glossary.html

63. Land that provides or is capable of providing forage for grazing animals.
http://www.wiley.com/college/geog/cutter018104/resources/glossary.htm,
http://www.wiley.com/legacy/college/geog/cutter018104/resources/Chapter06/gloss06.htm

64. Land that supports a cover of herbaceous or shrubby vegetation useful for grazing animals. http://www.mb.ec.gc.ca/nature/whp/prgrass/df03s09.en.html

65. Land used by grazing animals where the management consists of manipulating the vegetation primarily by adjusting grazing extent, or by prescribed fire, and other methods generally without cultivating the soil. http://www1.oecd.org/agr/biodiversity/us_brady.pdf

66. Land used for grazing by domestic livestock and wildlife including grasslands and forest lands with an understorey or periodic cover of herbaceous or shrubby vegetation. (Canada – British Columbia) http://www.for.gov.bc.ca/pab/publctns/frrra/app-c.htm

67. Land used or suitable for range.
http://www.m-w.com/cgi-bin/dictionary?book=Dictionary&va=rangeland

68. Land where livestock are grazed extensively on native vegetation, and where the rainfall is too low or erratic for agricultural cropping or for improved pastures.
www.affa.gov.au/corporate_docs/publications/pdf/oper_env/armcanz/armcanz-may28.pdf

69. Land which is predominantly grasses, grasslike plants or shrubs suitable for grazing. http://www.pfb.com/news/glossary.htm#R

70. Land which is predominantly grasses, grasslike plants, or shrubs suitable for grazing and browsing. Rangeland includes natural grasslands, savannahs, many wetlands, some deserts, tundra, and certain shrub communities. It also includes areas seeded to native or adapted and introduced species that are managed like native vegetation.
http://www.usda.gov/news/pubs/fbook97/13d.pdf(USDA)

71. Land, a major use of which is grazing by livestock and big game animals and on which the natural potential natural vegetation of plants is dominated by native grasses, grass-like plants, forbs, and shrubs. Some rangelands have been or may be seeded to introduced or domesticated plant species. Rangelands include natural grasslands, savannas, shrublands, many deserts, tundra, alpine communities, coastal marshes, and wet meadows.
http://fwie.fw.vt.edu/rhgiles/appendices/glossr.htm

72. Land, mostly grasslands, whose plants can provide food (i.e., forage) for grazing or browsing animals. See *feedlot*. http://www.epa.gov/globalwarming/glossary.html#R (EPA)

73. Land, usually in the West, that is used for grazing of animals rather than for growing crops. http://www.worldbank.org/html/aftsr/sfi23.htm

74. Lands, native and naturalized pasture, forest, and riparian areas that support an understory or periodic cover of herbaceous or shrubby vegetation useful for grazing or browsing by wildlife or

livestock and that are amenable to management principles or practices. www.plant-materials.nrcs.usda.gov/pubs/idpmctn280101.pdf

75. Non-agricultural, largely unoccupied drylands that are unused or used only occasionally by nomadic pastoralists. UNEP (1992) http://www.gps.caltech.edu/~arid/desert/desert.html

76. Open expanses of land over which animals (such as livestock) may roam and feed (Lund 1998).

77. Permanent Pasture 1000ha:land used permanently (five years or more) for herbaceous forage crops, either cultivated or growing wild (wild prairie or grazing land). The dividing line between this category and the category "Forests and woodland"; is rather indefinite, especially in the case of shrubs, savannah, etc., which may have been reported under either of these two categories. http://www.fao.org/waicent/faostat/agricult/landuse-e.htm (UN-FAO)

78. Places that have arid climates, where grassland or desert environments are more common than heavily forested ones (although forested areas may be present). http://jrm.library.arizona.edu/data/1996/491/069-075_brunson.pdf

79. Predominant land use is based on native and naturalised pastures. However, other land uses such as dryland and irrigated cropping, and mining also occur, along with nature conservation reserves and small, isolated urban development. http://www.dlwc.nsw.gov.au/care/land/wlr/final/ch1.pdf

80. Rangeland ecological sites are separated from forestland ecological sites based on the historic climax plant community that occupied the site before the arrival of European settlers. An Ecological Site Type of "Rangeland" is assigned where overstory tree production was not significant in the climax vegetation. Refer to the National Range and Pasture Handbook for details on rangeland ecological types. (NRCS)- http://www.statlab.iastate.edu/soils/nssh/622.htm

81. Rangeland, grassland (<10% cover trees, <20% shrubs). This subdivision includes rangeland used for hayland, including bluestems, mixed midgrasses and shortgrasses. http://www.statlab.iastate.edu/soils/nssh/622.htm#16

82. Rangeland, savanna (10 to 25% tree cover) http://www.statlab.iastate.edu/soils/nssh/622.htm#16

83. Rangeland, shrubby (20 to 50% shrub cover). http://www.statlab.iastate.edu/soils/nssh/622.htm#16

84. Rangelands and forestlands that support a cover of herbaceous or scrubby vegetation suitable for grazing or browsing use http://www.osmre.gov/mountaintop.htm#74

85. Rangelands, forests and woodlands, and riparian zones that support an understory or periodic cover of herbaceous or shrubby vegetation amenable to rangeland management principles or practices. http://www.mtnvisions.com/Aurora/glossary.html#R,http://www.nv.blm.gov/range/Glossary.htm

86. Refer to areas of land used extensively by grazing animals. Native grasses, shrubs and woody vegetation generally covers the area. The rangeland is also characterized by low annual rainfall. http://www.longpaddock.qld.gov.au/ClimateChanges/slides/glossary.html

87. Refers to regions of native vegetation grazed by wild or domestic animals. http://www.teachfree.com/ffyf/grazing.html

88. Regions of native vegetation grazed by wild or domestic animals. http://www.teachfree.com/ffyf/grazing.html

89. Those areas of the World which by reason of physical limitations-low and erratic precipitation, rough topography, poor drainage, or cold temperatures- are unsuited for cultivation and which are a source of forage for free ranging native and domestic animals, as well as a source of wood products, water and wildlife (Miller, 1997). http://www.fao.org/ag/AGP/AGPC/doc/pasture/peshawarproceedings/importantaspects.pdf

90. Those ecosystems dominated by grasses, grasslike plants, forbs, or shrubs and dominated by herbivores. Most of the rangelands in the United States are to the west of an irregular North/South line that cuts through the Dakotas, Nebraska, Kansas, Oklahoma, and Texas. http://www.hq.nasa.gov/iwgsdi/Rangeland.html. Definition Source: A Land Use and Land Cover Classification System for Use with Remote Sensing Data (NASA) and http://mapping.usgs.gov/pub/ti/LULC/lulcpp964/lulcpp964.txt

91. Those lands that naturally have less than 10 percent of area covered by crowns of trees and are not currently developed for non-range use. [Source: Lund, H. Gyde. 1984. The United States experience in the field of forest and rangeland inventory. In: Encuentro national sobre inventarios forestales. Memoria; 25-28 July 1984; Chihuahua, Mexico. Publicacion Especial No. 45. Mexico, D.F., Mexico: Subseretaria Forestal; Instituto Nacional de Investigaciones Forestales; 411-435.]

92. Unfenced country where cattle graze. http://members.aol.com/MNicholas2/cowboys/terms.htm#R

93. Unimproved grasslands, shrublands, savannas, and tundra. http://www.grida.no/climate/ipcc/regional/327.htm

94. Woodland range: forest land (within range allotments) that produces minor amounts of forage. It includes occasional even-aged timber harvest areas that have higher forage value for several years before being replaced by shrubs and trees. http://www.srs.fs.fed.us/sustain/report/appendix/glossary.htm

RECLAMATION

1. **(Land)** – Gain of land from the sea, or wetlands, or other water bodies, and restoration of productivity or use to lands that have been degraded by human activities or impaired by natural phenomena. http://www.nscb.gov.ph/peenra/Publications/Compendium/glossary.PDF

REGENERATION

1. **(Canada - Sask.)** Renewal of a forest stand (i.e. establishment of new young trees) by natural or artificial means. [Source: the Saskatchewan Long-term Integrated Forest Resource Management Plan March 1995 From: Mark Johnston <johnston@larix.derm.gov.sk.ca Date: Tue, 16 Jun 1998 17:44:48 -0600]

2. **(Canada)** The continuous renewal of a forest stand. Natural regeneration occurs gradually with seeds from adjacent stands or with seeds brought in by wind, birds, or animals. Artificial regeneration involves direct seeding or planting. (http://nrcan.gc.ca/cfs/proj/ppiab/sof/sof.html)

3. **(Czech Republic)** A set of measures resulting in the development of a new generation of forest stand. [Source: Act on Forests and Amendments to Some Acts (the Forest Act) dated 3 November 1995. Ministry of Agriculture of the Czech Republic. Prague, 1996. 58 pp. From: "Maksym Polyakov" <mpoliak@pcomp.usau.kiev.ua Date: Mon, 15 Jun 1998 11:32:47 +0300 (MSD)]

4. **(Japan)** Forest stands established following harvesting artificially or naturally. Definition of Glossary of Agriculture, Forestry and Fishery Statistics, Agriculture and Forestry Statistics Association. From: Masahiro Amano <masahiro@ss.ffpri.affrc.go.jp

5. **(Natural)** Areas that become forested through the ordinary process of forest succession (e.g. occupation of abandoned farm lands or lands laid bare by recent glaciation). Also where forest is being regenerated to the same or similar species as removed from the site. Brinkley 1997.

6. **(Natural)** Regrowth of forest vegetation, in the absence of planting or direct seeding, following any of many kinds of disturbances that were lethal to forest vegetation (e.g. landslide, fire, pest damage, wind, logging, clearing for agriculture) previously growing on the site. Stanley 1998.

7. **(UK)** (Natural Regeneration) - Plants growing on a site as a result of natural seed fall or suckering. The term is also used to describe the silvicultural practices used to encourage natural seeding and successful growth of the seedlings. [Source: THE UK FORESTRY STANDARD. The Government's Approach to Sustainable Forestry, EDINBURGH: FORESTRY COMMISSION, 1998.
http://www.forestry.gov.uk/standard.html and http://www.forestry.gov.uk/standard.pdf
From: "Maksym Polyakov" <mpoliak@pcomp.usau.kiev.ua Date: Tue, 23 Jun 1998 21:04:18 +0300 (MSD)]

8. **(UK)** Renewal of woodland through sowing, planting, or natural regeneration. [Source: THE UK FORESTRY STANDARD. The Government's Approach to Sustainable Forestry, EDINBURGH: FORESTRY COMMISSION, 1998 http://www.forestry.gov.uk/standard.html and http://www.forestry.gov.uk/standard.pdf
From: "Maksym Polyakov" <mpoliak@pcomp.usau.kiev.ua Date: Tue, 23 Jun 1998 21:04:18 +0300 (MSD)]

9. All types of natural recovering of forest vegetation on forest lands (without special seeding or planting), the natural one (seeds or coppice) or with the help of men by means of different types of forest activities such as scarification, stripes or gap cuttings, etc. (Yakovlev 1998).

10. An act or the process of regenerating : the state of being regenerated [Source WWWebster 11 June 1998]

11. Establishment and early development of new tree seedlings. In managed forests, regeneration may be natural or artificial (performed through seeding or planting.) (WESTVACO)

12. Process of formation of new generation of forest by natural way (in word-by-word translation) (Yakovlev 1998).

13. Renewal of a forest crop by natural, artificial or vegetative (regrowth) means. Also the new crop so obtained. The new crop is generally less than 1.3 m high.
http://nrcan.gc.ca/cfs/proj/iepb/nfdp/regen/regen_e/s18.htm

14. Renewal of a tree crop, either by natural or artificial means. Young tree crop (17).
http://rredc.nrel.gov/biomass/forest/tim_glossary/t_glossary.html#F

15. The renewal of a tree crop by either natural or artificial means. The term is also used to refer to the young crop itself (http://www.fs.fed.us/land/emterms.html).
16. The renewal of a tree crop through either natural means (seeded on-site from adjacent stands or deposited by wind, birds or animals) or artificial means (by planting seedlings or direct seeding). http://www.interfor.com/glossary/glossary29.html
17. The young regrowth of forest plants following disturbance or the forest such as timber harvesting or fire. http://www.rfa.gov.au/cra/vic/cenhigh/press/glossary.html

REHABILITATE/REHABILITATION

1. To return an area of land or a road or track surface to an original, proper and stable condition. This may involve reshaping, spreading topsoil, construction of banks and revegetation. http://www.privateforestry.org.au/glos_o-z.htm
2. Making the land useful again after a disturbance. It involves the recovery of ecosystem functions and processes in a degraded habitat. Rehabilitation does not necessarily reestablish the predisturbance condition, but does involve establishing geological and hydrologically stable landscapes that support the natural ecosystem mosaic. http://www.oregonwri.org/basin-info/floodrpt.html
3. The process of making land "productive" again. An alternative ecosystem is created with different structure and function than the original ecosystem. It usually has low species diversity and includes introduced species. It requires maximal human input to exist. Land uses include parklands, croplands, and commercial forests. http://www.epa.nsw.gov.au/soe/95/28.htm
4. **(Forest)** - A management strategy applied in degraded forest lands that aims at re-establishing site productivity and protective functions and many of the ecological services provided by a functional forest or woodland ecosystem. ITTO 2002. FAO. 2002. Draft Analytical Framework on Forest-Related Definitions.

REINSTATE

1. Introduce to a place one or more species or elements of habitat or geo-diversity that are known to have existed there naturally at a previous time but that can no longer be found at that place. (Natural Heritage Charter). See also: Revegetate. http://www.contacttrust.org.za/BiodiversityNetwork/webpage/docs/glossary.htm

RESTORATION

1. Reestablishing a habitat or plant community in an area that historically supported it. http://buttecreekwatershed.org/ecr/new/glossary.htm
2. Returning land to an original state or repairing damage done by human or natural disturbance. http://gardening.wsu.edu/text/nvglossr.htm
3. The process of improving habitats http://www.waterlink.org.nz/info/glossary.html
4. The recreation of communities of organisms resembling, in structure, function and dynamics, those prior to degradation, and protected from further human degradation. http://www.greenpeace.org/~comms/cbio/forp&g.html#annex

5. To increase or return species, structures, and processes that are currently diminished locally, regionally, or statewide, to locations on the property that have high capability/potential for both accommodating and sustaining these currently scarce resources. It would attempt to include missing successional stages and patch sizes. Or, to simply to return forest cover to presently /deforested areas. http://www.dnr.state.wi.us/master_planning/Brule/Documents/PrefAlt.pdf
6. The process of restoring site conditions as they were before a land disturbance. http://fwie.fw.vt.edu/rhgiles/appendices/glossr.htm
7. **(Active)** - Specific human actions taken to reestablish the natural process, vegetation, and resultant habitat of an ecosystem. http://buttecreekwatershed.org/ecr/new/glossary.htm
8. **(Ecological)** - The process of intentionally altering a site to establish a defined, indigenous, historic ecosystem. The goal of this process is to emulate the structure, function, diversity, and dynamics of the specified ecosystem. http://www.wsu.edu/pmc_nrcs/glossary/rrr.htm
9. **(Ecological)** - The process of renewing and maintaining ecosystem health. http://www.wsu.edu/pmc_nrcs/glossary/rrr.htm
10. **(Ecological)** - The process of returning an ecosystem as closely as possible to predisturbance conditions and functions. Implicit in this definition is that ecosystems are naturally dynamic; it is therefore not possible to recreate a system exactly. The restoration process reestablishes the general structure, function, and dynamic but self-sustaining behavior of the ecosystem. Restoration differs from rehabilitation in that restoration is a holistic process not achieved through the isolated manipulation of individual elements. While restoration aims to return an ecosystem to a former natural condition, rehabilitation implies putting the landscape to a new or altered use to serve a particular human purpose. http://www.oregonwri.org/basin-info/floodrpt.html
11. **(Ecological)** - The return of an ecosystem to a close approximation of its natural condition prior to disturbance. The goal is to emulate a natural, functioning, self-regulating system that is integrated with the ecological landscape in which it occurs. It may involve the manipulation of natural processes of ecological succession to create a self-sustaining indigenous ecosystem. The restored ecosystem should simulate the natural condition before it was damaged, or some other native ecosystem appropriate for the new conditions of the landscape. It must be stable with a minimum of human input after the initial efforts that may involve hastening the rate of plant succession, reverting to an earlier seral stage, or altering the direction of succession. http://www.wsu.edu/pmc_nrcs/glossary/rrr.htm
12. **(Ecology)** - Seeks to repair or reconstruct ecosystems damaged by human actions. http://www.mhhe.com/biosci/pae/glossary/glossaryr.mhtml
13. **(Ecosystem)** - Restoring and maintaining the physical, chemical, and biological conditions necessary to allow natural ecosystems to function and evolve overtime. http://www.nh.nrcs.usda.gov/Ecosystem_Restoration/Publications/Ecosystem%20Restoration%20Standard.pdf
14. **(Ecosystem)** - The process of repairing damage to the diversity and dynamics of ecosystems. http://www.oregonwri.org/basin-info/floodrpt.html
15. **(Ecosystem)** - The process of returning ecosystems or habitats to their original structure and species composition. http://www.fscstandards.org/regions/southeast/glossary.html

16. **(Ecosystem)** - The repair of ecological damage to an ecosystem so that it is close to the natural condition prior to a disturbance and it can function as a normal self-regulating system. This is done through processes such as chemical cleanups, revegetation, and the reintroduction of native species. http://www.internet.ve/wildlife/glosario.htm

17. **(Ecosystem)** - The return of an ecosystem or habitat toward: its original structure, natural complement of species, and natural functions or ecological processes. http://www.safnet.org/policy/costrategy1013.pdf

18. **(Ecosystem)** - The return of an ecosystem or habitat to its original community structure, natural complement of species, and natural functions (World Resources Institute et al. 1992) http://www.forestry.utoronto.ca/ac_staff/emeritus/My%20Webs/english.htm

19. **(Ecosystem)** - The return of an ecosystem to a close approximation of its condition prior to disturbance. http://www.tpwd.state.tx.us/texaswater/rivers/glossaryleft.htm

20. **(Forest)** - A management strategy applied in degraded primary forest areas. Forest restoration aims to enhance and accelerate natural processes of forest regeneration in order to regain the elastic capacity of the forest ecosystem. ITTO 2002. FAO. 2002. Draft Analytical Framework on Forest-Related Definitions.

21. **(Forest)** - Assisting the recovery of forest ecosystems from a degraded state to full functioning. A key part of this definition, from the standpoint of ecological responsibility, is its limitation of people's role in most cases to assisting, rather than fixing, natural processes. Usually the least risky approach is to respect and emulate those natural processes that reestablish the composition and structures and develop the biological diversity necessary for the return or improvement of forest functioning that has been lost or degraded. In some cases, restoration will require more radical intervention by humans. http://www.silvafor.org/ecocert/sffstandardsforbc.pdf

22. **(Habitat)** - To restore or bring back ecological integrity by actively removing invasive exotic plants, propagating native plants, and monitoring the resulting changes. http://www.nps.gov/goga/parklabs/toolbox/images/curriculums/htd/htd5.pdf

23. **(Land)** - The process of restoring site conditions as they were before land disturbance. Note: restoration involves restoring a site to a specific point in time. www.plant-materials.nrcs.usda.gov/pubs/idpmctn280101.pdf

24. **(Wetland)** - The processes of returning a site from a disturbed or totally altered condition to a previously existing natural or altered condition. This process requires some knowledge of the type of wetland that existed prior to modification. http://parks.state.co.us/cnap/Wetlands_BMP/17%20-%20Glossary.pdf

25. **(Wetland)** - Re-establishment of previously existing wetland or other aquatic resource character and function (s) at a site where they have ceased to exist, or exist only in a substantially degraded state
http://www.mawpt.org/pdfs/Strategy.pdf,
www.wrsc.usace.army.mil/iwr/pdf/wmb_tp2_Dec95.pdf

26. **(Wetland)** - To improve a disturbed wetland by returning wetland parameters which may be missing; adding soils, water, or plants. The restoration may return a missing or damaged wetland function to achieve a desired outcome; for example, removing an agricultural crop and planting native seeds to produce wet prairie grassland. http://www.ci.eugene.or.us/wewetlands/glossary2.htm

RESTORE/RESTORED

1. **Restore Ecosystems** - To reinstate an entire community of organisms to naturally occurring association. http://www.mhhe.com/biosci/pae/glossary/glossaryr.mhtml
2. **Restore Habitats** - Return existing habitats to a known past state or to an approximation of the natural condition by repairing degradation, by removing introduced species or by reinstatement. (Natural Heritage Charter).
   http://www.contacttrust.org.za/BiodiversityNetwork/webpage/docs/glossary.htm
3. **Restored Forests** - Forests planted, seeded, or otherwise restored in such a manner as to emulate the original natural forests of an area.
   http://www.af.nfr.no/andre-doc/alternativ-agenda/Forests.html
   http://www.igc.org/habitat/treaties/at-27.htm
   http://nativenet.uthscsa.edu/archive/nl/9208/0081.html

REVEGETATE

1. Introduce to a place plant species that are known to have existed there naturally at a previous time. http://www.contacttrust.org.za/BiodiversityNetwork/webpage/docs/glossary.htm
2. Reestablishing vegetation on a disturbed site.
   http://www.efw.bpa.gov/PSA/NEPA/DOCUMENTS/LOWERVALLEY/chapter10.pdf
3. The act of planting reclaimed land with grasses, trees, crops, etc.
   http://dnr.state.il.us/mines/lrd/guides/farm6.htm
4. The establishment of an effective vegetative ground cover by either natural regeneration or sowing with a seed and fertilizer mixture, to prevent soil erosion. It is preferable to use sterile hybrids if using exotic species. http://www.privateforestry.org.au/glos_o-z.htm
5. The natural or induced replacement of plants into a cleared area.
   http://www.mhhe.com/biosci/pae/glossary/glossaryr.mhtml
6. The recurrence of the same plant community that existed prior to clearing.
   http://www.mhhe.com/biosci/pae/glossary/glossaryr.mhtml
7. To cover bare mineral soil with plant re-growth. In BMP application, this refers to the expeditious establishment of grasses to minimize soil erosion.
   http://www.forestry.state.ar.us/bmp/glossary.html
8. To reestablish vegetation in a restoration site by planting and seeding of indigenous species.
   http://www.nps.gov/goga/parklabs/toolbox/images/curriculums/htd/htd5.pdf
9. The re-establishment and development of a plant cover. This may take place naturally through reproductive processes of the existing flora or artificially through the direct action of reforestation or seeding.
   www.superiornationalforest.org/july4thstorm1999/Appendix%20B.doc

REVEGETATION

1. A direct human-induced activity to increase carbon stocks on sites through the establishment of vegetation that covers a minimum area of 0.05 hectares and does not meet the definitions of afforestation and reforestation contained here (Kyoto Definition). [reference to UNFCCC definitions]. www.ghgprotocol.org/docs/GHG_Protocol_Project_Module_Glossary_0204.doc. FAO 2002. Draft Analytical Framework on Forest-Related Definitions.
2. A general term for renewing the vegetation on a project site. www.plant-materials.nrcs.usda.gov/pubs/idpmctn280101.pdf
3. Establishing or re-establishing desirable plants in areas where desirable plants are absent or of inadequate density, by management alone (natural revegetation) or by seeding or transplanting (artificial revegetation). www.plant-materials.nrcs.usda.gov/pubs/idpmctn280101.pdf http://www.roseworthy.adelaide.edu.au/~icooper/glossary/r.htm
4. Establishment of self-sustaining vegetation cover after earthworks have been completed. http://www.kalgold.com.au/aer/er98_glossary.html
5. Establishment of vegetation in areas which historically have been cleared. http://www.greenhouse.gov.au/ncas/files/strategic/glossary.html
6. General expression used for the process of planting bare areas (raw mineral soils) to perennial plants or less often to annual plants. http://www.wsu.edu/pmc_nrcs/glossary/rrr.htm
7. Planting of grasses, forbs, shrubs and trees in areas where vegetation has been removed, or in some-way disrupted or damaged. Revegetation is conducted under two different conditions: irrigated and nonirrigated. commercial and industrial areas. http://www.cityofboise.org/pds/Comp-Plan/Foothills/Appendix-A.pdf
8. Planting of grasses, forbs, shrubs and trees in areas where vegetation has been removed, or in some-way disrupted or damaged. http://www.cityofboise.org/pds/Comp-Plan/Foothills/Appendix-A.pdf
9. Planting of new trees and, particularly, of native plants in disturbed sites where the vegetation cover has been destroyed, to stabilize the land surface from wind and water erosion and to reclame the land for other uses. Revegetation practices are employed in mined lands, roadsides, parks, wetlands, utility corridors, riparian areas, etc (Source: REVEGa / CORBIT) European Environment Agency (EEA), European Topic Centre on Catalogue of Data Sources (ETC/CDS) : General Multilingual Environmental Thesaurus *Term Detail.* http://oaspub.epa.gov/trs/trs_proc_qry.alphabet?p_term_nm=R
10. Reestablishing and developing a plant cover. This may take place naturally through the reproductive processes of the existing flora or artificially through the direct action of people, e.g., afforestation, range reseeding. http://fwie.fw.vt.edu/rhgiles/appendices/glossr.htm
11. Refers to the vegetation construction phase of reclamation. www.plant-materials.nrcs.usda.gov/pubs/idpmctn280101.pdf
12. Regrowth or replacement of a plant community on a disturbed site. Revegetation may be assisted by site preparation, planting and treatment, or it may occur naturally. http://www.mwd.dst.ca.us/mwdh2o/pages/news/cadiznet/volumes/vol1/sections/v1s16.pdf

13. Replanting a cleared area with native plants. http://gardening.wsu.edu/text/nvglossr.htm
14. The establishment of perennial vegetative cover on disturbed areas by planting seed. http://parks.state.co.us/cnap/Wetlands_BMP/17%20-%20Glossary.pdf
15. The establishment of vegetation which replaces original ground cover following land disturbance. (Powter, 1995) http://www.agric.gov.ab.ca/publiclands/nprg/glossary.html
16. The planting of vegetation following either manual removal of existing vegetation or gradual dying off of once-present vegetation. http://www.ci.menlo-park.ca.us/creek/MPAppendixA.pdf
17. The process of replanting vegetation that previously existed at a site. http://www.waterlink.org.nz/info/glossary.html
18. The re-establishment of self-sustaining plant cover on a disturbed site. http://www.em.gov.bc.ca/Mining/MiningStats/Aggregate%20BMP%20Handbook/Chapters/A-1_Glossary.pdf
19. To plant or provide an area with new plant cover. http://www.nps.gov/goga/parklabs/restoration/plant.htm

SECONDARY (WOODLAND) FOREST

1. Secondary: 1 a : of second rank, importance, or value b : of, relating to, or constituting the second strongest of the three or four degrees of stress recognized by most linguists <the fourth syllable of basketball team carries secondary stress c of a tense : expressive of past time 2 a : immediately derived from something original, primary, or basic (http://www.m-w.com/dictionary)
2. (Europe) -Forest land where there has been a period of complete clearance by humans with or without a period of conversion to another land use. Forest cover has regenerated naturally or artificially through planting. http://www.biodiv.org/programmes/areas/forest/definitions.asp
3. (Nicaragua) - Draft - Bosque Secundario: Area boscosa que se desarrolla una vez que la vegetación original ha sido eliminada por actividades humanas y/o fenómenos naturales y se encuentra en período de sucesión secundaria. www.nicarao.org.ni/ja (see Borrador de la ley, CAPITULO II DEFINICIONES) Harrie <harnic@ibw.com.ni>
4. (syn. pioneer forest) Forest which has developed by secondary succession on deforested land, such as land abandoned after shifting or settled agriculture, or after pasture. http://www.itto.or.jp/policy/pds4/page5.html
5. (Thailand) secondary forest: forest which have been logged or cleared for other purposes, and are regrowing but not fully regrown. These forests would be expected to have significantly lower biomass densities than undisturbed forests of the same type. The report of Thailand's National Greenhouse Gas Inventory, 1990. "Wilailak Pangtawaong" wpangtaw@deqp.go.th .
6. A forest that has been logged and has recovered naturally or artificially. Not all secondary forests provide the same value to sustaining biological diversity, or goods and services, as did primary forest in the same location. http://www.biodiv.org/programmes/areas/forest/definitions.asp
7. A new forest no more than 50 years or so claiming back disturbed areas, either by human intervention or natural causes, such as fires, floods. http://www.geocities.com/RainForest/Canopy/5974/

8. A woodland occupying a site that has not been wooded continuously throughout history [in Britain since the last ice advance]. It may be the product of natural succession or of planting on formerly unwooded land. In the tropics, secondary woodland [forest] is pure or regrowing following clear-felling; it contains fewer species than primary forest (Allaby 1994). Helene M Cleveland CCMAIL hmclevel@aec.apgea.army.mil

9. Forests regenerating largely through natural processes after significant human and/or natural disturbance of the original forest vegetation at a single point in time or over an extended period, and displaying a major difference in forest structure and/or canopy species composition with respect to nearby primary forests on similar sites. (Chokkalingam and De Jong 2001).

10. Forest regenerating naturally after intense/drastic human and/or natural disturbance of the original forest vegetation, and involving a major change in canopy species composition from that of primary forests growing on similar site conditions in the area. Secondary forest can be said to have reverted to primary forest when canopy species composition approaches that of primary forest growing on similar site conditions in the area.
http://www.biodiv.org/Forests/Glossary.html

11. Forest that has been subject to a light cycle of shifting cultivation or to various intensities of logging, but which still contains indigenous trees and shrubs.
http://europa.eu.int/comm/development/forests/en/en4_6.htm

12. Forest that has regenerated naturally after clearcutting, burning or other land clearing activities. from the *Glossary of Terms* pp200 – 204 of *Indigenous Forestry – Sustainable Management* (Ministry of Forestry and the New Zealand Farm Forestry Association Inc., January 1998).

13. Forest that is subject to various intensities of logging, or to a long cycle of shifting cultivation, but that still contains indigenous trees and shrubs.
http://www.wrm.org.uy/actors/WB/1994policy.html

14. Forest which, after destruction of the original vegetation (primary forest) as a result of human activities (e.g. land clearing, anthropogenic fire), regenerates naturally, and is thus composed mainly of natural vegetation in early successional stages. Though often associated specifically with the tropics, the term is not limited to these: boreal and temperate forests left to natural regeneration after clearcutting are also secondary forests.
http://www.awi-bremerhaven.de/WBGU/wbgu_sn1998_voll_engl.html#Heading67

15. second growth -- (a second growth of trees covering an area where the original stand was destroyed by fire or cutting) http://www.notredame.ac.jp/cgi-bin/wn?forest

16. The ecosystems that regenerate from a substantial disturbance (flood, fire, land clearing or extensive and intensive logging) characterized by a scarcity of mature trees and an abundance of pioneer species and a dense understory of saplings and herbaceous plants. Although secondary forests frequently peak in terms of biomass accumulation well-within one felling cycle, the transition to primary forests usually requires several rotation lengths, depending upon the severity of the original disturbance. Irreversible transformation of the underlying soil and nutrient cycle brought about by chronic or intense use may render it impossible for the original, primary forest type to return. (further details will be addressed by FSC-approved national and regional standards of forest stewardship). PRINCIPLES AND CRITERIA FOR FOREST STEWARDSHIP. Revised March 1996, edited October 1996.
http://www.metla.fi/archive/forest/1994/07/msg00035.html
http://www.fscus.org/html/about_fsc/who_we_are/glossary_of_terms.html#s

17. Woodland formed on sites since 1600 AD which have formerly been under farmland, moorland or some other non woodland use. http://www.angelfire.com/on3/wildberks/Glossary.htm

18. Woodland growing on a site that has either formerly been woodland or has been cleared at some time http://www.tnw.org.uk/Note17.html

SEMI-NATURAL FORESTS

1. A forest that has a different species composition from natural forests in the area http://fscus.org/html/standards_policies/us_regional_standards/archives/ozark_ouachita4.html

2. A stand which is composed predominantly of native trees and shrub species which have not been planted. Also, a forest which has developed gradually or accidentally, as its location or site quality was not suited for intensive exploitation or production-oriented management (e.g. in mountainous regions). This kind of reconstruction of the natural forest cover can be or has been achieved by using various silvicultural practices e.g., natural regeneration or selective thinning and in some cases also planting. [Source: Definitions used in the Helsinki Process - http://www.mmm.fi/english/minkonf/criteria.htm]

3. A stand which is composed predominately of native trees and shrub species which have not been established by artificial regeneration methods. Semi-natural forests do not include forest land that is "undisturbed" by man (South 1998).

4. Forest areas where some of the principal characteristics and key elements of native ecosystems, such as complexity, structure and diversity are present, given the physical parameters of climate, geology, hydrology and successional patterns. http://www.canadian-forests.com/fsc-glossary.html and additional FSC terms proposed in the December, 1996 FSC newsletter

5. Semi natural forests can be defined as neither a forest undisturbed by man nor a plantation as defined separately. They represent mainly managed forests modified by man through silviculture and assisted regeneration. http://www.biodiv.org/Forests/Glossary.html

STOCKING

1. (Canada) A qualitative expression of the adequacy of tree cover on an area in terms of crown closure, number of trees, basal area or volume in relation to a pre-established norm. [Source: Criteria and Indicators of sustainable forest management in Canada: Glossary http://www.nrcan.gc.ca/cfs/proj/ppiab/ci/gloss_e.html From: "Maksym Polyakov" <mpoliak@pcomp.usau.kiev.ua Date: Wed, 17 Jun 1998 11:20:37 +0300 (MSD)]

2. (Canada-BC) A measure of the area occupied by trees, usually measured in terms of well- spaced trees per hectare, or basal area per hectare, relative to an optimum or desired level. [Source: Glossary of Forestry Terms, Province of British Columbia, Ministry of Forests, http://www.for.gov.bc.ca/pab/publctns/glossary/glossary.htm From: "Maksym Polyakov" <mpoliak@pcomp.usau.kiev.ua Date: Wed, 17 Jun 1998 11:20:37 +0300 (MSD)]

3. (Russian Federation)- Degree of a denseness of growing of trees in a tree stand describing a share of use by them of taken space. Usually under definition of stocking (polnota) understands a relative polnota of a tree stand - ratio of the sum of areas of cross-cuts of all trees of a tree stand at height of 1.3 meters (breast-height) on 1 ha to the sum of areas of cross-cuts of a normal tree stand (with a polnota 1,0), i.e. tree stand with optimum for the given species and types of forest

growing conditions the sum of areas of cross-cuts, which undertakes from the tables of growth. . [From: " Russian Forest Encyclopedia" "Igor Yakovlev" yakovlev@mari-el.ru Date: Sat, 6 Jun 1998 21:16:59 +0400]

4. A relative number of trees or volume per acre. A forest stand is most often described as being well-stocked, poorly stocked or overstocked. [Source: Glossary of Forestry Terms Commonly Used in Forest Management Plans http://ww.ehnr.state.nc.us/EHNR/DFR/fm-22.htm From: "Maksym Polyakov" <mpoliak@pcomp.usau.kiev.ua Date: Wed, 17 Jun 1998 11:20:37 +0300 (MSD)]

5. The amount of live trees on a given area in relation to what is considered the optimum. [Source: USDA Forest Service General Technical Report WO-44. Forest Stand Density and Stocking: concepts, terms, and use of the stocking guides. 8 p.]

6. The sum of areas of cross-cuts of all trees of a tree stand at height of 1.3 meters (breast-height) on 1 ha' is basal area. [From: "Maksym Polyakov" <mpoliak@pcomp.usau.kiev.ua Date: Wed, 17 Jun 1998 11:20:37 +0300 (MSD)]

SUSTAINABLE FOREST MANAGEMENT

1. Ecologically sustainable forest management. This definition specifies three requirements for sustainable forest use: • maintaining ecological processes within forests (the formation of soil, energy flows, and the carbon, nutrient and water cycles); • maintaining the biological diversity of forests; • increasing the net social benefit derived from the mixture of forest uses, within ecological constraints, whilst maintaining options for the future. http://www.rfa.gov.au/rfa/tas/raa/esfm/final/esfmfin3.html

2. Maintain - 1: to keep in an existing state (as of repair, efficiency, or validity): preserve from failure.

3. Sustain - 1: to give support or relief to 2: to supply with sustenance: nourish 3: keep up. http://www.m-w.com/cgi-bin/dictionary

4. Sustainability: A state or process that can be maintained indefinitely. The principles of sustainability integrate three closely interlined elements - the environment, the economy and the social system - into a system that can be maintained in a healthy state indefinitely. http://www.for.gov.bc.ca/pab/publctns/GLOSSARY/S.htm

5. Sustainable - 2 a: of, relating to, or being a method of harvesting or using a resource so that the resource is not depleted or permanently damaged <sustainable techniques> <sustainable agriculture> http://www.m-w.com/cgi-bin/dictionary

6. Sustainable development - Development that meets the needs and aspirations of the current generation without compromising the ability to meet those of future generations. http://www.wri.org/wri/biodiv/gbs-glos.html

7. Sustainable development - Industrial development that does not detract from the potential of the natural environment to provide benefits to future generations. http://www.infomine.com/help/dictionary/s.html

8. Sustainable development - 'meeting the requirements of present generations without compromising the ability of future generations to meet their own needs'. Brundtland report in 1987 (WCED 1987) http://helios.bto.ed.ac.uk/ierm/research/sucre/cons4.htm

9. Sustainable development Human intervention that meets the needs and aspirations of the current generation without compromising the ability to meet those of future generations. http://glossary.gardenweb.com/glossary/sustainable_development

10. Sustainable Development is a process in which development does not deplete the earth's resources or disturb fragile ecosystems http://www.netcore.ca/~gibsonjs/dict1g2.htm

11. Sustainable development. According to the WCED, this is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." Sustainable development implies economic growth together with the protection of environmental quality, each reinforcing the other. The essence of this form of development is a stable relationship between human activities and the natural world, which does not diminish the prospects for future generations to enjoy a quality of life at least as good as our own. Many observers believe that participatory democracy, undominated by vested interests, is a prerequisite for achieving sustainable development (Source: Mintzer, 1992). http://www.globalchange.org/glossall/glosss-u.htm

12. Sustainable development: preservation and protection of diverse ecosystems-the soil, plants, animals, insects and fungi while maintaining the forest's productivity. http://www.for.gov.bc.ca/pab/publctns/GLOSSARY/S.htm

13. Sustainable Development: describes those efforts to guide economic growth, especially in less-developed countries, in an environmentally sound manner, with an emphasis on natural resource conservation. http://www.state.nv.us/cnr/ndwp/dict-1/WORD_S.htm

14. Sustainable forest management - management regimes applied to forest land which maintain the productive and renewal capacities as well as the genetic, species and ecological diversity of forest ecosystems. http://www.for.gov.bc.ca/pab/publctns/GLOSSARY/S.htm

15. sustainable forest management - management that maintains and enhances the long-term health of forest ecosystems for the benefit of all living things, while providing environmental, economic, social and cultural opportunities for present and future generations. http://www.abforestprod.org/ARglossary.html

16. Sustainable forest management - Management to maintain and enhance the long-term health of forest ecosystems, while providing ecological, economic, social and cultural opportunities (CSA 1995) http://www.forestry.ubc.ca/concert/evans.html#III

17. Sustainable forest management - means "good management" and utilization of forests and forested areas in such a way and at such intensity that their biological diversity, productivity and regenerative capacity, their vitality, and their capacity to fulfil, now and for the future, their pertinent ecological, economic and social functions at the local, national and global levels, be maintained, without thereby doing harm to other ecosystems. Ministerial Conference of Helsinki (1993) http://iufro.boku.ac.at/iufro/publications/occ-p9/occp9-1.htm

18. Sustainable forest management - Security benefits for human needs while maintaining the structure, function and integrity of ecosystems on a bio-regional basis, incorporating in perpetuity complete forest successions in each bio-region http://www.igc.org/habitat/treaties/at-27.htm and http://nativenet.uthscsa.edu/archive/nl/9208/0081.html

19. Sustainable forest management - Stewardship and use of forests and forest lands in such a way, and at a rate, that maintains their productivity, regeneration capacity, vitality and their potential to fulfill now and in the future, relevant ecological, economic, and social functions, at local, national, and global levels, and that does not cause damage to other ecosystems (MCPFE 1993). http://www.forestry.ubc.ca/concert/evans.html#III http://www.google.com/search?q=cache:www.pefc.org/lisbon.htm+sustainable+forest+management+definition&hl=en Resolution H1

20. Sustainable forest management - The process of managing permanent forest land to achieve one or more clearly specified objectives of management with regard to the production of a continuous flow of desired forest products and services without undue reduction of its inherent values and future productivity and without undue undesirable effects on the physical and social environment. Developed by Poore. (ITTO 1992). http://www.forestry.ubc.ca/concert/evans.html#III http://helios.bto.ed.ac.uk/ierm/research/sucre/cons4.htm

21. Sustainable forest management comprises all those direct and indirect measures of protection, tending and utilization which ensure the permanent conservation of forests. Sustainable management maintains the natural plasticity and diversity of life forms which enable forests to evolve and provide human benefits from their ecological, economic, social and cultural functions in perpetuity. Heuveldop (1994) http://helios.bto.ed.ac.uk/ierm/research/sucre/cons4.htm

22. Sustainable Forestry- Managing our forests to meet the needs of people today without compromising the ability of future generations to meet their own needs. This is accomplished by growing, caring for, and harvesting trees for products while at the same time conserving soil, air, water, water quality, and wildlife and fish habitat. http://www.dnr.state.wi.us/master_planning/Brule/Documents/PrefAlt.pdf

23. Sustainable Forestry- The practice of managing dynamic forest ecosystems to provide ecological, economic, social and cultural benefits for present and future generations. Source: Wisconsin Administrative Code, Department of Natural Resources, Chapter NR 44 03 http://www.dnr.state.wi.us/master_planning/Brule/Documents/PrefAlt.pdf

24. Sustainable Management—A method of exploiting a resource that can be carried on indefinitely. For example, the removal of water from an aquifer in excess of recharge is, in the long term, not a sustainable management method. http://www.state.nv.us/cnr/ndwp/dict-1/WORD_S.htm

WOODLAND

1. "Woodlands" is defined in CSR 38-2-2.134 to mean commercial woodlands where the postmining land use would result in the development of a commercial product for which flat or gently rolling land is essential to facilitate the operation of mechanical harvesting equipment. http://www.osmre.gov/mountaintop.htm

2. (Australia – NSW) **Woodland** vegetation where trees cover 20-50% of the area under application (Crown separation ratio is 0.25-1). The trees are native but the shrubs or grasses may be native or exotic. **Open Woodland** where individual trees cover 0.2 - 20% of the area under application (Crown separation ratio is 1-20). The trees are native but the shrubs or grasses may be native or exotic. http://www.dlwc.nsw.gov.au/care/veg/pdfs/clearing_vegtypes_mar02.pdf

3. (Australia) - A vegetation type dominated by woody vegetation having a mature or potential mature stand height exceeding 5 metres, with an overstory canopy cover less than 20%. http://www.rfa.gov.au/documents/janis/janis011.html#E9E11

4. (Australia) Wooded Land - Land with vegetation with a projected foliage cover of less than 10% (this is equivalent to a crown cover of 0.25 to 20%) and included Tall, Medium and Low Trees (>30, 10-30 and <10 m respectively) and Tall Shrubs (>2 m). The Tall Shrubs category excludes eucalypts as these are included under 'forest' as Mallees." Karol.Andrzejewski@affa.gov.au NFI (1999) definition of Other Wooded land

5. (Austria) (and non-forest land) - Areas which are not under forest management and which have a crown cover of less than 30%; areas stocked by shrubs (except coppice stands and areas which have been identified as protective forests); rows of trees (except wind belts); short rotation plantations, for instance for fuelwood production (with a rotation period of less than 30 years); Christmas tree cultures, forest nurseries, plantations for seeds of forest trees or fruits. (Austrian Forestry Act (Federal Legal Gazette no. 440/1975, as amended Federal Legal Gazette 231/1977, 142/1978 and 576/1987) From: Weiss Peter weissp@ubavie.gv.at)

6. (Czech Republic) Land covered by trees and/or shrubs which is not destined to fulfil forest functions e.g., the belts on river banks. (European Communities 1997b - p. 1225).

7. (Estonia) - Other wooded lands - includes shrubs, bushes and non-agricultural land covered with trees. For FRA 2000 - Source: UN/ECE 2000 p. 77.

8. (Finland) Scrubland - Potential capacity to produce a mean annual increment of at least 0.1 m3/ha but less than 1.0 m^3/ha given an optimum tree species mix. (European Communities 1997a - p. 186)

9. (France) A subcategory of forest land - where the main function is not production. They consist of unmanaged forests: in accessible forest or forest land located on too steep slopes, protective forests (where cuttings are forbidden) and recreation forests, green spaces, no-admittance areas (military grounds for example). (European Communities 1997a - p. 255)

10. (Ireland) Coillte estate - Scrub and/or Amenity forests. (European Communities 1997a - p. 401).

11. (Miombo) Any woodland which is dominated by species of three related genera in the family *Leguminosae*: *Brachystegia, Julbernardia* and *Isoberlinia*. Miombo is regarded as woodland, in spite of its closed canopy (with crowns touching), because of its light foliage which allows sufficient light to reach the ground to support a continuous ground cover of grasses and other herbs. Source: http://www.africa-insites.com/zambia/travel/General/vegetati.htm

12. (Norway) Other wooded land then corresponds to: "Non-productive forest land" and "wooded mire". Non-productive forest land should have an average potential production of between 0.1 and 1.0 m^3 per ha and year, regardless of the current stocking and it should have mineral soil. Wooded mire has the same production potential as non-productive forest land, with a peat soil. From: marit-viktoria.pettersen@sftospost.md.dep.telemax.no (European Communities 1997b - p. 832).

13. (Oak) Those Devon woods which are dominated by English oak, sessile oak or the hybrids between the two. Devon Biodiversity Action.
http://www.devon-cc.gov.uk/biodiversity/oakwood.html

14. (Remote Sensing) Area with tree crown cover of 5-20% of the surface. Trees should be able to grow to a height of more than 7 m (Koehl and Paivinen 1996).

15. (Romania) - OWL - forests owned by different state owners outside the "forest fund" - which are not characterized by statistical parameters. For FRA 2000 - Source: UN/ECE 2000 p 85

16. (Russian Federation) - OWL = includes areas of shrubs and bushes. For FRA 2000 - Source: UN/ECE 2000 p 85.

17. (South Africa) Woodland - Tree canopy cover between 40-70%. A closed-to-open canopy community, typically consisting of a single tree canopy layer and a herb (grass) layer. Thompson 1996?

18. (South Africa) Woodlands - 40-99% canopy cover, usually a tree layer, shrub layer and grass layer, typically 6m or more tall; regular fires. http://www.polity.org.za/govdocs/green_papers/forest1.html#t1.1

19. (Sweden) - OWL - a quarter of the land with a tree crown ranging from 1-20 percent and areas larger than 0.25 ha. For FRA 2000 - Source: UN/ECE 2000 p 87.

20. (UK) - OWL - wood pastures For FRA 2000 - Source: UN/ECE 2000 p 90

21. (UN-FRA 2010 Proposed) - Land with tree canopy cover of more than 5 percent and area of more than 0.5 hectares. Trees, defined by Ecoregion, should be able to reach a minimum height of 2m at maturity in situ. Generally, woodland trees will not exceed 5m in height at maturity. Source: Brad Smith, USDA Forest Service, May 2002.

22. (USA-BIA) Woodland - Forestland with less than 5% crown cover by commercial timber species. http://conbio.rice.edu/nae/docs/assessment.html

23. (USA-USGS) -Woodland, which is defined as "forest land," includes deciduous, evergreen, and mixed forest land, and orchards. The woodland data layer identifies deforestation or reforestation resulting from urbanization or conservation. The woodland is compiled using criteria based on tint and spectral reflectance. The minimum mapping unit for woodland is 10 acres. The classification scheme adopted for woodland is a modification of the Anderson Level II classification system. All woodland areas are collected as polygons, compiled into one separate coverage, and assigned category 44. http://mcmcweb.er.usgs.gov/phil/gis.html

24. (USA-USFS-R8) An open stand of trees with crowns not usually touching (generally forming a 25 to 60 percent cover). USDA Forest Service 1997.

25. (USA-Virginia) - Woodland - Forest land incapable of producing 20 cubic feet per acre per year of industrial wood under natural conditions, because of adverse site conditions. http://state.vipnet.org/dof/glo.htm, http://www.srs.fs.fed.us/sustain/report/appendix/glossary.htm

26. (Vanuatu) Trees with separated crowns, generally <10 m tall. A clearly visible layer of herbs and/or grasses. Source: Bellamy, J.A. Vanuatu Resource Information System. VANRIS Handbook. Via Adam Gerrand.

27. A forest with low tree densities, often defined as less than 20% to 30% crown cover when trees are mature. http://www.sfrc.ufl.edu/Extension/ssfor11.htm

28. A landscape where the dominant vegetation is composed of tree species that are generally not capable of producing commercial tree growth. http://www.for.nau.edu/courses/for250/Definitions/Definitions.html

29. A natural community of widely spaced and often stunted trees that occurs on knolls and hill tops where soils are excessively well-drained and bedrock outcrops are abundant. http://www.midcoast.com/~wpl/mvlt/nri/glossary.html

30. A piece of land on which trees are cultivated http://www.ifdn.com/teacher/glossary.htm

31. A plant community dominated by short-boled trees (usually species of eucalypts) that are separated from each other and with grasses and other herbs forming a more or less continuous ground cover between them. http://155.187.10.12/glossary/fl-nsw.html

32. A small forest. http://www.fnr.purdue.edu/inwood/glossary.html

33. An area or biotic community dominated by widely-spaced trees of short stature growing on warm, dry sites. In the Southwest, common woodland species are oak, pinyon, and juniper; these woodlands usually occur below 8,000 feet elevation. http://www.rmrs.nau.edu/publications/rm_gtr_295/glossary.html

34. An area planted to trees for fuel, or timber. http://www.echonet.org/Technotes/AgroforestryPrinciples.html#definitions

35. Any wooded areas having a canopy closure of 50% and greater. http://gisdasc.kgs.ukans.edu/metadata/landcover.html

36. Area with tree crown cover of 5-20% of the surface. Trees should be able to grow to a height of more than 7 m. Included are 1) the area with young trees or coppice able to form open forest in the future, 2) area of potentially open forest which is temporarily unstocked due to regeneration or damage. Forest roads, firebreaks etc., as well as nurseries and storages less than 0.5 ha are included in open forest area (Köhl and Päivinen 1996).

37. Areas dominated by trees with a total canopy cover of 26-60 %, most tree crowns not touching each other. An herbaceous or shrub understory, or both, are usually present. An open stand of trees, sometimes called "open forest." http://www.gap.uidaho.edu/handbook/LandCoverMapping/UNESCO/

38. Areas of trees whose tops collectively shade less that 30 percent of the ground http://www.nafi.com.au/k12/ourforests/glossary.html

39. Areas with an annual yield capacity between 0.1 and 1 m^3 wood including bark per hectare under favourable stand conditions. As for productive forest land, consideration should be given to yield capacity and not a temporary absence of trees. [From: Stein Tomter stein.tomter@tor.nijos.no Date: Mon, 15 Jun 1998 14:50:20 +0200]

40. Forest land producing trees not typically used as saw timber products and not included in calculation of the commercial forest land ASQ. Medford Record of Decision and Resource Management Plan. http://www.or.blm.gov/Medford/medford/glossary.html http://www.streamnet.org/pub-ed/ff/Glossary/glossaryforest.html

41. Land covered with wood i.e. trees; a wooded region or piece of ground. Shorter Oxford English Dictionary http://www.taxbar.com/tr/jaggers.htm

42. Land devoted to the growing of trees http://www.co.hunterdon.nj.us/depts/taxboard/farmland.htm

43. Land either with a tree crown cover (or equivalent stocking level) of 5-10 percent of trees able to reach a height of 5 m at maturity in situ; or a crown cover (or equivalent stocking level) of more than 10 percent of trees not able to reach a height of 5 m a maturity in situ (e.g. dwarf or stunted trees) and shrub or bush cover. Excludes: Areas having the tree, shrub or bush cover specified above but of less than 0.5 ha and width of 20 m, which are classed under "other land"; Land predominately used for agricultural practices (UN-ECE 1997).

44. Land that is mostly covered with dense growths of trees and shrubs. A generalized term http://www.tnw.org.uk/Note17.html

45. Land under open stands of trees. Paraphrased from http://src.doc.ic.ac.uk/packages/Project-Gutenberg/etext99/world97.txt

46. Open stand of trees up to approximately 18 metres in height in which tree crowns cover at least 30 per cent of the land area but are, for the most part, not overlapping. http://europa.eu.int/comm/dg08/forests/en/en4_6.htm

47. Open stands of trees with crowns not usually touching (generally forming 25-60% cover). Canopy tree cover may be less than 25% in cases where it exceeds shrub, dwarf-shrub, herb, and nonvascular cover, respectively. http://www.cws-scf.ec.gc.ca/fff/GLOSS_E.HTM#Forest and http://www.wec.ufl.edu/coop/gap/moreinfo.htm

48. Other wooded areas are the wooded formations of any kind less than 0,5 ha in size, as well as open woodlands having a crown density less than 20%, areas of brushwood, shrubland, stunted trees etc.. http://192.83.171.71/newcrons/navig/en/theme8/milieu/10fo/notmeth.htm

49. Predominately tree covered land. Paraphrased from http://www.fsc-uk.demon.co.uk/Appendices.html.

50. Small forest, a forest composed of young trees, or a forest from which fuelwood is cut. Colliers Encyclopedia.

51. The tract of wooded land which is maintained primarily to furnish fuel, posts, lumber and other wood products for use on the farm. (Fergusen 1916).

52. Upland and bottomland forests or idle areas over grown with trees having canopy greater than 10 percent and at least 100 feet wide. Fence rows and woody draws are not classified as woodland but are included as features in the cropland, pature/hayland or old field habitat types. http://www.conservation.state.mo.us/landown/wild/guide/

53. Wooded area - A land area which is at least six (6) percent covered with trees that are two (2) metres or more in height. http://home.gdbc.gov.bc.ca/TRIM/IDM_Project_Riparian_Zone_specs.pdf

54. Wooded area - Corresponds to the FAO definition of forest and woodland. It refers to land under natural or planted stands of trees, whether productive or not, and includes land from which forests have been cleared but that will be reforested in the foreseeable future. http://www.tpesp.es/informe/HTMNF/COMPENDI/CHAP8.HTM

55. Wooded area consists of forest area and other wooded areas. http://192.83.171.71/newcrons/navig/en/theme8/milieu/10fo/notmeth.htm

56. Woodlands - 50-100% tree canopy cover, and a graminaceous layer. http://www.savannas.org.uk/savdef.htm

57. Woods, Copses, Shelterbelts - predominately tree covered land in smaller units. Paraphrased from http://www.fsc-uk.demon.co.uk/Appendices.html.

58. Woody land - "The Woody land class includes any species with an aerial stem that persists for more than one season. The class is divided into three subclasses: 1.41-Deciduous, 1`.42-Evergreen, and 1.43-Mixed." (Dobson, et al. 1995). Each of these classes in turn are divided into Forest and Scrub/Shrub components based on a 20 foot height criterion. http://www.dos.state.ny.us/cstl/Final_Draft_HTML/Tech_Report_HTM/Land_Cover/Appendices1_LC.htm

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Lund, H. Gyde. 2002. Definitions of old growth, pristine, climax, ancient forests, and similar terms.[Online publication], Gainesville, VA: Forest Information Services. Misc. pagination. http://home.att.net/~gklund/pristine.html

Lund, H. Gyde. 2002. Definitions of agroforestry, forest health, sustainable forest management, urban forests, rangeland, agricultural land and related terms. [Online publication], Gainesville, VA: Forest Information Services. Misc. pagination. http://home.att.net/~gklund/moredef.htm

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BIOME-SPECIFIC FOREST DEFINITIONS

Technical paper

Report[39] to the UNFCCC secretariat
by Zoltán Rakonczay[40]

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I. SUMMARY

1. Parties to the UNFCCC have agreed on a forest definition for the purposes of Article 3.3. and 3.4 of the Kyoto Protocol, to be applied for the first commitment period. At the same time, they requested the SBSTA to investigate the possible application of "biome-specific forest definitions" for the second and subsequent commitment periods. This paper investigates the potential implications of such a change in definition.

2. First, the possible interpretations of "biome" are considered. It is shown that the meaning of "biome" in the given context is less than clear, and some plausible scenarios for the adoption of a reasonably consistent and meaningful biome classification system are outlined. It is argued that the adoption of a sufficiently detailed and ecologically meaningful biome classification system will require considerable effort, even if it is based on an existing classification system. Of the existing global biome classifications, the GEZ system, developed for the purposes of the Forest Resources Assessment 2000 programme of the FAO, is presented as the most practical choice.

3. It is argued that whatever zoning system is to be adopted, the forest definition in each biome is likely to follow the current structure based on minimum tree height, minimum crown density (or similar measure) and minimum area, but with different minimum values. An analysis of the impact of each of these parameters on the corresponding forest area and on the feasibility of ARD activities indicated that the forest definition can have a significant impact on the area qualifying as forest, especially near the natural boundaries of forest distribution, and in heavily impacted (degradation, fragmentation) communities.

4. There is no strong indication that a change in the way forests are defined in any ecological zone would lead to appreciable benefits either in terms of consistency of carbon estimates (agreement with the real values) or in terms of environmental benefits. The adoption of biome-specific forest definitions, if biome boundaries are not identical with national boundaries, is likely to make carbon accounting more difficult and/or less accurate, and is likely to lead to inconsistencies among forest carbon estimates of different biomes within countries (since different definitions are likely to result in different error structures).

5. The analysis of the implications of changing from one forest definition to another (be it biome-specific or otherwise) identified areas of concern. A change in forest definition between commitment periods will require double accounting (at least for the time of the changeover). In addition, it will inevitably create apparent changes in the amount of forest indicated, even if there is no actual change in the amount of woody vegetation. These apparent gains and/or losses of forest area will have to be differentiated from actual changes in woody vegetation. Separating accounted changes owing to real processes and those resulting from the definition change may pose considerable methodological problems. A change in forest definition may also lead to paradoxical situations, may generate perverse incentives and may provide opportunities for abuses of the system.

II. INTRODUCTION

A. Background

6. Under Article 3.1 of the Kyoto Protocol, Annex I Parties have agreed to reduce their emissions of greenhouse gases between 2008 and 2012. The Kyoto Protocol makes provision for Annex I Parties to take into account afforestation, reforestation and deforestation (ARD) activities (under Article 3.3) and other agreed land use, land-use change, and forestry (LULUCF) activities

(under Article 3.4) in meeting their commitments under Article 3. The use of LULUCF activities is also acknowledged under Article 6 and incorporated under decision 17/CP7 relating to Article 12, where only eligible projects are limited to afforestation and reforestation (see also decision 11/CP.7).

7. The definitions, modalities, rules and guidelines relating to LULUCF activities under Articles 3, 6 and 12 of the Kyoto Protocol were considered by the resumed sixth session of the Conference of the Parties. The resulting decision (11/CP.7) recommends that the first COP serving as the meeting of the Parties to the Kyoto Protocol (COP/MOP1) adopts, for application in the first commitment period, the definitions for "forest" and for ARD activities.[41]

8. The primary function of the forest definition in this context is the identification of areas affected by ARD activities. Thus, such activities are considered only on areas of land which are converted from forest to non-forest or non-forest to forest (as specified by the forest definition). This affects the application of Article 3.3 and has implications for Articles 6 and 12 (e.g. eligibility for CDM activities). In addition, forest management activities, allowed under Article 3.4, can be carried out only on forest land.

9. The decision mentioned above, however, leaves the door open for a different forest definition to be used in the future by requesting the SBSTA to investigate the possible application of biome-specific forest definitions for the second and subsequent commitment periods.

10. This paper investigates some methodological issues relating to the possible implementation of biome-specific forest definitions.

B. Methodology and structure of the report

11. The study is based on an analysis of the text of the UNFCCC, the Kyoto Protocol and relevant decisions of the COP. It relies on the reports and guidelines issued by the IPCC, and takes into account relevant international conventions, agreements and processes, especially the relevant efforts of FAO. It draws heavily on the technical literature and expert consultations.

12. The report assumes the following logical sequence in arriving at "biome-specific forest definitions":

(a) The land surface of the Earth is first divided into a finite number of biomes in such a way that any point can be assigned to one biome;

(b) For all of the biomes identified in step (a), there has to be a definition of "forest";

(c) For at least one of the biomes, the definition of forest is different from that agreed upon by Parties for the first commitment period.

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[41] "Forest" is a minimum area of land of 0.05-1.0 hectares with tree crown cover (or equivalent stocking level) of more than 10-30 per cent of trees with the potential to reach a minimum height of 2-5 metres at maturity *in situital*. A forest may consist either of closed forest formations where trees of various heights and undergrowth cover a high proportion of the ground, or of open forest. Young natural stands and all plantations which have yet to reach a crown density of 10-30 per cent or tree height of 2-5 metres are included under forest, as are areas normally forming part of the forest area which are temporarily unstocked as a result of human intervention such as harvesting, or of natural causes, but which are expected to revert to forest.

Each Party included in Annex I shall [...] select a single minimum tree crown cover value between 10 and 30 per cent, a single minimum land area value between 0.05 and 1 hectare and a single minimum tree height value between 2 and 5 metres. The selection made by a Party shall be fixed for the duration of the first commitment period.

13. The relevant sources were reviewed for the above steps. As there are virtually limitless possibilities both for defining/delineating "biomes" and for defining "forest", the discussion is limited to the most plausible scenarios.

14. Section 2 reviews the text of the Convention, the Kyoto protocol and available IPCC documents, as well as other relevant sources for guidance on the appropriate interpretation of the expressions "biome" and "biome-specific". Addressing step (a) above, plausible scenarios for the specification of biomes are outlined, highlighting the most important theoretical and practical issues associated with each.

15. Section 3 addresses step (b) above by considering scenarios for the definition of "forest" in the various biomes. It investigates the potential benefits and disadvantages of the different choices.

16. Section 4 addresses step (c) above by exploring the potential implications of switching from the current forest definition (adopted for the first commitment period) to "biome-specific" definitions for the subsequent commitment periods.

17. Section 5 synthesizes the main findings of the report.

III. BIOME MAPPING

18. To analyze the implications of "biome-specific" definitions, the plausible options for delineating "biomes" have to be explored. In this section, relevant sources of information are reviewed in search guidance on the possible definition(s) of "biome" in the given context. Options are presented for the development/adoption of a biome classification system, and the implications of each.

A. Review of sources

1. Generic reference sources

19. This section examines the definitions offered by major reference sources. First, some definitions for "biome" are reviewed.

20. The Oxford English Dictionary (1989) defines biome as "A biotic community of plants and animals, spec. such a community in a prehistoric period", suggesting the importance of the potential vegetation type (by referring to a "prehistoric period"). The Merriam-Webster Collegiate Dictionary (2001) provides some examples to illustrate the level of classification it assigns to the biome concept.[42]

21. The Encyclopaedia Britannica (1995) emphasizes that biomes are large units. However, by introducing the concept of "biome type" (a grouping of biomes), it makes clear that biomes are not the highest level of classification of life zones.[43] While it gives "temperate deciduous forests" as an example of a "biome type", the McGraw-Hill Encyclopedia of Science & Technology (1992) uses

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[42] **biome** a major ecological community type (as tropical rain forest, grassland, or desert).

[43] **biome**, also called major life zone, the largest geographic biotic unit, a major community of plants and animals with similar life forms and environmental conditions. It includes various communities and developmental stages of communities and is named for the dominant type of vegetation, such as grassland or coniferous forest. Several similar biomes constitute a biome type – for example, the temperate deciduous forest biome type includes the deciduous forest biomes of Asia, Europe and North America. "Major life zone" is the European phrase for the North American biome concept.

the same forest type as an example of "biome",[44] demonstrating that the level of classification assigned to the biome concept is somewhat arbitrary.

22. All the above sources also offer synonyms for the term "biome", which happens to be just one of several words and expressions denoting similar concepts. These include: *formation, major life form, major life zone, major community (type)*. Although not mentioned above, *ecoregion* and *ecofloristic zone* are also related terms and can be considered as synonyms. Although they may differ in their origin or area of application, they should all be treated as different interpretations of "biome". Some are rather vague,[45] while others are more specific[46] about the level of classification implied.

2. IPCC documents

23. Further to the above generic definitions, various IPCC documents provide some guidance as to how "biome" and "biome-specific" may be interpreted in the context of the Kyoto Protocol.

24. The IPCC Guidelines for National Greenhouse Gas Inventories (IPCC, 1997) make no explicit reference to "biomes". However, there are several sections which can be interpreted as guidance for the development of biome-specific forest definitions. The following expressions, referring to the categorisation of forests, can be found in the Guidelines: *forest category, forest formation, ecosystem category, ecosystem type, vegetation cover class*. These expressions are used in the document more or less interchangeably and in a rather inconsistent fashion.

25. Specifically, three ecosystem types are described, with three to six sub-types in each. Countries are encouraged to use more detailed classification where applicable/feasible, but they are also required to report aggregate figures for the categories specified. This suggests that any detailed national classification should be compatible with the categories given. However, these categories are not well defined. For the tropics, the categories are based "mainly on the FAO system", referring to the FAO Forest Resources Assessment 1990 (FAO, 1993), which has since been revised (FAO, 2001). No clear reference is given for the other "ecosystem types", which makes application of the FRA problematic. (For example, it is unclear how the vast amount of temperate mixed forest can be classified within the "coniferous" or "broadleaf" category.)

26. The IPCC Special Report on Land Use, Land-use Change and Forestry (IPCC, 2000) (SR- LULUCF) provides a detailed analysis of the main implications of some definitional scenarios for "forest" and related terms. One of these (the "biome scenario") assumes that different definitions will be developed for different biomes. However, the report stops short of discussing what those biomes might be, or how to delineate them.

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[44] **biome** A major community of plants and animals having similar life forms or morphological features and existing under similar environmental conditions. The biome, which may be used at the scale of entire continents, is the largest useful biological community unit. In Europe, the equivalent term for biome is major life zone, and throughout the world, if only plants are considered, the term used is formation. [...] Each biome may contain several different types of ecosystems. [...] Terrestrial biomes are usually identified by the dominant plant component, such as the temperate deciduous forest. [...]

[45] **formation** *Ecol.* A community formed by groups of plants which have adapted themselves to similar climatic conditions. Oxford English Dictionary (1989).

[46] **formation** the largest unit in an ecological community comprising two or more associations and their precursors <grassland *formation*>. Merriam-Webster Collegiate Dictionary (2001).

27. The IPCC Special Report on Regional Impacts of Climate Change (IPCC, 1998) includes many references to different vegetation classification systems. In its glossary, it includes the following definition:

28. Biome: A grouping of similar plant and animal communities into broad landscape units that occur under similar environmental conditions.

29. It does not specify one particular classification system as preferable to others. It presents an ecoregional map of North America (figure 8-3), and one for Latin America (figure 6-4), but the two use different classification systems, and the ecoregion boundaries do not match at the border of the two maps, suggesting that the two systems are not fully compatible.

30. The IPCC Third Assessment Report (IPCC, 2001) makes reference to some of the African ecoregions as "biomes" (such as the Succulent Karoo biome in South Africa), suggesting a very detailed classification system.

31. While it is clear that not all uses of the word "biome" can be considered as an endorsement of a certain kind of classification system, it must be pointed out that a multitude of interpretations are available and have been used within the climate change context.

3. UNFCCC documents

32. The text of the Convention and its Kyoto Protocol do not contain the word "biome", neither do they provide any guidance as to possible interpretation of the concept.

33. Having reviewed the decisions of the COP and the recommendations of the SBSTA, few documents make explicit reference to biomes as such, and none offer clear guidance as to how the biomes should be defined/delineated, let alone what the specific forest definitions might be. Beyond the one already mentioned above (11/CP.7), the following are to be noted.

34. There are several submissions by Parties recommending the adoption of forest definitions which are specific to biome categories. Samoa (on behalf of the AOSIS group) suggested that "forest" should be defined for the following "biome categories": tropical forests, temperate forests, boreal forests, tropical savannas, temperate grasslands, deserts and semi-deserts, tundra and wetlands.[47] Chile[48] suggested that "a single threshold of canopy cover be adopted for each relevant biome, such as tropical moist forest, tropical dry forest, boreal forest, temperate forest, planted forest and agroforestry, among others, in order to reduce bias in defining lands under Article 3.3".

35. A common element that can be inferred from the submissions by Parties is that they recommend broad ecological categories as "biomes", and there seems to be an agreement that forest definitions should be assigned to the different biomes internationally, rather than allowing Parties to set their own definitions. Although these submissions are not definitive, they provide indications of the intentions of some Parties who promoted the use of biome-specific forest definitions during the process of responding to the Buenos Aires Plan of Action. For example, it is interesting to note that Chile's submission considers management categories (planted forest and agroforestry) among the biome designations.

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[47] FCCC/SBSTA/2000/MISC.6/Add.2.

[48] FCCC/SBSTA/2000/9 paragraph 27.

B. Scenarios for the adoption of a biome classification system

36. The above discussion has concentrated on the concept of "biome". It has been shown that the term can be interpreted in many different ways, each leading to a different classification system. There is a reasonably complete agreement among the sources that biomes should be identified by the prevailing vegetation and/or (macro)climatic parameters, and should represent large units. At the same time, there are indications that other factors (such as land use considerations) may play a role

37. This section outlines some possible options for the development of the biome scheme. The advantages and disadvantages of three main scenarios are presented, while it is acknowledged that many more are possible. The likelihood for the adoption of the various scenarios is also considered.

1. Parties use their own national systems of ecological zoning

38. Under this scheme, Parties could use their own biome definitions. These definitions would have the same structure as the current ones, but different threshold values might be selected. Forest definitions would be assigned to biomes permanently.

39. Advantages: Most countries have appropriate national methods for classifying forests in ecologically meaningful units. National categories are likely to describe local peculiarities best. Maps are already available in sufficient scale. Implementation at the national level would be inexpensive.

40. Disadvantages: Comparability of data and the transparency of reporting could be compromised. Expert review teams would have to scrutinize the appropriateness of the national classification system. Dispute resolution might be difficult. Similar areas on the two sides of national boundaries could fall into different categories, leading to serious inconsistencies.

41. Such a system, in its "pure" form might be difficult for Parties to implement. However, national zoning systems, or at least elements of them, might be used for some countries, especially bigger ones, and ones where consistency across boundaries is a lesser problem (e.g. some island states). It may also be the method of choice for dealing with relatively small, but very distinct, systems, which are difficult to categorize properly at the international level. Most notable are the various mountain systems, with a high diversity of habitats in relatively small areas.

2. Parties decide to develop a completely new global zoning system for the purposes of the Kyoto Protocol

42. As none of the existing classification systems was designed specifically for the purposes of carbon inventories/accounting, arguments could be made for the development of an entirely new system, specifically designed to serve the needs of the Kyoto Protocol.

43. Advantages: such a system, at least theoretically, could serve the needs of the Convention. It could take advantage of the latest scientific knowledge on carbon dynamics and other related areas. It could be developed at the right scale, and it could be expected to minimize inconsistencies.

44. Disadvantages: the scientific, organizational and financial requirements of such a project are likely to be prohibitive, especially since it would serve just one component of the system created by the Kyoto Protocol.

3. Parties adopt (with appropriate adjustments, if necessary) an existing global classification system, or several regional ones

45. Many zoning schemes have been developed for the classification of land into ecologically meaningful units; they represent a broad range of scales and level of detail, from the regional to the global. Most of these were developed on the basis of macroclimatic elements and floristic characteristics.

46. The most important regional systems include that of Bohn *et al.* (2000) for Europe and Bailey (1998) for North America. Holdridge (1947) developed several national vegetation maps for Latin America, based on his system which makes use of evapotranspiration data, in addition to temperature and rainfall.

47. Global systems include that of Köppen (1931), which was later modified by Trewartha (1968). More recent efforts include a global ecoregion map developed by WWF (WWF, 2000). A review of all existing systems would go beyond the limitations of this report, but a list of the most important references is provided in appendix A (based on FAO, 1999). A detailed review of the available classification systems can be found in FAO (2000).

48. An advantage of adopting an existing system is that no major effort is required to develop/adapt the system. Furthermore, most systems enjoy a degree of acceptance, and their benefits and shortcomings are known.

49. Disadvantages: existing systems were developed for purposes other than carbon accounting, and their applicability for implementation of the Kyoto Protocol is limited. Regional systems may require significant harmonization efforts (at least in the regions where they meet/overlap). Global systems tend to be better suited for some areas/continents than for others, either because they were first developed with one region in mind, or because of uneven data availability; so it may be difficult to have them accepted by all Parties. Most earlier maps exist only in hard copy, and only with relatively modest accuracy, so georeferencing and the refinement of the boundaries of the biomes may pose significant problems.

50. Should Parties decide to introduce biome-specific forest definitions, it is likely that they would need to adopt one or more of the existing classification systems, probably with some modifications. The global ecological zoning system of FAO (FAO, 2000) has overcome most of the above difficulties, and deserves special attention as it is the best system yet for consistent global classification of forest type. It is reviewed in more detail in the following section.

C. Global ecological zoning for the Forest Resources Assessment 2000

51. The GEZ map, developed for the FRA 2000 report (FAO, 2000) is presented here in more detail, as it is a good example of a comprehensive, global classification of ecological zones. It appears to be the best system developed to date.

52. Characteristics and components of the FAO GEZ classification include the use of the Köppen-Trewartha system (Trewartha 1968), with some modifications, in combination with vegetation characteristics, as a basis for the delineation of zones. The GEZ classification system has a hierarchic structure: at the broadest level five domains are distinguished, which are subdivided into 20 "ecological zones". The mapping work was carried out principally using regional or national potential vegetation maps to define boundaries of ecological zones at the global level. Regional

experts and scientists provided support and advice. Although using a variety of input maps inevitably caused methodological problems such as edge matching across adjacent maps, a protocol for correcting such problems was successfully developed and implemented. In addition to the global EZ map, regional descriptions were prepared on the vegetation, climate and physiography of the ecological zones. The GEZ used the following definitions (FAO, 2001):

> **(a) Ecological zone:** Defined as a zone or area with broad yet relatively homogeneous natural vegetation formations, and similar (not necessarily identical) physiognomy. Boundaries of the ecological zones coincide approximately with Köppen-Trewartha climatic types, which are based on temperature and rainfall. An exception to this definition are "mountain systems", classified as one separate ecological zone in each domain and characterized by a high variation in both vegetation formations and climatic conditions.
>
> **(b) Domain:** Broadest entity or level in classification, equivalent to the five thermic Köppen-Trewartha climatic groups and including the tropical, subtropical, temperate, boreal and polar domains.

53. The five domains are divided into a total of twenty ecological zones. A full list of GEZs with brief descriptions is given in appendix B. The benefits of the GEZ system for the purposes of Article 3.3 include the following:

(a) It is the most recent of such systems;

(b) It was developed specifically for forestry purposes (unlike some other systems, which were developed for scientific or conservation purposes), and so it is likely to be well adapted for Article 3.3;

(c) It was developed by many experts in a collaborative effort representing a good regional balance, and was developed under the sponsorship of a United Nations agency, which is likely to increase its political acceptability;

(d) Its mapping was carried out using GIS technology, making the maps easy to use and to manipulate;

(e) Its hierarchical system allows "biome" to be defined either as a top-level category (equivalent to the "domains" of the GEZ), or as a second-level one ("ecological zone").

54. Some of its limitations are:

(a) The base scale of the GEZ map is 1:1 million. While this is sufficient for global-level analysis, it may be insufficient for the accurate identification of ARD land on a local scale;

(b) There are regional differences in the accuracy of the source maps (despite all efforts to use the most precise source maps);

(c) Small ecological zones could not be properly classified. Most importantly, mountain systems are delineated as a separate zone at level 2 in all but one (polar) of the five domains, but they are not classified in detail. As mountain systems tend to have a high degree of habitat diversity (e.g., lush rain-forest and bare alpine rock can exist within a very short distance from one another), a single forest definition for mountain forest may not be appropriate. A resolution of this (perhaps at the regional/national level) is likely to be necessary if the system is to be adopted.

D. Conclusions

55. In summary, it is not easy to determine what kind of biome classification system could be adopted as the basis for biome-specific forest definitions. There is no single accepted definition for the term "biome". The word has been used interchangeably with several related words and expressions, representing a wide range of different concepts from the crudest division of the land surface of the Earth (into no more than three classes) to the most detailed floristic classification of certain regions.

56. Existing classification systems tend to rely mostly on macroclimatic parameters, potential vegetation type and physical features. These parameters allow the permanent delineation of biomes, discounting the possibility of significant shifting of biome boundaries due to climate change or other environmental change.

57. At least some proponents of biome-specific forest definitions have proposed that some biome categories (such as "agroforestry" or "plantations") should be defined on the basis of land use. As land use can and does change relatively quickly, such a system would not allow the consistent and permanent categorization of land. For this reason, it would be very difficult to factor land use considerations into the definition of biomes.

58. Parties may arrive at an acceptable set of biomes in different ways. The primary options are summarized in table 1.

Table 1. Overview of the primary options for the possible adoption of a biome classification system

Options	Advantages	Disadvantages
Parties use their own national systems of ecological zoning	- Well adapted to local conditions - Systems readily available, generally at an acceptable resolution - Some relevant statistics may be available according to classification	- Inconsistencies between systems (countries) - Systems not developed with carbon accounting in mind - Difficult to monitor/review application
Development of a new global zoning system specifically for the purposes of the Kyoto Protocol	- Optimal performance can be achieved - Carbon dynamics can be taken into account from the beginning - The system can be developed with sufficient detail	- Expensive and time consuming process - Duplication of effort
Adoption of existing regional/global system(s)	- Well adapted to the given area (continent) - Consistent across regions (or even globally) - Available	- Inconsistencies between regional systems - Low resolution - Less relevant for local/national circumstances - Systems not developed with carbon accounting in mind

59. The need for global comparability, consistency and transparency suggests that a global, as opposed to a regional, classification system would need to be adopted. Of the existing global classifications, the GEZ system of FAO, developed for the purposes of FRA 2000, would appear to be the best. However, this system would need refinement and further elaboration, if it is to be used effectively for carbon accounting under the Kyoto Protocol.

IV. FOREST DEFINITIONS

60. The current forest definition under the Kyoto Protocol follows the structure of the FAO forest definition used for the TBFRA (FAO, 1998) by establishing a minimum threshold value for the same three attributes.[49] Renegotiating forest definitions theoretically opens up the possibility of using any definitional scenario, or even different scenarios for different biomes, starting with the second commitment period. Despite this possibility, in this section it is generally assumed that Parties will retain the current structure of the forest definition, changing only the threshold values of the three parameters (i.e. for minimum area, minimum crown cover and minimum height).

61. There are two main reasons for this assumption. First, the resources available for this report did not allow the analysis of the implications of all plausible forest definitions. For the FRA programme, more than 650 definitions of forest were assembled (FAO, 2000). Some of the most representative definitional scenarios are analysed in detail in the SR-LULUCF (IPCC, 2000), and it is unnecessary to repeat the analysis here. Second, on the basis of the Parties' submissions sent before the Marrakesh accords, including those recommending biome-specific definitions, it appears that most Parties prefer the current structure of the definition.[50]

62. The implications of applying different definitions for the various biomes are demonstrated in the GEZs of FRA 2000. This system was chosen as it was considered the best available global classification system, and it is detailed enough for most of the important considerations to be presented.

63. This section presents first the relevance of the three parameters in the various biomes. Then the potential effects of these parameters on ARD activities are investigated.

A. Effect of forest definitions on the estimated forest area

64. When applied to large tracts of closed formations of productive forests, the threshold values used in the definition of forest have virtually no effect on the estimated forest area. The threshold values begin gaining importance as the extremes of the natural range of forest are approached or when dealing with heavily impacted forests. The impact of the three definitional parameters is reviewed here in the context of the various biomes.

4. Minimum height at maturity

65. The minimum height gains most importance close to the natural tree lines in boreal forests and in mountain areas. The classification of vast areas of boreal forest (mostly tundra) can depend on the minimum height. In the mountains, the affected area is much smaller (limited mostly to Alpine areas near the timberline), although it can be significant locally. The minimum height can also be important for the categorization of some dry forest/shrubland ecosystems, as well as some

[49] But the FAO definition sets firm minimum values for area, height and crown cover (0.5 metres, 5 metres and 10 per cent, respectively), and it explicitly excludes lands that are used predominantly for agriculture.

[50] For an example, see FCCC/SBSTA/2000/9, paragraph 27.

agroforestry systems. Many countries do not include a minimum height in their forest definition, as it is not considered necessary as long as the type of dominant vegetation (forest tree species) is specified.

5. Minimum area

66. This parameter is best discussed separately for open woodlands (where woody and other vegetation alternate in patches of various sizes) and closed forest formations.

67. In closed forests, using a minimum area threshold is needed for administrative and ecological reasons. Ecological considerations are based on the recognition that for forests to fulfil their various ecological functions and to exhibit their representative structure and dynamics, they have to be of a certain size.[51] There are strong arguments for linking the minimum area to the type of forest, for example as a function of the dominant tree height.[52] For administrative reasons, the minimum area has to be set as a fixed value, but biome-specific definitions should reflect the above considerations.

68. In most temperate and dense boreal (taiga) forests, the impact of the area threshold on the amount of land identified as forest is minimal. A simulation study conducted for 19 EU and EFTA countries estimated the impact of applying various minimum threshold values to the estimated area (EU, 1997). The study found that by varying the area threshold, the forest area of individual countries could be overestimated by up to 10 per cent, or underestimated by up to 6 per cent. If the 10 per cent threshold of the TBFRA-2000 (United Nations, 2000) is used for all countries (which tend to have similar or higher national thresholds, up to 30 per cent), the forest area of the region would be overestimated by only 1 per cent, which is well within the margin of error for the practical estimates of the carbon balance of terrestrial ecosystems.

69. No similar numerical estimates for Russia, North America or other major countries could be obtained. It is likely, however, that the impact of the area threshold would be larger in these cases. The area threshold is likely to be most influential in tundra, steppe, shrubland and dry forest formations.

70. The area threshold is also influential in forests under significant human pressure (encroachment, logging, etc.) Under such conditions, an ecological zoning system can provide the distinction between an open forest formation and a fragmented closed forest formation.

71. In the case of open forest formations, the minimum area requirement cannot always be separated from the canopy cover threshold. While they refer to different spatial scales of assessment (the former being interpreted on a larger scale), there can be a considerable overlap between these scales.[53] The size restriction can be interpreted as one referring to administrative/ownership/management units, but this is not explicit. A biome-specific approach, if sufficiently detailed, can clarify the interpretation.

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[51] For similar reasons, many countries specify a minimum width (often set as 10 or 20 metres) for forests, to allow the practical classification of shelterbelts, windbreaks, hedgerows and other linear wooded areas common in many cultural landscapes.

[52] As an example, the minimum area could be defined as the square of three times the height of the dominant tree class. This would result in a minimum of one hectare for trees 33 metres tall, and 0.0225 hectare for 5 metres tall vegetation.

[53] For example, 20 dense groups of trees, 1000 square metres each, evenly distributed over a 10 hectare area, could be interpreted as 10 hectares of open forest (with 20 per cent canopy closure) or 2 hectares of closed forest (in 20 stands, surrounded by non-forest), or any combination in between.

6. Minimum crown cover

72. The minimum crown cover can be a limiting factor in many areas where height can be limiting (as discussed above). In addition, it is a very important parameter for classifying open woodlands (dry forest and steppe formations). However, crown cover has a major significance in all forest types, as virtually all disturbances, human induced or natural, have a temporary or lasting effect on crown cover, making it a sensitive indicator of "naturalness" and disturbance.

73. The possible interlinkages between minimum crown cover and minimum area have been mentioned above. As the minimum area parameter acts at a larger scale, crown cover is the most commonly used proxy for assessing the naturalness of closed forest formations and it is the most important simple parameter for detecting degradation of forests.

74. If the crown cover indicates less than full stocking, it is important to make the distinction between reductions due to natural disturbances, to sustainable human activities (e.g. logging with appropriate control and regeneration measures in place) and unsustainable activities leading to the degradation of forest. While these distinctions can be made on the ground, or can be inferred from time series remote sensing images, it is difficult to include such considerations in the definition of the forest.

75. Table 2 summarizes the effect of the threshold value of the definitional parameters on the amount of forest detected in the various biomes.

B. Implications of forest definitions on the detection of ARD activities

76. The previous section presented some of the implications of choosing different threshold values for forest definitional parameters for the area of land classified as forest. From the perspective of carbon cycling (estimating sources and sinks of carbon), changes in forest land are more important than the amount of forest itself. For this reason, ARD activities receive special attention in the Kyoto Protocol. This section presents the implications of some definitional choices for the detection of ARD activities.

7. Afforestation/Reforestation (A/R)

77. As they are currently defined in the Marrakesh accords, there is no difference between afforestation and reforestation in the context of Article 3.3. Both assume the creation of forest in an area that did not contain forest on 31 December 1989. It should be noted that afforestation includes, and in some interpretations is limited to, the establishment of forest on areas that historically/naturally had, never before contained forest. In a biome-based system, it might be conceptually difficult to define the required attributes of a forest for an area that is naturally treeless.

78. It normally takes several to many years from the initial A/R activity before the vegetation established meets or exceeds the minimum values of the parameters set in the definition of forest. This is recognized in the current definition of forest, which includes young natural stands and plantations if they are expected to revert to forest.

Table 2: The effect of forest definitions on forest area detected. Signs indicate the expected change in the forest area estimated due to an increase in the given definitional parameter. (- small decrease, - - large decrease, 0 no significant impact. Brackets indicate uncertain effect.)

Classification		Effect of increase in parameter		
Level 1	Level 2	**Min. area**	**Min. height**	**Min. crown cover**
Tropical	Tropical rain forest	0	0	0
	Tropical moist deciduous forest	0	0	0
	Tropical dry forest	0	0	-
	Tropical shrubland	-	- -	- -
	Tropical desert	0	0	0
	Tropical mountain systems	(-)	-	(-)
Subtropical	Subtropical humid forest	0	0	0
	Subtropical dry forest	0	0	-
	Subtropical steppe	- -	- -	- -
	Subtropical desert	0	0	0
	Subtropical mountain systems	(-)	-	-
Temperate	Temperate oceanic forest	0	(-)	(-)
	Temperate continental forest	0	0	0
	Temperate steppe	- -	-	- -
	Temperate desert	0	-	0
	Temperate mountain systems	(-)	-	-
Boreal	Boreal coniferous forest	-	-	-
	Boreal tundra woodland	- -	- -	- -
	Boreal mountain systems	- -	- -	- -
Polar	Polar	0	0	0

79. Minimum area is largely irrelevant in this context. Setting the minimum area high can disqualify some small plantings (e.g. schemes encouraging revegetation activities on small farms) from the A/R category, but such effects are not likely to be biome-specific. In open formations, where the characteristics of the vegetation could prevent the establishment of contiguous forests of sufficient scale, the size requirement can be limiting if there is a high threshold for crown cover (see section 3.1.2 on the link between the two parameters).

80. Minimum crown cover can be an important factor in the determination of areas under A/R. On the one hand, a high value can block some open formations from being eligible for A/R projects. Although these areas are likely to be less productive (sec 3.1.3), there might be strong arguments (social and environmental) for considering them for reforestation. On the other hand, sufficient crown cover is a major success indicator for young forests. Setting the value too low for closed forest formations could allow less than fully stocked young stands to get credit for A/R, which could raise questions about the environmental integrity of the system. However, this is unlikely to be a major risk, as those establishing new forests are usually genuinely interested in the success of the plantings. Furthermore, environmental performance can be assured in other ways (through national

policies for many countries, and provisions in the CDM for non-Annex I countries, providing safeguards for environmental integrity).

8. Deforestation

81. Deforestation often occurs quickly, through the harvesting (or other sudden loss) of forests, followed by land-use change. However, gradual forest loss (degradation) can also lead to deforestation. Under current rules, deforestation is considered to occur at the moment the forest no longer meets the definitional criteria, even though its degradation may have started much earlier. These concepts are illustrated in figure 1, using crown cover as the threshold criterion.

82. When deforestation occurs abruptly (as in the case of clear cutting or burning), the change is normally obvious, and the actual threshold values do not make a difference. However, when forest loss occurs through gradual degradation, the threshold can have important implications.

83. Minimum tree height is normally not relevant as an indicator of deforestation, even when the tallest trees are harvested first. The minimum forest area can be important in some settings, where degradation occurs through fragmentation, resulting in isolated groups of trees. In most cases, nevertheless, the best indicator of degradation is the loss of crown cover.

84. For degradation to trigger the definition of deforestation at an early stage, it has been recommended that a relatively high crown cover threshold be used for closed forest formations prone to deforestation. This could ensure that significant carbon losses would be accounted for under Article 3.3. While this is true for reasonably intact forests, however, such a measure could have just the opposite effect for forests already degraded to some extent, as demonstrated on figure 2.

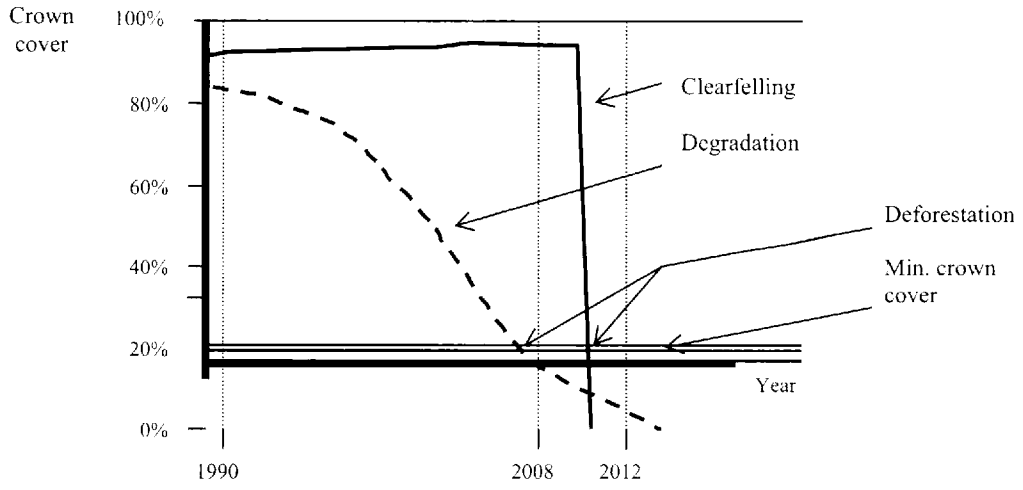

Figure 1. Sudden forest loss and degradation. Degradation is registered as deforestation only years after the process started.

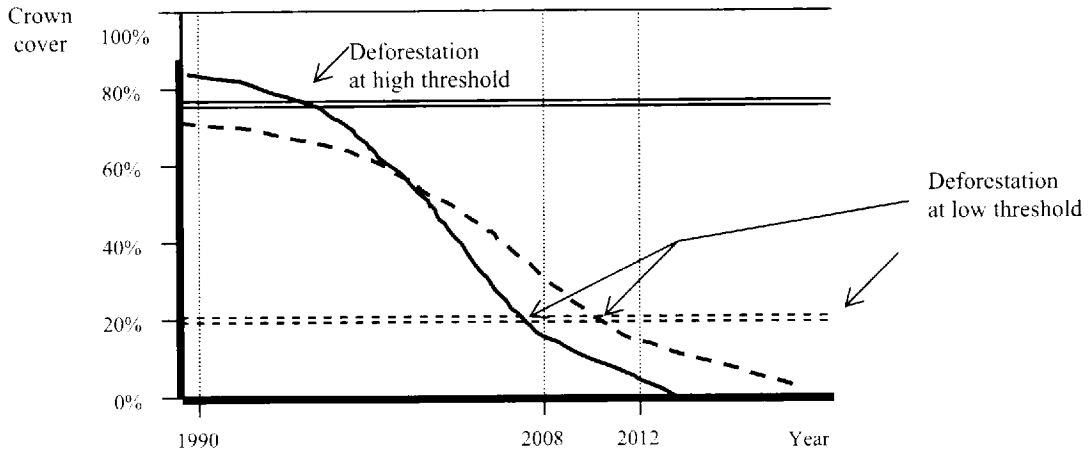

Figure 2. Forest degradation at different crown cover thresholds. While continued degradation always triggers deforestation at a low threshold, a high threshold is efficient only if degradation starts at a nearly full stocking level.

C. Conclusions

85. Analysis of the effect of the minimum values of the definitional parameters on the amount of land identified as forest or as land affected by ARD activities in the various biomes provided few conclusive results. In general, in reasonably intact closed forests there is little difference between the definitional scenarios. In more marginal communities, the values selected can significantly affect the amount of land classified as forest and/or the likelihood of ARD activities to be eligible/detectable.

86. In closed forest formations, the minimum area parameter is important mainly for administrative reasons. In open formations (and heavily fragmented forests) it can be important in effectively defining forests. However, the effect of this parameter is somewhat similar to that of the minimum crown cover value, and the two should be considered in conjunction.

87. Minimum crown cover is the criterion most directly linked to forest quality (naturalness/degradation); thus it is also the most debated one.[54] A low threshold value leads to the acceptance as forest of some sparsely wooded areas of low productivity, as well as severely degraded stages of more productive formations. While this can raise environmental concerns, a higher threshold may create similar problems by failing to capture the disappearance of forests already under the threshold.

88. No strong arguments have been identified either in favour of or against defining forest on a biome-specific basis. Left unchanged long enough, any reasonable definitional scenario will detect major trends in transitions between forest and non-forest areas. As long as the system is based, in any one place, on a set of threshold criteria, its sensitivity (its ability to detect small changes) can be increased not so much by changing the definition, but by reducing the size of the spatial assessment units.[55]

[54] Stephen Kelleher and others, WWF, personal communication.
[55] Eveline Trines, personal communication.

V. IMPLICATIONS OF CHANGING FROM THE CURRENT FOREST DEFINITION TO A BIOME-SPECIFIC ONE

89. It would be premature to speculate as to the potential aggregate effect of switching from one definition to a set of new, biome-based definitions, as the nature of the possible new definitions is not yet known. It is, however, possible to summarize the types of problems and scenarios that may result from a changeover from one definition to another, and the steps necessary in order to reduce negative impacts.

A. Reporting national data under new definitions

90. First and foremost, a changed definition will require the modification of existing methods for the estimation of forest land. Between the first and second commitment periods, the way the forest area is estimated will have to be changed. For example, in country A the national forest definition specifies a 20 per cent minimum crown cover, which is what this country chose to use for the first commitment period under the Kyoto Protocol. If the new forest definition specifies a 40 per cent minimum crown cover, then the national inventory figures will have to be adjusted (downwards, if other factors remain unchanged). Should the country include more than one biome with different forest definitions, the adjustment will be more complicated since the national inventory will have to be divided along the biome boundaries (which may not coincide with any national system), and then the adjustments will have to be made to the various biomes.

91. Most countries (probably all) use a single forest definition for administrative purposes, and their instruments (maps, inventories, models, regulations) have been designed to work with that definition. Generating data that match a different definition is likely to cause at least some difficulty for all countries, and these problems may be grave for some. Certain adjustments may be relatively easy to make. In countries with detailed inventories it might be possible to use a different definitional scenario by simply running a different query on the national database.

92. Most countries already have some experience in reporting detailed data on the basis of definitions other than the national one. FAO (and, for developed countries, UN-ECE) has for decades been collecting forest-related information from all countries. As the current definition under the Kyoto Protocol is very similar to that used by FAO (FAO, 2000), countries might be able to make the necessary adjustments with reasonable effort. It should, however, be noted that FAO and UN-ECE have been reporting significant problems with data quality and reliability. This might be, in part, due to the poor national data of some countries. Nevertheless, much of the error can be attributed to adjustments from one definition to another.

93. Assuming that the second commitment period will immediately follow the first, for the end of the first commitment period, the forest area will have to be estimated by both the old and the new methods. It will be shown below that for some areas it might be necessary to continue the use of both the old and the new definitions for an indefinite period of time.

B. Accounting problems

94. A change in forest definition is likely to result in a reclassification of at least some land from forest to non-forest class, and/or from non-forest to forest. It means that the overall forest area is likely to change without the involvement of any ARD activity. The land categories so created are demonstrated by means of a simple example involving changing two parameters (figure 3). This change in forest land will have to be separated from any due to ARD activities, which raises several questions regarding reporting and reviewing procedures.

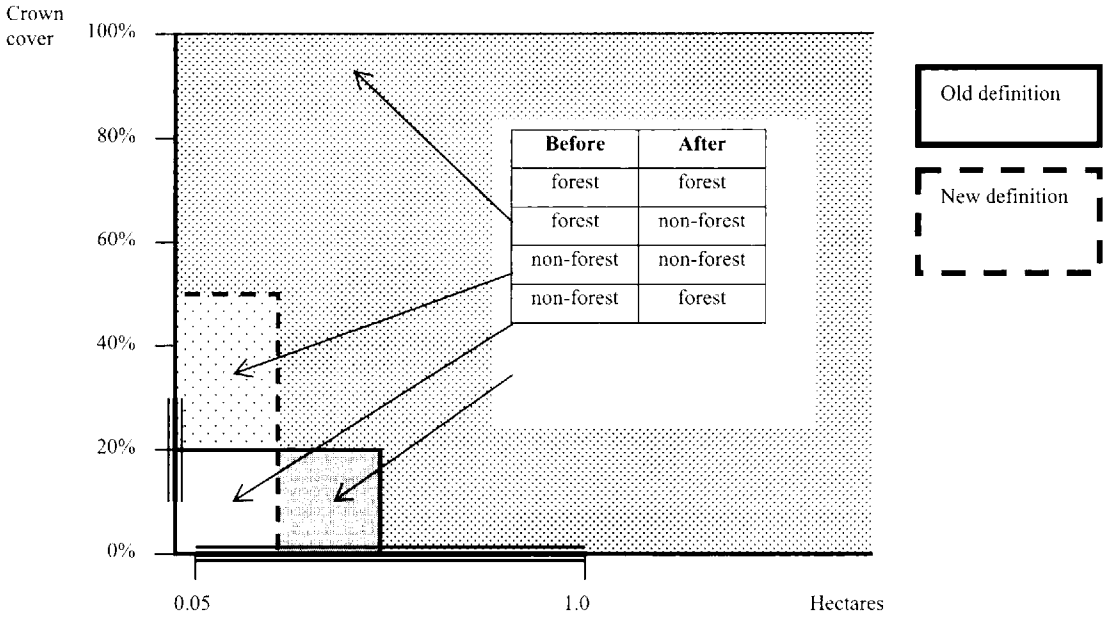

Figure 3. An example of land categories created by a change in forest definition. The minimum crown cover was raised from 20 per cent to 50 per cent, while the minimum area was reduced from 0.5 hectare to 0.25 hectare.

95. The following sections discuss a number of simple but plausible situations which may result from changing definitions. They assume a change in one of the three definitional parameters (crown cover was selected). The change leads either to a more restrictive definition (by raising the minimum canopy cover), or to a more liberal one (by lowering the threshold).

9. Partitioning forest loss

96. The simplest scenario, with no actual change in woody vegetation, only a single definitional change, is demonstrated in figure 4. The area covered with 40 per cent woody vegetation will be "lost" from the national inventory. Situations like this might be relatively easy to handle, as the actual amount of woody vegetation is unchanged, and the statistical difference can be entirely attributed to the change in definition (there should be no debit for deforestation). However, the picture is more complicated when the definitional change coincides with an actual change in woody vegetation.

97. Figure 5 demonstrates a scenario where definitional change is implemented during a steady degradation of the vegetation. While neither deforestation, nor the change in definition, in or by themselves, would be enough to trigger "deforestation", the combined effect is a loss of area qualifying as forest. This is likely to be a rather common scenario, should the minimum canopy closure requirement be raised for closed forests which are under strong deforestation pressure.

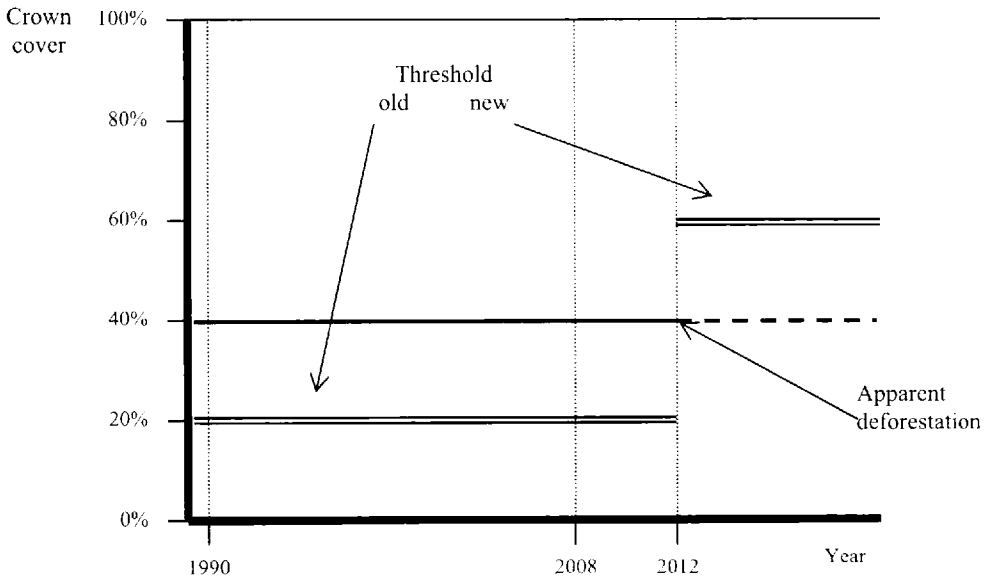

Figure 4. Change in forest definition (from 20 per cent to 60 per cent minimum crown cover). Amount of woody vegetation unchanged at 40 per cent, which qualifies as "forest" in the first commitment period, but not afterwards.

98. This raises the problem of how to partition the apparent loss of forest. Although it is the definitional change that ultimately triggers the reclassification of the area, this would not happen without the occurrence of continuous degradation for some years before 2012. The problem is compounded by the fact that not all forests can be inventoried at the moment of definitional change, which means that the actual forest cover on 31 December 2012 can be determined only by modelling techniques which are likely to incorporate some subjective elements.

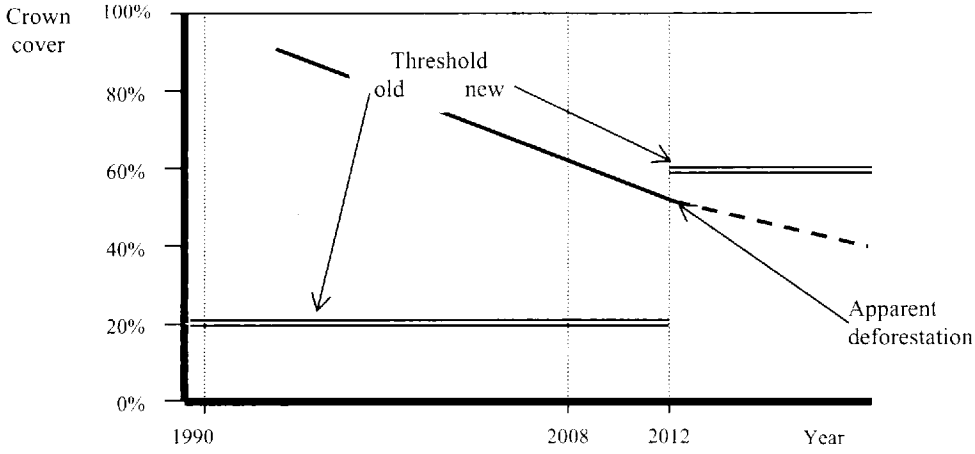

Figure 5. Change in forest definition (from 20 per cent to 60 per cent minimum crown cover). Amount of woody vegetation in steady decline. Apparent forest loss needs to be partitioned between causes.

10. Afforestation issues

99. A hypothetical afforestation project (which could be the restoration of an open forest type, or the establishment of an agroforestry system) aims at achieving 50 per cent forest cover in 10 years (figure 6). Initiated in 2000, with a minimum crown cover requirement of 20 per cent at maturity, the project qualifies as afforestation. However, if it is initiated in 2010, its status is questionable. Although at the time of planting the same definition applies as before, the threshold changes before the trees reach the minimum height. The main question here is when the new definition becomes effective in the case of immature, developing stands. While this is unlikely to create problems with carbon accounting (as the land would be registered as "ARD land", regardless the status of the area), it can lead to odd situations where an afforestation project, although successfully implemented, never actually results in forest.

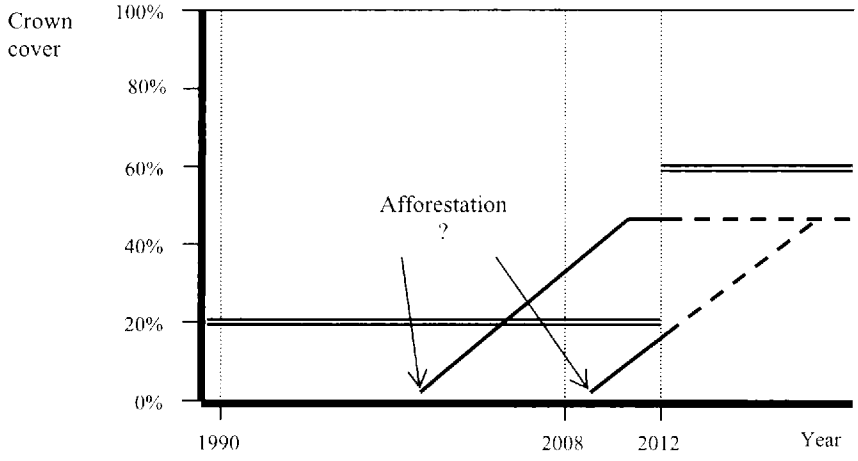

Figure 6. Change in forest definition (from 20 per cent to 60 per cent minimum crown cover). Afforestation is carried out, aiming at the development of an agroforestry project with 50 per cent crown cover in 10 years.

C. Potential loopholes, perverse incentives

100. A change in definition can open up a number of loopholes for those who might try to abuse the system. Similarly, it can create opportunities for avoiding debits or claiming extra credits by simply bringing forward or postponing some activities, perhaps only on paper.

101. In figure 7, a well-stocked natural forest is to be converted to other land use in 2013. This would be considered deforestation under any definition. However, deforestation debits could be avoided (at least theoretically), by bringing forward the beginning of the operation by a few months, reducing the crown cover to around 30 per cent before the end of the first commitment period. The area would then be reclassified as non-forest (due to the change in definition, no debits). The remaining trees could then be harvested from the area without its qualifying for deforestation.

102. In a similar case, the new forest definition is assumed to be more liberal than the old one (figure 8). A degraded forest, with about 20 per cent canopy cover remaining, is about to be reclassified as forest, due to a change in definition (changing the threshold from 30 per cent to 10 per cent). Seeing that unavoidable further degradation will result in deforestation, the land manager allows the clearing of the remaining vegetation before this counts as deforestation.

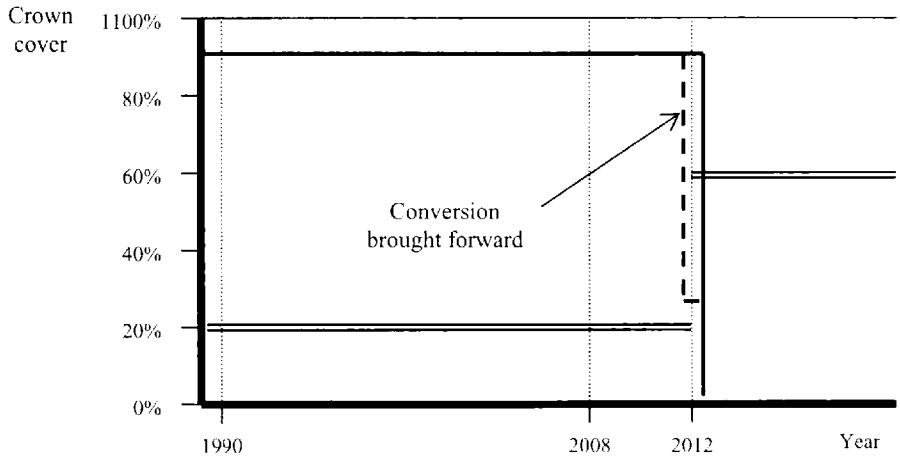

Figure 7. Forest conversion brought forward to avoid deforestation debits.

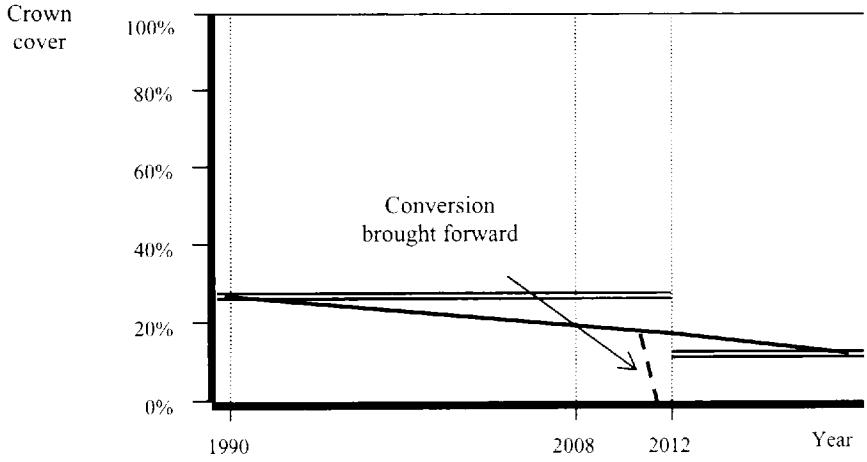

Figure 8. Forest conversion brought forward to avoid deforestation debits.

D. Conclusions

103. Changing the applicable forest definition from one commitment period to the next is likely to create considerable difficulties for Parties in their reporting. It can introduce a new source of error into the conversions, making it even more difficult to calculate changes in carbon stocks over time reliably. This factor alone can raise questions about the wisdom of changing definitions.

104. In addition, different definitions will result in areas changing status (from forest to non-forest or vice versa) solely or partly due to the definition change. Modalities will have to be developed to allocate the change in forest area to various causes.

105. Predictable changes in how forests are defined can open up loopholes or provide incentives to circumvent the system. Most of the above scenarios describe cases which can be prevented by proper formulation of the changeover. However, the range of possibilities is endless. It should also be pointed out that the bigger the difference between the current and the future definitions, the more opportunities and incentives there are going to be to circumvent the system. Such opportunities may be limited if the new system is only slightly different from the current one. In that case, however, it is questionable whether changing the system is justified.

VI. CONCLUDING REMARKS

106. There is no clear guidance regarding the possible interpretation of "biome" in the given context. Parties could choose to develop a new "biome" classification system for the purposes of the Kyoto Protocol. However, the development of an entirely new system would require considerable time and resources.

107. Alternatively, Parties could adopt one or more of the many global, regional and national ecological zoning systems that already exist. All of these have certain weaknesses, and their application may cause considerable methodological and political difficulties; so they need to be adapted.

108. There is a trade-off between the level of detail (ecological representation) and cost (time and resources needed for development). A coarse system (such as one that defines only five biomes based on macroclimatic parameters) may be easy to define and apply, but it will be unable to reflect local variations in vegetation, productivity and other parameters, and thus it is likely to have significant inconsistencies within and between biomes. A refined system, operating with hundreds of ecological zones, is likely to reflect ecological variability better, but it is likely to be difficult to design, negotiate and implement. Any system developed on a global scale will have significant inconsistencies at the local (forest stand) level.

109. Of the existing classification systems, it is the GEZ system, developed by FAO for the FRA 2000 report, which appears to be the most appropriate for adoption, as it was developed for forestry purposes, it builds on the most widely accepted precedents, it is well harmonized between countries and regions, it is of relatively high resolution and it is available in digital format. It is also likely to be the most acceptable politically.

110. Forests have been defined in hundreds of different ways. International precedents and the submissions of proponents of "biome-specific forest definitions" suggest that such definitions would continue to rely on a combination of the same basic parameters as the current definition, namely: minimum area, minimum tree height at maturity, and minimum canopy cover (or another appropriate measure of density).

111. The values of the above parameters can influence the amount of land that is classified as forest. The effect of these parameters on the amount of land classified as forest seems to be greatest towards the margins of the natural distribution of forests, and in areas highly impacted (disturbed/fragmented) by human beings.

112. Similarly, a change in forest definition can affect the amount of land detected as afforested/reforested or deforested. However, the net effect of the definitional change on the amount of land under ARD activity cannot be generalized, as it depends on numerous factors.

113. In general, each country uses one single forest definition for inventory and administrative purposes. The introduction of biome-specific forest definitions, unless the "biome" boundaries follow country borders, will require at least some countries to use multiple forest definitions for their reporting, which may cause considerable methodological problems and inconsistencies.

114. There have been no strong arguments identified either in favour of or against defining forest on a biome-specific basis. Left unchanged for long enough, any reasonable definitional scenario will detect major trends in transitions between forest and non-forest areas. As long as the system is based on a set of threshold criteria, its sensitivity (its ability to detect small changes) can be increased not so much by changing the definition, but by reducing the size of the spatial assessment units.

115. A change in the forest definition is likely to cause difficulties with carbon accounting, as at least some of the land will have to be reclassified (from forest to non-forest or vice-versa). Separating real change in the amount of forest from apparent change due to a different definition may be difficult not only in practice, but even theoretically. This may complicate inventories, can make reviews more difficult and is likely to create loopholes and negative incentives which have to be carefully considered before a decision on a change in definition is made.

116. It should be mentioned that some of the above problems may emerge without the introduction of biome-specific forest definitions. The forest definition negotiated for the first commitment period allows countries to set their own minimum values, within the range specified, for the three threshold parameters. While this selection cannot be changed for the first commitment period, the decision leaves open the possibility for countries to choose another set of minimum values for the second commitment period. Parties may want to decide to remove this possibility, in order to improve the integrity of the system.

117. Finally, it should be emphasized that this paper has focused on the (change in the) definition of forest, that is, the implications of how forest land is differentiated from non-forest land. It assumes that all land classified as "forest" will be treated similarly, and does not consider the possibility of using different carbon accounting methods in the forests of different biomes. There could be strong arguments for requiring different inventory/carbon accounting methodologies for different forest types. For example, it could be argued that for those vegetation types where much of the terrestrial carbon is contained in the soil (most boreal forest types, for example), carbon accounting should always include the carbon pool of the soil. However, such considerations (which could be described as biome-specific carbon accounting) would go far beyond the limitations of this study, and would require a fundamentally different approach.

Annex I

Review of existing global ecological zoning systems

118. This annex is based on the review prepared for the FAO Forest Resources Assessment 2000 Report (FAO 1999). It lists, and gives some relevant particulars about, the most important global climate, ecological zone or potential vegetation maps that were available before the GEZ System of the FRA was developed.

119. The global maps described below primarily define climatic ecological zones. Two of them particularly emphasize differences in biogeography or species origins: the Udvardy (IUCN-UNESCO MAB) map and the WWF-US maps. Some regional maps also emphasize the biogeographical/ phylogenetic aspect. Regional maps which show vegetation types but do not emphasize ecological zones are not included in these descriptions but are listed at the end of this annex.

Map of Köppen and Trewartha's climate classification (Köppen, 1931, Trewartha, 1968)

120. A digital map usable at a scale of 1:30,000,000 is available though FAO. No details are available on the origin of this map, which shows five major Köppen climatic types: Polar, Cold, Temperate (humid), Tropical (humid), Dry. A number of subclasses are distinguished, which brings the total number of categories mapped to 14. Because many of the ecological zone maps described below use some major climatic criteria to distinguish their classes, it is deemed worth the effort to list Köppen's climatic classes for the globe; these are: E (polar climates with extremely cold winters and summers) subdivided into ET: tundra, EF: frozen; D (moist mid-latitude climates with cold winters) subdivided into DF: wet all seasons, DW: dry winters; C (moist mid-latitude climates with mild winters) subdivided into CF: continually moist subtropical, CW: winter dry sub-tropical, CS: summer dry subtropical (Mediterranean); B (dry climates with deficient precipitation during most of the year) subdivided into BS: semi arid, BW: desert; A (tropical moist climates) subdivided into AF: continually wet tropical, AM: tropical monsoon, AW: seasonally dry tropical. These classes are fairly coarse and do not always correspond directly with other Köppen classes used in the literature.

Map of Holdridge's life zone system (Holdridge, 1967)

121. Holdridge's work was aimed at correlating world plant formations by means of simple climatic data. The system embraces all major environmental factors in three hierarchical tiers.

122. Level I – The life zone. This is determined by specific quantitative ranges of long-term average annual precipitation, mean annual biotemperature and potential evapotranspiration ratio. These are modified for montane systems.

123. Level II - The association. This is an area of land which, under undisturbed conditions, supports a distinctive natural community adapted through evolution to a specific narrow range of atmospheric and edaphic conditions. No Association can occur in more than one Life Zone.

124. Level III – The successional stage or cover type, which takes into account that the community may not be in its climatic state, either through natural causes or through human intervention.

A map of the Level I life zones of the globe is available in digital form, usable at a scale of 1:30,000,000. It is, however, raster-based and quite coarse. It was prepared by Rik Leemans, who

was then working in the Biosphere Project in IIASA, Laxenburg, Austria. The mapped classification does not differentiate montane communities as such but uses the major cooler climatic types to denote the montane progressions. This map was used for the non-tropical areas of the world in an exercise by the World Conservation Monitoring Centre (WCMC) and the Center for International Forest Research (CIFOR) to investigate global forest protection by forest type and ecological zone (Iremonger *et al.*, 1997).

125. There are many national maps available for Life Zones, particularly in the Americas.

Map of Walter's zonobiomes (Walter and Box, 1976, Walter, 1979)

126. This is a map setting out an ecological classification of the world's climates. It is based on the climate-diagram pattern of Walter, in which temperature and rainfall are correlated to show periods of aridity and humidity, in relation to plant growth. Also taken into account are numbers of frost days and other extremes which influence vegetation patterns. There are nine different major zonobiomes, which have modifiers added if they are particularly dry, cold or wet. The map is only available in hard copy, at a scale of 1:30,000,000. The continents are shown as distinct entities on the map, and not joined into one complete global picture.

127. Walter's work on the zonobiomes goes beyond what is mapped, describing the different major variants within the zonobiomes, named pedobiomes and orobiomes (edaphic or altitudinal factors).

Ecotones between the major zonobiomes are also described.

Bailey's ecoregions map of the world (Bailey, 1989, 1998)

128. The purpose of this work, which began in 1976, was to show how the national forests of the United States fit within the global ecoregional scheme. In this system an ecoregion is defined as any large portion of the Earth's surface over which the ecosystems have characteristics in common. There are three levels in this classification system, the Domains, the Divisions and the Provinces.

Ecoregions of the continents are based on macroclimate (that is, the climate lying just beyond the local modifying irregularities of landform and vegetation). The theory behind the approach is that macroclimates are among the most significant factors affecting the distribution of life on Earth. As the macroclimate changes, the other components of the ecosystem change in response. Macroclimates influence soil formation and help to shape surface topography, as well as affecting suitability for human habitation.

Four Domains were defined: Polar, Humid temperate, Humid tropical and Dry. The combination of temperature and rainfall to indicate major climatic zones was based on Köppen and Trewartha's work, where dry climates were treated as a separate entity from tropical humid and temperate humid. However, the Köppen system defines an additional "Subtropical" division at this level.

The next level in the Bailey system is the Divisions, and these are also climate-based: for example, in the Humid temperate Domain there is Hot continental, Warm continental, Subtropical, Marine, Prairie and Mediterranean, all with Mountain variants (that is, a total of 12 Divisions in this Domain). There are a total of 30 of these.

The third and last level is the Provinces, which are based on physiognomy of vegetation, modified by climate. For example, the Forest-Meadow of Eastern Oceanic (Monsoon climate). There are a total of 98 of these subdivisions.

The global map has been digitized and converted to a geographic (lat./long.) projection by the WCMC, Cambridge, UK. It is also available on CD from NOAAs National Geophysical Data Center in Boulder, Colorado as part of their Global Ecosystem Database Project (http://www.ngdc.noaa.gov/Storc/).

Bailey has also drawn a more detailed map of the ecoregions of North America. This uses the same system as the global map and defines 63 Provinces. All maps are available in paper form from the author. Robert G. Bailey, USDA Forest Service, 3825 E. Mulberry St., Fort Collins, CO 80524, USA (e-mail: rbailey/wo_ftcol@fs.fed.us).

Milanova and Kushlin's map of present day landscapes (Milanova and Kushlin, 1993)

This was prepared using existing maps also produced by Moscow State University, "Geographical belts and zonal types of landscapes of the world" and "Land use types of the world", as well as remote sensing imagery and sample field observations. The world is first divided into temperature-defined zonal belts and one intrazonal belt, thus: Polar, Subpolar, Temperate, Subtropical, Tropical, Subequatorial, Equatorial and Intrazonal (8 divisions).

Within these are the Landscapes, which are primarily based on the natural land cover and its associated soil type. There are 39 of these, which are the most useful units on this map for the FRA ecological zoning exercise. Each polygon representing one of these types is then given a letter indicating degree of alteration - whether it is virtually undisturbed ("Modal Landscape"), with moderate interference (such as secondary vegetation), with strong interference (crop cultivation) or with extreme change (such as towns).

The map is available digitally and in hard copy from Moscow State University. Copies are also held in the WCMC, Cambridge.

Olson and Watts' map of major ecosystem complexes (Olson and Watts, 1982, Olson *et al,* 1982)

The purpose of this map was to attempt to quantify carbon in live vegetation. The primary division in the mapped classes includes a mixture of criteria: plant formations, edaphic factors (a wetland class is distinguished) and areas altered by human activity. This map is not considered to be one of the principal sources of information contributing to the ecological zoning system of the FRA, because it maps actual land cover rather than potential.

It was originally printed at a scale of 1:30,000,000, and is available digitally from WCMC, Cambridge.

Udvardy's map of the biogeographical provinces of the world (Udvardy, 1975)

This map was prepared by IUCN as a contribution to the UNESCO MAB programme. The main purpose of the work was to devise a satisfactory classification of the world's biotic areas for purposes of conservation. It is the fourth attempt in a series of revisions, updating the previous three works written by Dasmann.

The logic behind the system was that the plant and animal world occurs within the biosphere of the Earth in the form of an intertwined network of individuals, populations and interacting systems. To be able to view them in a systematic way, the biologist may use the following approaches:

1. Taxonomic order
2. Ecological order

3. Phylogenetic order (origins and history)
4. Biogeographic order - grouping the above entities on a geographic basis.

To define geographic units for conservation purposes, the following were considered: (a) the distribution of species and (b) the distribution of ecosystem units. The result was a system serving both aims, a hierarchical system of geographical areas which would give a framework for conserving species as well as ecologic areas. These hierarchical biogeographical entities were named Realms, Biomes and Provinces.

The first subdivision, the Realm, used the phylogenetic subdivisions of the world, unifying those for flora and fauna. It is a continent or subcontinent-sized area with unifying features of geography and flora/fauna/vegetation. Eight Realms were distinguished. The second division is the Biome. These were not the same as the major vegetation formations of the world (see UNESCO, 1973), but combine the features of a major vegetation type with climate. There are 14 of these. These were largely based on the work of Dasmann. The third, most detailed, subdivision was the Province, delimited on a faunal, floral and ecological basis. There are 186 of these.

The map is available digitally from WCMC, Cambridge. It is usable at a scale of 1:30,000,000.

The WWF-US terrestrial ecoregions of the world (Dinerstein *et al,*. 1995, Olson *et al,*. 2001)

The purpose of this study was primarily to make a tool for the identification of geographic priorities for biodiversity conservation. The result is a system of regional-scale biogeographic units called ecoregions. These are described as relatively large units of land or water containing a geographically distinct assemblage of natural communities sharing a large majority of their species, dynamics and environmental conditions.

The global coverage was drawn up on a continental basis, and not all parts of the world are currently available. The rationale behind this was that the major split in the global map would be by biogeographic realm. However, the splits were made on political bases, not phylogenetic. Despite this the authors found the division practical for the conservation analyses for which the maps were intended.

The methodology for making the maps included collaboration with regional experts as well as the use of a great number of previously published national and regional maps, including some from Holdridge and McKinnon's Indomalayan Realm study. Udvardy's map was apparently not used.

The primary subdivision within each geographical region (continent) was into six mainly formation-based categories called Major Ecosystem Types, which were then subdivided into 14 Major Habitat Types, which are comparable to the concept of Biome, as used by Udvardy. These were further classified according to Bioregions. There were 867 units of the final class, Ecoregion, identified.

For copies of these maps, in paper or in digital form, please contact WWF-US Conservation Science Program, World Wildlife Fund, 1250 24th Street, NW, Washington DC, 20037-1175, USA.

Maps of the natural vegetation of different regions/continents of the globe

In addition to the above global classification systems, there are a number of regional systems available. Below are a few of the more important regional maps.

BOHN, U. and G.D. KATENINA (1994). *Map of Natural Vegetation.* Komarov Botanical Institute, St Petersburg. Scale 1:2,500,000. This has recently been used as a base map for the delineation of European ecoregions in the WWF-US system of ecoregion classification.

CARNAHAN, J.A. (1989). *Australia - Natural Vegetation*. Australian Surveying and Land Information Group, Department of Administrative Services. 1:5,000,000 scale.

HUECK, K. (1972). *Mapa de la vegetación de America del Sur.* Gustav Fischler Verlag, Stuttgart. 1:8,000,000 scale.

UNESCO (1980). *Vegetation map of South America*. UNESCO, Paris.

WHITE, F. (1983). *The vegetation of Africa*. UNESCO, Paris.

Annex II

The FAO global ecological zoning framework

Level 1 Domain	Level 2 Global ecological zone		
Name	**Name**[56]	**Code**	**Criteria**[57]
Tropical All months without frost, in marine areas over 18°C	rain forest	TAr	wet: 0-3 months dry[58]
	moist deciduous forest	TAwa	wet/dry: 3-5 months dry
	dry forest	TAwb	dry/wet: 5-8 months dry
	shrubland	TBSh	semi-arid: evaporation > precipitation
	desert	TBWh	arid: all months dry
	mountain systems	TM	approximately: > 1000m altitude (sizeable local variations)
Subtropical >7 months over 10°C	humid forest	SCf	humid: no dry season
	dry forest	SCs	seasonally dry: winter rains, dry summer
	steppe	SBSh	semi-arid: evaporation > precipitation
	desert	SBWh	arid: all months dry
	mountain systems	SM	approximately: > 800-1000m altitude (sizeable local variations)
Temperate 4-8 months over 10°C	oceanic forest	TeDo	oceanic climate: coldest month > 0°C
	continental forest	TeDc	continental climate: coldest month < 0°C
	steppe	TeBSk	semi-arid: evaporation > precipitation
	desert	TeBWk	arid: all months dry
	mountain systems	TM	approximately: > 800m altitude (sizeable local variations)
Boreal <4 months over 10°C	coniferous forest	Ba	vegetation physiognomy: coniferous dense forest dominant
	tundra woodland	Bb	vegetation physiognomy: open woodland and sparse forest dominant
	mountain systems	BM	approximately: > 600m altitude (sizeable local variations)
Polar	polar	P	same as domain level: all months < 10°C

[56] Reflecting dominant zonal vegetation, resulting from macroclimatic gradients.

[57] Approximate equivalent of Köppen-Trewartha hectare climatic types, in combination with vegetation physiog nomy and one orographic zone within each domain.

[58] A dry month is defined as the month in which the total precipitation expressed in millimeters is equal to or les s than twice the mean temperature in degrees centigrade.

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BOHN, U. *and others* (2000). *Map of the natural vegetation of Europe.* (ed.) Bundesamt für Naturschutz Bonn-Bad Godesberg, Germany.

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Volume 2: Greenhouse Gas Inventory Workbook. 346 pp.
Volume 3: Greenhouse Gas Inventory Reference Manual. 482 pp.

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III. National Reporting to Forest-related International Instruments: Mandates, Mechanisms, Overlaps and Potential Synergies

by Susan Braatz

Abstract

Ten international conventions and agreements (or instruments) are identified as being most relevant to forests. National reporting requirements to these instruments, including report periodicity and content, both in general and in regard to forests in particular, are reviewed. In most cases, reporting on measures taken to implement commitments under the instrument consists of qualitative information on activities and means of implementation, such as policy, legislative or institutional measures. In a few cases, however, quantitative biophysical and socio-economic data on forest resources or resource use is required. Most instruments have provisions for information collection, analysis and exchange and for monitoring and assessment. In recognition of the need for quantitative data to assess impact of the measures taken, many of the instruments are working to develop impact indicators. Several of the instruments with a strong sustainable development dimension, are using or considering use of criteria and indicators developed under regional or international processes for sustainable forest management. These indicators represent a potential pivot point around which efforts for harmonization of information and data needs on forests can be focused. Efforts that are under way on harmonization of reporting on sustainable development, biological diversity, and forests are reviewed.

International conventions and agreements related to forests

In the absence of a global forest convention, the United Nations Forum on Forests (UNFF) serves as the main forum for international policy deliberations on forests. The work of the UNFF has been defined by the agreements made on forests at the United Nations Conference on Environment and Development (UNCED)[59] and by the proposals for action agreed upon by the Intergovernmental Panel on Forests (IPF) and Intergovernmental Forum on Forests (IFF) between 1995 and 2000. The UNFF is part of a broader process of UNCED follow-up, supported by the Commission on Sustainable Development (CSD). The CSD is a functional commission of the United Nations set up in 1993 to review progress, elaborate policy guidance, promote dialogue and build partnerships to facilitate the implementation of commitments made at UNCED.

In addition to the UNFF, which is a "soft-law" instrument, there are a number of legally binding international instruments that include articles and decisions that address forests or forest resources. They are as follows:

- ☐ Convention on the Conservation of Migratory Species of Wild Animals (CMS)
- ☐ Convention on Biological Diversity (CBD)
- ☐ Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
- ☐ Convention on Wetlands of International Importance, Especially as Waterfowl Habitat (Ramsar Convention)
- ☐ International Tropical Timber Agreement (ITTA)

[59] including Chapter 11 ("Combating deforestation") of Agenda 21 and the "Forest Principles"

- ☐ Convention Concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention - WHC)
- ☐ United Nations Convention to Combat Desertification (UNCCD)
- ☐ United Nations Framework Convention on Climate Change (UNFCCC)

The table in Annex 1 provides information on the nine instruments and the CSD, including the year of entry into force/establishment, number of Parties/members, and objectives and relevance to forests of each instrument.

Some distinguishing characteristics of the nine conventions are as follows:

- UNFF and ITTA are the only instruments focused specifically on forests and forest resources. The other instruments address forests in the context of environmental conservation (i.e., conservation of biological diversity, mitigation of climate change and combating desertification).

- CITES, CMS, Ramsar and WHC are concerned primarily with the conservation of biological diversity. CITES and CMS focus on conservation at the species level. Ramsar and WHC address the ecosystem level through the conservation of sites of international importance. The conservation of biological diversity is a major objective of the CBD, but the Convention's other objectives (sustainable use and equitable sharing of the benefits of biological diversity) give CBD a strong sustainable development dimension.

- UNFF, CBD, UNCCD, ITTA, and, to a somewhat lesser extent, UNFCCC, have a sustainable development emphasis. The wider scope of these five instruments gives them greater relevance to overall forest policy than the other four instruments.

National reporting to key forest-related international instruments and to the CSD

Parties or members are committed to report on measures that they have taken to implement their commitments under the instrument and, in some cases, information and data related to progress in achieving them. The instruments' texts provide the mandate for reporting by Parties/members to the decision-making body of the instrument. Annex 2 provides the reference article mandating reporting under the nine instruments and the CSD, as well information on the periodicity of reporting, reporting guidelines, and more detailed information on the content of national reports. The forest-related content of national reports under the various instruments is summarized below.

CITES, CMS, Ramsar and WHC

National reports to CITES and CMS contain information related to the status of, and conservation efforts targeted at, species on their respective Appendices, which list species that are endangered, threatened or have an unfavourable conservation status. National reports to CITES consist of statistical information on trade in those species on the CITES Appendices. The CITES secretariat maintains the Appendices lists and quantitative time-series databases of species trade statistics. CITES Appendices include 15 timber or woody species, some of which are commercially important. National reports to CMS provide information, mostly qualitative, on steps taken to protect species on CMS' Appendices, raise awareness of the role of CMS, provide financing, and implement resolutions of the Conference of the Parties (COP). Forests are relevant in that they are habitat to some of the species listed on the CMS Appendices. At its sixth session, the COP in 1999 approved

the launching of an Information Management Plan. This includes the development of a database on listed species (COP 6 Resolution 6.5).

Ramsar and WHC focus on the conservation and management of specific protected areas. Ramsar is concerned with internationally important wetlands, a third of which are forested wetlands (1999 figure). The List of Wetlands on International Importance ("Ramsar sites") is a database of site information, mainly in narrative form. WHC focuses on sites of cultural and natural significance, including many forest sites. The WHC maintains the World Heritage List, compiled from member States inventories. When a country becomes a member State of WHC, it is obliged to submit an inventory of property (location and significance) situated on its territory and suitable for inclusion on the list. National reports to Ramsar provide information on measures taken to promote membership, implement the Ramsar Wise Use Guidelines, increase institutional capacity, promote international cooperation and mobilize financial assistance. Parties to the WHC must report on steps taken related to identify national heritage properties, legislative and administrative provisions and other actions taken for the application of the WHC, and the state of conservation of the World Heritage properties located on its territories.

CSD

National reporting to the CSD on implementation of the chapters of Agenda 21 provides a comprehensive picture of progress made in sustainable development since UNCED a decade ago. This provides a wider context for the four forest-related instruments that arose from UNCED: UNFF, CBD, UNCCD and UNFCCC. Countries are asked to provide national reports each year on specific topic areas. They submitted national reports on forests in 2000. Country Profiles, providing an overall picture of progress in sustainable development across all chapters of Agenda 21, are compiled from the national report. The first Country Profile was prepared in 1997. It was updated in 2002 for the purposes of the World Summit on Sustainable Development (the WSSD or Rio +10), to be held in Johannesburg, South Africa in August/September 2002.

CBD

National reports to the CBD provide information on the implementation of commitments under the Convention, as defined in its Articles. The first national report (1997) focused on Article 6 -- conservation and sustainable use of biological diversity. The second National Report (submitted in 2001 for discussion at COP 6 in April 2002) consists of a series of questions based on the Articles of the Convention and related decisions of the COPs addressed to Parties of the CBD. While several of the articles have some relation to forest biological diversity, those with the most direct relevance to sustainable forest management are: Article 8 (*in-situ* conservation); Article 8j (traditional knowledge), Article 9 (*ex-situ* conservation); and Article 10 (sustainable use of biological diversity).

In addition to the national reports, Parties were invited to submit a thematic report on forest ecosystems for consideration at COP 6. The thematic report provides information on the implementation of the three programme elements of the work programme on forest biological diversity, specifically: 1) the application of the ecosystem approach, 2) analysis of human influence on forest biological diversity and assessment of means to minimize negative influences, and 3) elaboration of the implementation of criteria and indicators for forest biological diversity. An expanded programme of work on forest biological diversity was approved at COP 6, and Parties have been invited to report through a voluntary thematic report to COP 7 in 2004 on their implementation of this programme (Decision VI/22).

UNCCD

Each Party to the Convention is required to communicate to the COP the measures undertaken to implement the UNCCD. The content of the reports differ slightly depending on into which category(ies) a Party falls:

- Parties affected by desertification and drought, report on their strategies to combat desertification and provide relevant information on implementation of the strategies. Affected parties that have action programmes (National Action Programmes, or NAPs) also describe the programmes and their implementation. Groups of affected country Parties may make a joint communication on measures taken at the subregional and/or regional levels to implement the Convention.
- Developed country Parties report on measures taken to support the preparation and implementation of action programmes at all levels, including information on financial resources.
- Parties that are both affected and developed observe both obligations: to present a national report and a report as a developed country Party.

Information provided in these reports have relevance to sustainable forest management, in particular on measures taken in the NAP to improve natural resource conservation, monitoring and assessment of effects of drought and participatory processes used in NAP.

UNFCCC

Each Party to the UNFCCC is to submit initially and at certain intervals thereafter a National Communication, including:

a) A national inventory of anthropogenic emissions of greenhouse gases (GHGs) by sources and removal by sinks (to the extent that capacities permit), and
b) A general description of steps taken/envisaged by the Parties to implement UNFCCC.

In addition, each developed country Party and each other Party included in Annex I of the Convention should report on:

a) Policies and measures it has adopted to limit its anthropogenic emissions of GHGs and protect and enhance its GHG sinks and reservoirs.
b) A specific estimate of the effects that the policies and measures referred to above will have on anthropogenic emissions, with the aim of returning individually or jointly to their 1990 levels.

Each developed country Party in Annex I and developed country Party included in Annex II, report on measures taken related to technology transfer and provision of financial resources.

Since 1996, all countries listed in Annex I of the Convention must also provide an annual national inventory of GHG sources and sinks.

The methodology for the calculations for the inventory figures is provided by the Guidelines for National Greenhouse Gas Inventories of the Intergovernmental Panel on Climate Change (IPCC). In

order to carry out the national inventory, very specific data on forests and forest resources are required, mainly for the calculations of GHGs in the land-use change and forestry section but also for some in the energy section. Data are needed on forest area and biomass stocks, changes in area and biomass, non-forest trees, removal of wood by timber harvesting and for fuelwood consumption, conversion of forest to other uses, CO_2 emissions/removals from soils, as well as GHG emissions from combustion of woody biomass and from the pulp, paper and print industries.

UNFF

Modalities for national reporting to the UNFF do not yet exist, although the elements constituting the monitoring, assessment and reporting (MAR) function of UNFF have been identified. At the first session of UNFF in 2001 (see E/2001/42/Rev.1), it was agreed that the MAR function would consist of the following:

- Progress in implementation of the IPF/IFF proposals for action;
- Progress towards sustainable management of all types of forests; and
- Review of the effectiveness of the international arrangement on forests.

Furthermore, UNFF 1 invited countries, regions, organizations and processes to report to the UNFF, on a voluntary basis, on their progress in implementation of the IPF/IFF proposals for action. It also stressed the importance of the use of regional and national criteria and indicators for sustainable forest management (SFM) as a basis for reporting on SFM.

Many of the IPF/IPP proposals for action address monitoring, assessment and reporting and related activities, such as a common understanding of forest-related concepts, terminology and definitions; streamlining reporting; and resource assessment and information management.

An ad hoc expert group is expected to be established after the third session of UNFF (May/June 2003) and will develop proposals for UNFF's consideration on the MAR function of UNFF. In the meantime, the UNFF Secretariat will develop a reporting format for the purposes of national reports on implementation of proposals for action related to the agenda of UNFF 3.

ITTA

Parties to ITTA, 1994 are to provide statistics and information on timber, timber trade and activities aimed at achieving sustainable management of timber producing forests. Members are asked to submit data annually on their national production, trade, supply, stocks, consumption, and prices of tropical timber for the "Annual Review and Assessment of the World Tropical Timber Situation" of the International Tropical Timber Organization (ITTO).

Members are to supply other statistical data and specific indicators, as requested by the International Tropical Timber Council (ITTC), and to report on activities aimed at achieving sustainable forest management and on progress towards ITTO's Year 2000 Objective.[60] At its 24th session (May 1998), the ITTC strongly urged member countries to apply the (revised) ITTO Criteria and Indicators for reporting in relation to the Year 2000 Objective (Decision 3 XXIV). At its 30th session the ITTC encouraged Member countries (Decision 9 XXX) to submit their first National level report by the

[60] ITTO adopted the Year 2000 Objective in 1991 as the strategy by which all its member countries would progress towards achieving trade in tropical timber from sustainably managed forests by the year 2000.

end of 2001 using the ITTO reporting format (ITTO, 2001). ITTO will publish the "Status of Tropical Forest Management Report", largely based on the national reports provided.

The reporting format for the national level report is extremely detailed, calling for both qualitative and quantitative information on the ITTO indicators of the following criteria for sustainable forest management (SFM):

1. Enabling conditions for SFM (laws, policies, regulations, institutional capacity, investment, economic instruments, technology, information, participation)
2. Forest resource security (resource base – area, forest type, resource protection)
3. Forest ecosystem health and condition (area/degree of damage from human activities and by natural causes, protection procedures)
4. Flow of forest products (resource rights, harvesting levels; existence of management plans, management guidelines and long-term projections; etc.)
5. Biological diversity (protected areas, threatened/endangered species, genetic diversity, monitoring and evaluation,
6. Soil and water (area managed for and measures taken for soil/water protection
7. Economic, social and cultural aspects (contribution to GDP, quantity/value on non-wood forest products, efficiency of use of harvested products, employment, occupational safety, cultural aspects and social uses, participation, indigenous people)

Information and indicators in the forest-related instruments

As indicated above, national reporting on implementation of commitments under these nine forest-related instruments is diverse in approach, content and degree of detail. What is apparent is that the information requested is most often descriptive and is focused on measures taken related to policy, legislation, capacity building, financing, or other "means of implementation." Only a few instruments require Parties to provide, on a regular basis, quantitative information related to forests or forest resources. Those that do are CITES (on species trade), ITTA (on timber trade and indicators of sustainable forest management) and UNFCCC (on GHG emissions and removals from forests and forest resource use).

The information provided by national reports on measures taken to implement the instrument is essential for making an overall assessment of progress in the implementation of the instrument. Several of the instruments have identified implementation indicators for this purpose. This information, however, is not sufficient to assess the impact of the measures taken in achieving the goals of the instrument. For that kind of assessment, quantifiable data, such as on the status and trends in resources, are needed.

Most of the instruments have provisions for information and data collection, analysis and exchange (e.g. Article 4 of CBD, Article 16 of UNCCD, Article 4 of UNFCCC), for, among other purposes, monitoring and assessment. However, what data to be collected and how to fulfill international data needs is in most cases not defined.

In order to provide for global assessments of the state and change of the resource (forest, land affected by desertification, biological diversity) and to assess the impact of a convention or agreement, commonly agree impact indicators are needed. Several international instruments addressed here are now working to define indicators.

There is a risk that, as work continues under the various instruments to identify indicators for monitoring and assessing impact, that if different indicators are chosen countries' reporting requirements will be compounded and complicated, increasing the burden of complying with them. The important role that sustainable development indicators can play in helping countries make informed decisions and the need for harmonization of efforts to develop such indicators was internationally recognized at UNCED and embodied in Chapter 40 of Agenda 21. The United Nations has recently published a set of indicators of sustainable development that can help harmonize efforts to assess progress toward sustainable development goals (UN, 2001).

Many of the forest-related instruments discussed here are working on indicators. The work of the UNCCD and CBD is summarized below.

The UNCCD began working to develop benchmarks and indicators even before it entered into force. It has identified implementation indicators, but work is still underway to identify: a) the type of data needed to assess the status and trends of desertification and b) impact indicators to monitor biophysical, socio-economic and institutional impacts of the NAPs. To date, 14 primary impact indicators have been identified that are relevant in the African context. These were discussed by the Committee on Science and Technology in October 2001 (see report ICCD/COP(5)/CST/7). The CST recommended that these indicators be further defined and also considered by other regions, with a view to developing common sub-regional or regional indicators.

The CBD has been working for several years to develop a set of indicators that can be used to monitor and assess biological diversity. A core set of indicators was considered at the third meeting of the Subsidiary Body for Science, Technology and Technological Advice (SBSTTA) in 1997 (UNEP/CBD/SBSTTA/INF.13). A second set was developed and presented to SBSTTA 7 in November 2001 (UNEP/CBD/SBSTTA/7/12). COP 6 decided that an ad hoc expert group should be convened to refine the indicators further (Decision VI/7). COP advised that regional approaches to indicator development be promoted and that these processes are taken into account in the development of the CBD's indicators. Specifically, the COP 6 decision on forest biological diversity:

> *Recognizes* existing criteria and indicators for sustainable forest management including forest biological diversity at the national and regional levels, and *agrees* that these should be applied where criteria and indicators are needed for the purposes of the expanded work programme, and recognizes the need for further development and selection of criteria and indicators for the assessment of the status and trends of forest biological diversity at the national and regional levels (Decision VI/22, para. 34)

Criteria and indicators for sustainable forest management

Criteria and indicators (C&I) for sustainable forest management (SFM) were developed to provide countries with a framework for defining SFM and assessing progress toward this goal. Criteria and indicators are tools to help identify trends in the forest sector, determine the effects of forest management interventions over time, and facilitate decision making in national forest policy processes.

Criteria define essential elements against which the sustainability of forest management is judged. Each criterion is defined by indicators, which are monitored periodically to provide an indication of whether a country is moving towards or away from sustainability.

ITTO began work on criteria and indicators for sustainable forest management in 1990. Today there are nine major C&I processes, involving approximately 150 countries and covering most of the world's forested area.[61]

The processes are similar in objectives and approach, but differ somewhat in content and structure. They have all developed criteria and indicators for use at the national level. The criteria identified by the processes correspond fairly closely, all incorporating, in some fashion, the following fundamental elements of SFM:

- extent of forest resources and global carbon cycle
- forest ecosystem health and vitality
- biological diversity in forest ecosystems
- productive functions of forests
- protective functions of forests
- socio-economic functions and conditions
- political, legal and institutional frameworks

As discussed above, national reporting to ITTO Year 2000 Objective is based on the ITTO Criteria and Indicators. UNFF has recognized criteria and indicators for sustainable forest management as a basis for reporting on SFM. CBD has also recognized criteria and indicators for SFM as useful to its work on forest biological diversity.

There is clearly strong acceptance of criteria and indicators of SFM as the basis for impact indicators related to forests. This convergence offers potential for harmonization of information across the forest-related instruments and improvement of reporting on forests. This was indicated in a proposal for action agreed upon by the IPF in 1997, which "recommended that criteria and indicators be used by FAO and other relevant organizations in order to improve consistency in reporting on forest assessment and sustainable forest management." (E/CN.17/1997/12, paragraph 115(e))

Concerns over the reporting burden on countries: efforts to harmonize reporting to international instruments

The burden on countries to fulfil the various international reporting requirements was noted in a Report of the Secretary-General to the fifth session of the CSD in 1997, as follows:

> "Concern at the increasing number of national reports that countries are required to submit has been growing and expressed in various forums. Member States have noted that they must prepare reports not only for the Commission but also to comply with the requirements of conventions, agreements reached at major conferences and global programmes of action. For all countries, the requests constitute a burden; but for countries with limited capacity, the burden has become overwhelming. It has also become apparent that some of the information being requested is duplicative and redundant" (E/CN.17/1997/6).

[61] African Timber Organization (1993), Dry Forest Africa (1999), ITTO (1992) Dry Zone Africa (1995), Lepaterique Porcess (Central America)(1997), Montreal Process (1995), Pan-European Forest Process (1993), Tarapoto Proposal (1995), Near East Process (1996).

Streamlining of reporting on sustainable development

The CSD report made various proposals for the streamlining of requests within the UN context for national reporting on sustainable development issues. The focus was on streamlining the reporting process, rather than on streamlining the content of the reports, which respond to legal commitments or legislative mandates. It was agreed that countries would not need to report separately to the CSD on issues in which they report to Conference of the Parties of international conventions and other intergovernmental bodies. The country need only make these reports available to the CSD secretariat.

Another proposal made to CSD 5 was to have a UN system-wide sustainable development website developed, which would not only provide all national reports to the CSD but would have electronic linkages to reports and databases of related UN conventions. The Secretariat to the CSD is currently working on this site, with hopes to have it available in the near future. As well as linking to national reports to international bodies, it would provide links to national databases on environment and development, where possible.

Harmonization of reporting on biological diversity

Over the past few years, some major initiatives have been taken to streamline national reporting on biological diversity, in particular to the five biodiversity conventions: CBD, CITES, CMS, Ramsar and WHC.

In 1998 the secretariats of these five treaties and United Nations Environment Programme (UNEP) commissioned World Conservation Monitoring Centre (WCMC) to undertake a feasibility study to identify opportunities for harmonizing information management between the treaties. In October 2000, UNEP convened a workshop in Cambridge, U.K. to explore ideas for a more harmonized approach to national reporting to international agreements and to develop pilot projects for testing the ideas at national and international levels (WCMC, 2000). Pilot project ideas were proposed for testing various approaches to information management: modular reporting, consolidated reporting, linking reporting to State of Environment reporting processes, and information management and regional support. The pilot projects are underway in four countries.

Another initiative has been taken by the Environmental Management Group (EMG). The EMG is a forum for UN agencies and secretariats of multilateral environmental agreements as a mechanism for enhancing interagency cooperation in the field of environment and human settlements. The EMG is chaired by UNEP. At its first meeting in January 2001, the EMG identified harmonization of environmental reporting, with a focus on biodiversity-related conventions, as needing additional attention. A background paper was prepared and discussed at the EMG's third meeting in October (UNEP 2001). The results of the analysis have contributed to documentation prepared for the WSSD on enhancing complementarities among international agencies.

At a regional level, the European Environment Agency is working on a project to streamline reporting systems for the 64 environmental agreements to which the European Commission is a party (EEA, 2001).

Harmonization of reporting on forests

The concern over reporting burden has also been strongly expressed in the international forest dialogue. A proposal for action (19a) of the IPF encouraged:

"countries, ITFF[62] member organizations and other relevant international and regional organizations to develop harmonized, cost-effective, comprehensive reporting formats for collecting and synthesizing national forest information to meet the diverse demands for reliable and timely data by various forest-related international organizations and instruments. There is a need to incorporate information on relevant criteria and indicators for sustainable forest management, including indicators on environmental, social and economic functions .... into such reporting formats in order to reduce reporting burdens on countries and increase the timeliness and consistency of reporting." (E/CN.17/2000/14)

The UNFF, at its second session (March 2002), invited "the Collaborative Partnership on Forests members to streamline reporting requests and, to the extent possible, to synchronize their reporting cycles so as to reduce reporting burden on countries" (E/CN.18/2002/14).

In April 2002, the CBD, by Decision VI/22, adopted the expanded work programme on forest biological diversity, which includes as one of its activities to "seek ways of streamlining reporting between the different forest-related processes, in order to improve the understanding of forest quality change and improve consistency in reporting on sustainable forest management" (Programme element 2, goal 1, objective 2, activity a).

A few preliminary efforts have been taken to date to on the issue of harmonizing reporting on forests, as follows:

- Expert Meeting on Synergies Among the Conventions on Climate Change, Biological Diversity, Desertification and the Forest Principles, held in Sede Boqer, Israel in March 1997 (UNDP, 1997). Among the topics discussed was reporting requirements and recommendations for harmonization.

- Workshop on Finding Synergies between Forest-Related Multilateral Environmental Agreements, convened by Ecologic – Institute for International and European Environmental Policy in Berlin on 7-8 December 2000 (Tarasofsky and Oberthuer, 2001)

- International Expert Meeting on Monitoring, Assessment and Reporting on the Progress toward Sustainable Forest Management, hosted by the Japan Forestry Agency and held in Yokohama, Japan, from 5 to 8 November 2001 (Forestry Agency, Japan, 2002).

There is strong potential to build on these efforts and those on harmonization of reporting on sustainable development and on biological diversity. The three efforts should be compatible and complementary.

[62] The Interagency Task Force on Forests established in 1995 to support the work of the IPF and subsequently the IFF. The ITFF has been superseded by the Collaborative Partnership on Forests (CPF) – see text later in the paper.

The Collaborative Partnership on Forests is in the process of establishing a "CPF Task Force on Streamlining Forest-related Reporting Requirements". The CPF was established in 2001 to support the work of the UNFF and to increase cooperation and collaboration on forests among its members. The CPF consists of 13 international organizations, institutions and instruments that have substantial programmes on forests. They are: FAO (Chair), Center for International Forestry Research (CIFOR), ITTO, International Center for Research in Agroforestry, Secretariat of the CBD, Secretariat of the Global Environment Facility, Secretariat of the UNCCD, Secretariat of the UNFCCC, United Nations Department of Economic and Social Affairs, United Nations Development Programme, UNEP, the World Bank and the World Conservation Union (IUCN). The objective of the Task Force is to propose ways to streamline forest-related reporting requests, synchronize reporting cycles and facilitate the provision of information by CPF members in order to reduce the reporting burden on countries.

Conclusions

The UNFF is the international instrument with exclusive focus on forests and the most comprehensive coverage. Although its predecessors, the IPF and IFF, adopted many proposals for action related to monitoring, assessment and reporting, the modalities for reporting to the UNFF itself have not yet been agreed upon.

National reporting to the other eight instruments and the CSD vary in their nature and content. The forest-related content of CITES, CMS, Ramsar and WHC, while relevant, is limited in scope.

The other five instruments – UNFF, ITTO, CBD, UNCCD and UNFCCC – all have considerable forest content and a strong sustainable development dimension. These five are most relevant to the issue of comprehensive international reporting on forests. National reports to UNFCCC and ITTO are strongly quantitative, whereas the content of national reports to CBD and UNCCD are qualitative, focusing on the means of implementing commitments under these conventions. Perhaps because of the difficulty of assessing the impact of their actions without quantitative measures, both CBD and UNCCD have been working to identify impact indicators, or biophysical and socio-economic indicators on which quantitative data can be collected.

There seems to be a very promising convergence of acceptance of criteria and indicators of sustainable forest management as the basis for assessing the state and trends in forests, forest resource use and the equitable sharing of the benefits of that use. UNFF, ITTO and CBD have all accepted the criteria and indicators of SFM as the basis for assessing progress in their forest-related work.

Various important efforts are under way on streamlining and harmonizing reporting on sustainable development, biological diversity, and forests. The work to develop proposals for the streamlining of forest reporting anticipated to be undertaken by a CPF Task Force, can build upon similar efforts carried out for sustainable development by the CSD and on biological diversity by the five biodiversity conventions.

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Annex 1
International conventions and agreements related to forests

Instrument	Date: entry into force or establishment	Status of participation	Objectives	Relevance to forests
Commission on Sustainable Development (CSD)	1993	53 members elected for terms of three years. All UN member States may participate in sessions, but without voting rights.	To review progress in implementation of recommendations and commitments made at UNCED, elaborate policy guidance and options for future activities to follow up UNCED and achieve sustainable development, and to promote dialogue and build partnerships for sustainable development.	Commitments made at UNCED include Chapter 11 ("Combating deforestation" of Agenda 21) and the "Forest Principle" (i.e., the "Non-legally Binding Authoritative Statement of Principles for a Global Consensus on the Management, Conservation and Sustainable Development of All Types of Forests".
Convention on the Conservation of Migratory Species of Wild Animals (CMS)	1 November 1983	79 Parties (as of Feb. 2002)	To conserve wild animal species that migrate across or outside national boundaries by developing and implementing cooperative agreements, prohibiting taking of endangered species, conserving habitat, and controlling other adverse factors.	Forests are important habitats to some migratory species listed on the appendices of the CMS (i.e., endangered species and species with an unfavourable conservation status). Range States for these species are to conserve and restore habitats critical for the species' survival.
Convention on Biological Diversity (CBD)	29 December 1993	183 Parties (as of March 2002)	The conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising from the utilization of genetic resources.	Many of the articles of the convention relate to the conservation and sustainable use of biological resources, including forest resources. Those most relevant to sustainable forest management are: Article 7, which requires Parties to identify and monitor components of biological diversity important for conservation and sustainable use, and to identify processes and activities with adverse impacts on the conservation and sustainable use of biological diversity. Article 8, which address *in situ* conservation, including within and outside protected areas, rehabilitation and restoration of degraded ecosystems, and actions to minimize negative impacts of alien species Article 8j, which addresses the roles and rights of traditional and local communities related to forests Article 10, which addresses sustainable use of biological diversity. At COP 4 in 1998, a work programme on forest biological diversity was adopted. An expanded programme was adopted at COP 6 in 2002.

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	1 July 1975	158 Parties (as of June 2002)	To prevent the overexploitation, due to international trade, of species listed in the Convention's appendices. Various levels of control or restrictions are placed on the trade of these species.	Some 15 timber or woody species, some of which are commercially important, are included on CITES appendices.
Convention on Wetlands of International Importance, Especially as Waterfowl Habitat (Ramsar Convention)	21 December 1975	132 Parties (as of June 2002)	Wetland conservation and wise use, recognizing wetlands as ecosystems that are extremely important for biodiversity conservation in general and for the well-being of human communities.	Ramsar promotes the conservation and wise use of wetlands considered internationally important, including mangroves and forested peatlands. As of November 1999, 306 of the 1028 sites on the Convention's List of Wetlands of International Importance were forested wetlands.
International Tropical Timber Agreement (ITTA)	1 January 1997 for an initial period of four years (Successor agreement to ITTA, 1983).	57 members (as of July 2001)	To provide an effective framework for consultation, international cooperation and policy development among all members with regard to all relevant aspects of the world timber economy, including international trade in tropical timber, and to enhance the capacity of members to implement a strategy for achieving exports of tropical timber from sustainably managed sources.	While primarily a commodity agreement aimed at regulating international trade in tropical timber, the scope of ITTA and the work of the International Tropical Timber Organization (ITTO) also includes forest conservation and management issues. In 1990 the ITTA Council adopted the Year 2000 Objective, which states that exports of tropical timber should be from sustainably managed sources by the year 2000. Much of the work of ITTO relates to policy development and projects.
Convention Concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention - WHC)	17 December 1975	167 Parties (as of May 2002)	To define and conserve the world's cultural and natural heritage, by drawing up a list of sites (the World Heritage List) whose outstanding values should be preserved for all humanity and to ensure their protection through closer collaboration among nations.	Of the 721 sites currently on the World Heritage List, 41 are tropical forests and many are temperate and boreal forests.
United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, particularly in Africa (UNCCD)	26 December 1996	179 Parties (as of May 2002)	To combat desertification and mitigate the effects of drought, particularly in Africa, in an integrated approach aimed at contributing to sustainable development in affected areas.	UNCCD addresses biophysical and socio-economic aspects of desertification and the effects of drought. The aspects of the Convention that are particularly relevant to forests include vegetation conservation and traditional knowledge.
United Nations Forum on Forests (UNFF)	18 October 2000	Membership open to all member States of the UN	To promote the management, conservation and sustainable development of all types of forests and to strengthen political commitment to this end.	UNFF is recognized as the foremost forum for discussion of international forest policy. The UNFF is primarily concerned with facilitating the implementation of the IPF/IFF proposals for action, which represent an international forest policy agenda.

United Nations Framework Convention on Climate Change **(UNFCCC)**	21 March 1994	186 Parties (as of Dec. 2001)	To stabilize greenhouse-gas (GHG) concentration in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system, and to achieve this level within a timeframe sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.	Forest play an important role in mitigating climate change through serving as reservoirs, sinks and sources of GHGs, particularly carbon. Forests are addressed directly or indirectly in several provisions of the UNFCCC (Articles 4.2, 4.1(c) and 4.1 (d)) and its Kyoto Protocol (Article 3.4). Parties to the Convention committed themselves to carrying out national inventories of GHG emissions and carbon sinks, including forests. Sustainable forest management, reduction of deforestation, and afforestation and reforestation are all included in UNFCCC as measures to mitigate climate change. The Kyoto Protocol (not yet entered into force) identified quantified emission limitation or reduction commitments by Parties, which can be met by, among other actions, afforestation, reforestation and (avoided) deforestation. Joint implementation and the Clean Development Mechanism offer potential opportunity for financial transfers between Parties wishing to meet some of their commitments through forest-related activities in other countries.

Annex 2
National Reporting to International Conventions, Agreements and Commission on Sustainable Development

Instrument (and mandate for reporting)	Guidelines for reporting, and national reports and databases, with website addresses	Periodicity / date(s) of issue[63]	Content of national reports
Commission on Sustainable Development **(CSD)**	**Country profiles** (based on national reports submitted to CSD) available at: http://www.un.org/esa/agenda21/natlinfo/ **National reports:** status of implementation of the Agenda 21 chapters and other issues to be discussed at that year's CSD session *National reports on forests were provided for CSD 8 (2000) **National assessment reports**: self-appraisal of the country's efforts to implement Agenda 21 over the 10-year period since UNCED.	Every five years 1997: Prepared for the Earth Summit +5. 2002: Updated for World Summit on Sustainable Development. Annual 2000 2002	A report on each of the chapters of Agenda 21, including information on the status of cross-sectoral issues (decision-making structures, capacity building/technology issues, finance, regional/international cooperation) and statistical data/indicators 1. Brief statement of current situation of SFM and achievements 2. Progress in the implementation of IPF/IFF proposals for action 3. Policy and legal framework 4. Information: participation in criteria and indicators (C&I) processes; use of C&I for reporting and policy purposes; dissemination of information on SFM 5. Overriding issues (forestry-poverty linkages; consumption and production trends) Policy measures taken, specific challenges encountered and constraints faced.
Convention on the Conservation of Migratory Species of Wild Animals **(CMS)** (Article VI)	The model format provided by Resolution 4.1 (1994), has been updated for voluntary use on a trial basis for COP 7 (Sept 2002). See http://www.wcmc.org.uk/cms/	Every three years	New reporting format: Appendix I species: general information on steps taken to protect species; species specific information on population size, trends and distribution, efforts in research, monitoring and habitat protection Appendix II species: CMS agreements Party has undertaken to conserve species Role conservation of migratory species plays in national and regional priorities Use of satellite telemetry Membership – steps taken to encourage non-Parties to join CMS Actions taken to increase national and global awareness of importance of CMS Mobilization of resources Implementation of COP Resolutions

[63] The date indicates the year the report was/is to be submitted. In some cases the date at which the report is considered by the COP is the following year.

Instrument (and mandate for reporting)	Guidelines for reporting, and national reports and databases, with website addresses	Periodicity / date(s) of issue[63]	Content of national reports
Convention on Biological Diversity **(CBD)** (Article 26)	**National Report to the Convention on Biological Diversity** Guidelines for reporting (second report)Ñ http://www.biodiv.org/world/nr-guidelines.asp?t=s or UNEP/CBD/COP/5/13/Add.2 Access to national reports: http://www.biodiv.org/doc/world/asp **Thematic Reports** (on thematic programme areas of the CBD; timetable decided by COP) Thematic Report on Forests (considered by COP6, April 2002) Guidelines for reporting: http://www.biodiv.org/world/nrguidelines.asp?t=thm Access to reports: http://www.biodiv.org/world/reports.asp?t=fr Voluntary thematic national report on the implementation of the expanded programme of work on forest biological diversity	Every four years First report: 1997 Second report: 2001 Third report: 2005 2001 2003	Contents of first National Report: implementation of Article 6 Contents of second National Report: Reporting on the implementation of the articles of the Convention and related COP decisions addressed to Contracting Parties, including on the following Articles: 5 (Cooperation); 6 (General measures for conservation and sustainable use); 7 (Identification and monitoring); 8 (In-situ conservation); 9 (Ex-situ conservation); 10 (Sustainable use of biological diversity); 11 (Incentive measures); 12 (Research and training); 13 (Public education and awareness); 14 (Impact assessment and minimizing adverse impacts); 15 (Access to genetic resources); 16 (Access to and transfer of technology); 17 (Exchange of information); 18 (Technical and scientific cooperation); 19 (Handling of biotechnology and distribution of its benefits); 20 (Financial resources); 21 (Financial mechanism); 22 (Relationship with other international conventions); 23 (Conference of the Parties); 24 (Secretariat); 25 (Subsidiary Body on Scientific, Technical and Technological Advice); 26 (Reports) Reporting on implementation of the work programme on forest biological diversity (Decision IV/7): Element 1: Ecosystem approach Element 2: Analysis of the ways human activities influence biological diversity and assessment of ways to minimize or mitigate negative influences Element 3: Elaboration and implementation of criteria and indicators for forest biological diversity Decision VI/22 calls for Parties to submit voluntary reports on the implementation of the expanded work programme on forest biological diversity to COP 7, including the following information: 1. Priority actions that Parties have identified 2. Successes in implementing the programme 3. Challenge and impediment The report format to be prepared by the CBD secretariat and approved by the Bureau of the COP.

Instrument (and mandate for reporting)	**Guidelines for reporting, and national reports and databases, with website addresses**	**Periodicity / date(s) of issue[63]**	**Content of national reports**
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (Article VIII, para. 7)	**CITES Annual Reports** Reporting guidelines: http://www.cites.org/eng/notifs/1999/085a.pdf **Biennial Reports**	Annual Biennial	Reporting on statistics on trade of species included in the CITES Appendices, including the kind and quantity of specimens, country of origin or destination, purpose of trade, source of specimens, and permit or certificate number. Report on legislative, regulatory and administrative measures taken to enforce the provisions of CITES.
Convention on Wetlands of International Importance, Especially as Waterfowl Habitat **(Ramsar Convention)**	**National Reports** Reporting format for national reports to COP8 (2002) http://www.ramsar.org/cop8_nr_natl_rpt_intro_e.htm	Every three years	Reporting on measures taken to: 1. Increase Ramsar membership 2. Implement and further develop the Ramsar Wise Use Guidelines 3. Raise awareness of wetland values and functions 4. Reinforce institutional capacity 5. Ensure conservation of all sites on the Ramsar List 6. Increase the number of Ramsar sites, particularly of under-represented wetlands types 7. Promote international cooperation and mobilize financial assistance 8. Provide the Convention with required institutional mechanisms and resources
United Nations Forum on Forests **(UNFF)** (Ecosoc Resolution 2000/35)	Not yet available The UNFF Secretariat to suggest a format for country reports to UNFF 3 on implementation of the IPF/IFF proposals for action. Thereafter, an ad hoc expert group shall provide advice to UNFF on monitoring, assessment and reporting.	To be determined	No reporting modalities have as yet been decided. UNFF 1: a) identified the three areas for UNFF's monitoring, assessment and reporting function as: Progress in implementation of the IPF/IFF proposals for action; Progress towards sustainable management of all types of forests; and Review of the effectiveness of the international arrangement on forests. b) invited countries, regions, organizations and processes to report to the UNFF, on a voluntary basis, on their progress in implementation of the IPF/IFF proposals for action, c) stressed the importance of the use of regional and national criteria and indicators for sustainable forest management (SFM) as a basis for reporting on SFM

Instrument (and mandate for reporting)	Guidelines for reporting, and national reports and databases, with website addresses	Periodicity / date(s) of issue[63]	Content of national reports
International Tropical Timber Agreement **(ITTA)** (Article 29)	ITTO/UNECE/FAO/EUROSTAT Joint Forest Sector Questionaire (for use in the ITTO Annual Review and Assessment of the World Timber Situation) http://www.itto.or.jp/inside/joint_forest/index.html Input to Year 2000 Objective Review Reporting format: http://www.itto.or.jp/Index.html	Annual	1. Production and trade of all timber by ITTO Producers and Consumers 2. Direction of trade in volume of primary tropical timber products between major ITTO Producers and Consumers 3. Major tropical species traded 4. Prices of major tropical timber and selected competing softwood products 5. Trade in secondary processed wood products
Convention Concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention) **(WHC)** (Article 29)	Periodic Reporting on the application of the World Heritage Convention Reporting Guidelines:[64] Reporting format: http://www.unesco.org/whc/reporting/periodic.htm Explanatory notes: http://whc.unesco.org/reporting/prexpl.htm Reports not available on the Web	Each State Party reports every 6 years (with rotation by region) Arab States 2000 Africa 2001 Asia & Pacific 2002 Latin Am & Caribbean 2003 Europe & N. America 2004/2005	Section 1: Application of the WHC by State Party 1.1. Introduction 1.2. Identification of cultural and national heritage properties 1.3. Protection, conservation and presentation of the cultural and natural heritage 1.4. International co-operation and fund raising 1.5. Education, information and awareness building 1.6. Conclusions and recommended actions Section 2: State of conservation of specific World Heritage properties II.1. Introduction II.2. Statement of significance II.3. Statement of authenticity/integrity II.4. Management II.5. Factors affecting property II.6. Monitoring II.7. Conclusions and recommended action

[64] The World Heritage Committee, at its twenty-second session held in 1998 approved this format and explanatory notes, which have been used since for reporting. The Operational Guidelines of the Convention have been revised, including slight changes in the explanatory notes for reporting, and will be presented to the 26th session of the WHC in late June 2002.

Instrument (and mandate for reporting)	Guidelines for reporting, and national reports and databases, with website addresses	Periodicity / date(s) of issue[63]	Content of national reports
United Nations Convention to Combat Desertification **(UNCCD)** (Article 26) (also decision 11/COP.1)	**UNCCD National Reports** http://www.unccd.int/cop/reports/menu.php	First reporting 1999 – affected African countries 2000 – other affected countries 1999/2000 – non affected countries Second reporting 2002 – all regions Reporting will be done for each future ordinary session (2003, 2005, 2007 … etc.), with non-affected countries reporting to every session, and affected countries reporting to every other session, alternating between African countries and countries in other regions	**(a) Reports on national action programmes** Strategies and priorities of sustainable development plans and/or policies Institutional measures taken to implement UNCCD Participatory process used in national action programme (NAP) Consultative process used in NAP and partnerships with developed country Parties Measures taken or planned in NAP, *i.a.* to improve: economic environment, natural resource conservation, institutional organization, knowledge of desertification; and to monitor and assess drought effects National and financial allocations and financial and technical assistance received Benchmarks and progress indicators **(b) Reports on joint, subregional and regional action programmes** (SRAPs and RAPs, repectively) Areas of cooperation under the programme and measures taken or planned Consultative process used in the preparation and implementation of the SRAPs or RAPs and partnership agreements with developed country Parties and other interested entities Financial allocations by affected country Parties of the subregion or region in support of implementation and financial assistance and technical cooperation received and needed Benchmarks and progress indicators used **(c) Reports of developed country Parties** Consultative process and partnership agreements in which they are involved Measures taken to support the preparation and implementation of action programmes at all levels, including information on the financial resources they have provided, or are providing, both bilaterally and multilaterally. **(d) Reports of affected developed country Parties not preparing action programmes** Strategies and priorities, within the framework of sustainable development plans and/or policies, to combat desertification and mitigate the effects of drought and any relevant information on their implementation.

Instrument (and mandate for reporting)	**Guidelines for reporting, and national reports and databases, with website addresses**	**Periodicity / date(s) of issue[63]**	**Content of national reports**
United Nations Framework Convention on Climate Change **(UNFCCC)** (Article 12)	National Communication Guidelines for Annex I Parties: http://unfccc.int/resource/docs/cop5/07.pdf (under revision: to be addressed at COP 8) Guidelines for Annex II Parties: Decision 10/CP.2 (not available on web) Communications available at: http://unfccc.int/resource/natcom/index.html **National Inventory** (Annex I countries) UNFCCC guidelines provide a common reporting format http://unfccc.int/resource/docs/cop5/07.pdf Intergovernmental Panel on Climate Change Guidelines for National GHG Inventories (IPFF Guidelines) provide methodology http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm	Each Annex I Party shall make its initial communica-tion within six months of the entry into force of the Convention for that Party. Each other Party shall make its initial communication within three years of the en-try into force of the Con-vention for that Party, or of the availability of financial resources in accordance. Least developed country Parties make their initial communication at their discretion. Annual	Annex I Parties: report of implementation of commitments under Articles 4.1 and 12, including: Greenhouse gas inventory information Policies and measures Projections and the total effect of policies and measures Vulnerability assessment, climate change impacts and adaptation measures Financial resources and technology transfer Research and systematic observation Education, training and public awareness Balance of GHG emissions and removals from: in energy section: from woody biomass combustion from pulp, paper and print industries in land –use change and forestry: changes in forest and other woody biomass stocks - in forests, distinguishing between tropical, temperate, and boreal; plantations and other forests; various species; non-forest trees - removed in commercial harvest, traditional fuelwood consumption, other wood use forest and grassland conversion - distinguishing between various types of tropical, temperate and boreal forests - distinguishing between immediate release by fire and delayed release from decay abandonment of managed lands - areas and rate of regrowth of various types of tropical, temperate and boreal forests CO_2 emission/removals from soil - area of cultivation of different types of soils

IV A hierarchical terminology for more or less natural forests in relation to sustainable management and biodiversity conservation – Erik Buchwald

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Abstract

Existing terminologies since the late 1980's are reviewed revealing gaps, inconsistencies and overlapping definitions. Many terms have been used very differently by different organisations with semi-natural forest being the worst example. It has variously been used for any kind of forest except exotic plantation. A new hierarchical terminology is proposed based on the work of many authors, persons and organisations working with this issue during the 1990's. Fourteen mutually exclusive levels of naturalness are delimited, defined, named and grouped, including virgin forest, old-growth, newly untouched forest, exploited natural forest, native plantation, exotic plantation and exotic self-sown forest. Consistent definitions for groups of levels and for qualifying features are also presented, e.g. for natural forest, planted forest, native forest, exotic forest, primary forest, minimum-intervention forest, ancient woodland and grazed forest. The definition of natural forest follows UNCED, FAO, EU and the World Bank. For other terms official sources like FAOs Forest Ressources Assesment has been followed as far as possible.

Key words:*Natural forest; Terminology; Management; Grazing; Conservation; Biodiversity; Old-Growth;*

1. Introduction - the need for common terms

Especially since the UNCED Rio summit 1992 there has been much interest in protecting the natural qualities of forests including their biodiversity and ecological functions. This has lead to many meetings and papers dealing with issues related to more or less natural forests and their biodiversity.

It has been clear in the political processes derived from UNCED that no commonly accepted terminology exists on forests relating to their management and conservation. This has given rise to lengthy debates about the words and long texts explaining local/regional definitions, most of which have no general acceptance. Some papers have not defined their words, paving the way for misunderstandings.

The lack of a generally accepted terminology is a problem both domestically in many countries and even more so internationally – especially in legal/political negotiations and in scientific work. Both inside and between continents there are problems with misunderstandings (IUFRO 1997 & 2002, COST E4 2000, Lund 2001, FAO 2002).

In this paper I use **forest** as defined in FAO (2001b), and **native tree species** as defined in FAO (2001a) for indigenous tree species. When using "predominantly consisting of" about tree species ratios, I mean ratios of vertical crown projections. I focus on the terminologies used during the past ten years, including single works of major importance a few years older.

The main aim of this review is to improve understanding of existing terminologies and to suggest a possible consistent terminology – not to monopolise the terms. The general public often uses some of

the words in a broad sense or with a different meaning than any published definition (Peterken 96) This cannot be avoided.

The choice of terms and definitions is affected by the objectives of the setting. If definitions are well-documented, logical and hierarchical it should be possible to translate and relate them to other objectives and settings. First I explore some of the background for why inconsistencies develop, and then set out a new hierarchical approach.

1.1. Earlier attempts at a mutual terminology

Several authors have provided overviews of how the international terminology has been used (Broekmeyer & Vos 1993, Schuck et al. 1994, Peterken 1996, COST E4 2000, Lund 2001).

On the basis of these and other works, international attempts have been made to address the problem of a lacking mutual terminology. Precision is especially important in international research, statistics and political negotiations where definitions have therefore been elaborated (MCPF 1996, UN-ECE/FAO 1997 & 2000, FAO 2001a, IUFRO 2002).

1.2. Problems with the existing terminologies and definitions

Analysing the definitions of the commonly used terms referring to more or less natural forests reveals that one reason for the lack of mutual acceptance could be that most of the terms are not defined logically or precisely enough. Overlaps and gaps are common. It is often impossible from the published definitions to understand where the limits or even the typical range of the features in question are (Peterken 1996, Lund 2001).

A further general problem is that many sets of definitions are vague in places, and leave undefined gaps in others – see appendix 1.

There seems to be a need for a more stringent, logical and precise approach to defining a terminology. This might enable common use of terminology in international work in the future. It might also inspire national organisations to define national terminology more precisely. Improved terminology has for example been recommended in the Lisbon resolutions of the Ministerial Conference on Protection of Forests in Europe in 1998 (MCPF3 1998).

1.2.1. Etymology - are humans part of nature?

One set of problems arises around the concept of naturalness because humans have been an integral part of nature until some time in the past. However most people do not accept the major impacts of modern humans as natural - meaning as an integral part of nature.

Therefore we need to consider a level of impact where the transition happens from humans being a part of nature to being something apart from nature impacting on it. Unfortunately there is no simple logical way of discerning when or why human impact on (forest) ecosystems became too large to be accepted as natural.

The wordpairs nature >< culture and natural >< artificial are antonyms. The words are derived from Latin natura nature (from natus born), cultura cultivation of plants (from colere to till) and arte

factum art work (Henderson 1979). These antonyms of general acceptance may help in deciding where to set logical limits compatible with the understanding of most people.

From these words it can be seen that some of the features which set humans definitely apart from nature are the cultivation of plants (tilling, sowing and planting) and the production of art. This is supported by the fact that no animals cultivate plants or produce art. From archaeological evidence the departure from nature can thus be taken as happening in the time period after the first art works and before Neolithic farming started. That would be between 5.000 and 25.000 years ago in much of the World depending on location.

Human activities such as hunting and the use of fire were already widespread ten-thousands of years earlier. This indicates that humans had impacts on nature before ceasing to be part of it.

In reality it is not the artworks/artefacts themselves that disturb our notion of people as part of nature, but the escalated impacts on wildlife and landscape which often occured more-or-less simultaneously. For example evidence from isolated islands and continents shows a close correspondance between prehistoric human colonisation and extinctions of large animals (Stuart 1991, Bradshaw & Mitcell 1999). Extinctions especially hit megaherbivores, which are herbivorous animal species which grow larger than 1000 kg. In several continents these went extinct roughly 10-20.000 years ago. Megaherbivores have major influence on the dynamics of ecosystems and landscapes, and thus their disappearance must have had large impacts (Owen-Smith 1988).

In the light of such archaeological information it can be seen that the idea in the head of many people that forests until a few thousands of years ago were totally unimpacted by humans is a misconception.

This misconception is reflected in numerous published definitions of terms like primeval, pristine and virgin forest. These terms – and in a few cases also natural forest and old-growth (Lund 2001) - have often been defined in a way excluding any human impact ever (WWF/IUCN 1996, MCPF 1996, COST E4 2000). Such definitions are *a priori* problematical because humans have been present for hundreds of thousands of years with great potential impact already from the start of use of fire more than 200.000 years ago (Andersson & Appelquist 1990).

2. Developing a new hierarchical approach

A hierarchical logic is already partly inherent in many of the features covered by commonly used terms, without being appropriately incorporated or delimited in the published definitions.

The following fundamental forest features can be described in a hierarchical manner:

1. More or less natural *origin/genesis* >< More or less artificially created/regenerated
2. More or less natural *flora, fauna and genepool* >< More or less modified by human activities
3. More or less natural *processes and structures* >< More or less modified by human activities
4. Timespan of *continuity* of features >< History of change including human influence
5. Type and intensity of *management operations and utilisation*

In practice, although each of these features is a continuum, breaks in continual distribution tend to be present. The features are also interrelated and can be combined in a multi-dimensional matrix. From such a matrix sections can be grouped and identified to develop a logical hierarchic terminology.

1.1. Logical breaking points in the continual distribution of features

There is a logical breaking point in the continuum of **origin/genesis** when human action changes the existing /spontaneous vegetation of a site to an artificial stock of trees (by planting or seeding). This is also a breaking point in the continuum of the four other features and is therefore fundamental. The breaking point between natural and artificial regeneration can also occur when planted stands later regenerate naturally.

For **flora, fauna and genepool** there is a major breaking point in the continuum when native vegetation of a site loses its dominant role to non-native vegetation (e.g. to invasive non-native species). The fauna can be with or without key species of large wide-ranging animals. A usually prehistorical breaking point was at the first human-induced extinctions. It is not deemed feasible to incorporate breaking points relating to lower than species level, even though such impacts on the genepool can be of great importance.

Important breaking points in the continuum of **processes and structures** are presence/absence of significant native/aboriginal human modification and presence/absence of significant modern/western civilised human modification (e.g. logging). In sites with discontinued modification a breaking point in the reverse direction is when signs of the former human modification can no longer be seen/measured. Other breaking points relate to size (landscape-, forest- or stand-scale) and to seral stages of forest dynamics – which is especially relevant for old-growth versus younger seral stages. A last breaking point refers to presence/absence of a plantation-like structure.

A logical breaking point for **continuity** is when humans clear forest for other types of land-use, e.g. agriculture. Many hundreds of years of woodland continuity is of prime importance for many elements of flora and fauna (Peterken 1996, Graae 2000). Sites with forest continuity back to the oldest maps often also have continuity much further back in time.

Major logical breaking points in the continuum of **management** are if sites mainly serve industrial wood production purposes, are left untouched or have special management (e.g. old-time traditional management types, biodiversity protection, hunting estates, grazing, water protection or recreation).

1.2. Levels of naturalness

In order to overview the existing terminology I developed an array of levels of naturalness each with a corresponding definition labelled with a number instead of a name. For each new terminology reviewed, levels were added if necessary to incorporate details of definitions.

When the process was finished, 14 mutually exclusive levels emerged. The most logical and generally accepted parts of existing definitions were reused and incorporated in the definitions of levels. Amendments and adjustments were generally necessary in order to make the definitions more universally useful, consistent and without gaps. Appendix 1 shows the results of the review, while appendix 2 gives the level definitions. Level names have been added to both – see below.

In cases where the references use the words without defining them, there are uncertainties regarding the limits of terms, even though the context often gives a quite clear clue. In other cases definitions are vague or imprecise. Uncertainties are displayed with question marks in appendix 1.

Often it can be difficult to document historical and other features, e.g. whether a 200 years old forest stand is planted or not. I propose different solutions to such documentation problems at different levels, including the documentation topic in each relevant level definition. Any forest stand should be referable to the appropriate level by a field visit supplemented by general historical and biological knowledge of the area.

2.3. Names for the levels

I have tried to match the levels with the most commonly used and directly meaningful terms at hand in order to obtain logical hierarchy and best chances of communication with minimal misunderstandings.

The words primeval and virgin have traditionally been connected to forest of an ultimately natural character – with some differentiation. **Primeval** bears in the word itself the reference to "the earliest ages (as of the world or human history)" (Lund 2001) making it useful for denoting the ultimately natural situation before human impacts (in most cases a very prehistoric situation).

The term **virgin** on the other hand denotes a situation which during the generations repeatedly can occur, but where the qualities cannot be restored once lost. It should be acceptable that virgin forest can still develop nowadays under certain ultimately natural conditions. This would be in line with the countries still claiming to have at least some virgin forest. Peterken (1996) supplements with Near-virgin Forest and World Resources Institute (1997) uses Frontier Forest which can be relevant in certain cases – see definitions of these in appendix 2.

For forest with a very high degree of naturalness but not as ultimate as the four abovementioned levels several continents use **Old-growth** – especially America, Australia and Asia (Russia) (Lund 2001). The term has been the issue of a separate working group to discuss definitions (IUFRO 1997). Many local definitions are very specific, but most can be encapsulated by the more generic definitions used at national scale in Russia, Australia, Canada and the US, which are fairly similar (Lund 2001). The main part of the level n6 definition is unchanged from the United States Forest Service 1989 definition of old-growth (via Lund 2001). An almost identical wording is used and recommended in Canada (Wells et al. 1998).

Alongside the abovementioned terms the following ones are sometimes defined almost identically as synonyms dealing with forests of ultimate to high degree of naturalness: Pristine, primary, antique, climax, ancient and natural forest (COST E4 2000, Lund 2001). These terms are less suited for these levels because they either have a very limited and not generally accepted use and/or do not communicate the correct/precise inherent meaning in them and/or have been used widely with other definitions better relating to the inherent meaning of the words.

This leaves us with the lower levels of naturalness, where it is not possible to find good and broadly accepted names or definitions. The terms Semi-natural Forest, Secondary forest, Modified Forest, Man-made Forest, Planted Forest, Plantation and Plantation Forest are much used, with definitions

varying between authors and countries. They are often inconsistent (see Appendix 1). Artificial Forest is also sometimes used.

The range of forest naturalness between levels n6 and n1 is particularly important because large areas in many countries are covered by such forests. They often have a complex balance between conservation and use, and raise a lot of debate about sustainability. I have proposed names for the levels which as far as possible directly reflect their content. See appendix 2.

1.3. Names for groups of levels

On the basis of the analysis of the word **natural** (etymology and antonyms) and of the logical breaking points, I support the many organisations and authors who have used or defined Natural Forest rather broadly covering many levels of naturalness (e.g. UNCED 1992, EU 1996, Peterken 1996, COST E4 2000, Lund 2001, FAO 2001b, IUFRO SilvaVoc 2002). The minimum level of naturalness in these definitions is mostly at naturally regenerated native forest - regardless of intensity of human use.

Natural Forest should thus be used broadly for relatively to ultimately natural situations, encompassing a broad range of naturalness from level n1 through n10. This matches the international definitions of e.g. UNCED, FAO, IUFRO and World Bank (see appendix 1) and national definitions used in many countries e.g. China, Iran, Vietnam, New Zealand, Brasil (Lund 2001), Sweden (Selander 1969) and Japan (IUFRO 2002). See appendix 3 for definition.

Semi-natural Forest is used in Europe, especially Great Britain, about forests which are more or less natural or resemble such forests enough to make it difficult to tell the difference. Inventory and statistical purposes have been the main reasons for this rather unprecise term, e.g. for sites where it is difficult or impossible to find out if the stand was planted or not - maybe 200 years ago (Peterken 1996). Different works have set up quite different limits for what semi-natural forest is – see appendix 1.

The word semi-natural is more difficult to translate to other languages than most others terms and is not directly meaningful to most people. It has been used for any level of naturalness except p2, Exotic plantation (see appendix 1). I therefore recommend it used as little as possible in international work.

Care must also be taken in translation of the other terms to national tongues. In numerous cases a "direct" translation will give useless and confusing results. This problem has been known for years and will continue, no doubt.

See appendix 3 for other names for groups of levels of naturalness.

1.4. Qualifying features (continuity, grazing, protection status)

The breaking points of the fundamental features cover important divisions, but distinctions along another axis of the matrix can be worthwhile for some purposes. Qualifying features can be used to describe and rank sites in a more detailed manner or as determinants of management, when biodiversity is an important objective. Ellenberg (1988), Peterken (1996) and Vera (2000) can be consulted for details on the features.

I recommend the use of a terminology for continuity, grazing and protection regime in combination with the terminology outlined in appendix 2 and appendix 3, because of the importance and management implications of these qualifying features.

1.5.1 Continuity

Woodland continuity is of such prime importance for biodiversity, that it is worthwhile using it across the whole terminology, discerning between ancient woodland and recent woodland, see box 1. Further specification can be made, e.g. continuity of old trees, dead wood, tree species presence, undisturbed soil or of elements developed by grazing at moderate levels. Regardless of level there can be important differences in biodiversity between ancient and recent woodland. Sometimes the terms primary versus secondary forest are used to indicate if non-forest land-use has occurred, but this leads to confusion with another use of the same wordpair, see appendix 1 and figure 1.

1.5.2 Grazing regime

The original natural grazing pressure by wild animals in the Pleistocene and early Holocene is an issue of much debate (Vera 2000, Svenning 2002). Since those prehistoric times grazing levels have oscillated in complex manners with domesticated herbivores being very important in most continents for hundreds to thousands of years (Bradshaw & Mitchell 1999). Today, breaking points are presence/absence of fencing and of wild/domestic large herbivores (deer, antilope, kangaroo, beaver, buffalo, pigs, oxen, horses etc.) and whether grazing impact is significantly lower, higher or thought to be near the originally natural situation with intact wildlife. Absence of grazing by large herbivores is unnatural from a biodiversity and evolutionary point of view, while intensive domestic livestock grazing is also unnatural and detrimental to forest. See box 2 for proposed terminology.

1.5.3 Protection regime

The protection regime of forest reserves can take on three principally different forms: 1) Minimum-intervention, 2) Traditional Management or 3) Designed Management (NFNA 1994, Peterken 1996 & 2000), see box 3. A code of practice can detail the specific management principles and prescriptions of a reserve or of sub-types of the three forms (e.g. NFNA 1994). Minimum-intervention reserves are often called Strict Forest Reserves, Strictly Protected Forests or Scientific Forest Reserves (COST E4 2000).

Peterken (2000) has elaborated on Minimum-intervention, which he sub-divides into a) Non-intervention and b) Protective Intervention. Typically some human activities are accepted even in Non-intervention reserves, e.g. access, research, grazing regulation, recreation, restoration of natural hydrology or felling trees for security reasons along roads. In Protective Intervention non-native species are controlled also. Minimum-intervention as management prescription is synonomous with untouched forest as prescription (NFNA 1994).

IUCN codings of protected areas are not well suited for stand- or forest-scale assesments because the IUCN class definitions work at protected area scale. Very often at that scale there are multiple habitat types and/or levels of protection regimes, e.g. zones, which cannot be accounted for by the IUCN system (IUCN 1994, EUROPARC & IUCN 1999, COST E27 2001).

3. Discussion

1.1. The role of differing objectives

Many stakeholders use words regarding the naturalness of a forest in relation to their different objectives such as forest policy, statistics, research and biodiversity protection as well as to the general objective of sustainable development. Appendix 1 illustrates the many risks of misunderstandings brought about by different organisations using the same words differently.

Differing objectives can be the reason of some of the variation. But in many cases chance, tradition and historical background seem to be the main reasons, e.g. level n1–n10 being called native forest, natural forest and semi-natural forest in Australia, China and the UK respectively. Similarly, plantation, plantation forest and forest plantation are used synonymously for level p2-p4.

There are tendencies for there to be different "Schools" of terminology. The use of the word semi-natural has spread from the UK to European organisations (MCPF and UN-ECE/FAO), but not in a consistent manner. This may be because semi-natural has been used with differing definitions even inside the UK (Peterken 1996). In North America Canada and the US use more or less the same terminology, and from here the word "old-growth" has spread to other continents.

As can be seen in appendix 1, the World Bank, UNCED, IUFRO and FAO represent another school of terminology. It is of major importance, since it has been used internationally in many contexts both before and after the Rio summit in 1992, and because it is used in more or less legally binding documents of UNCED and EU regarding natural forests and primary forests.

1.2. Documentation problems

The genetic level of biodiversity has not been incorporated in the main terminology, mainly because it is almost never included in the reviewed terminologies, but also because inclusion would give rise to documentation problems. Pollen of trees mix over large and uncontrollable distances in a dynamic way. This makes definitions focused on "clean" local provenances and strains/races almost impossible to use in practice.

Dynamic evolution of species, strains and their distributions continues. This makes it necessary also to reflect on how native range is defined and on when species are deemed exotic. Native range should not be seen statically in relation to political boundaries, but dynamically in relation to soil, climate, dispersal barriers, rate of historical change, potential future changes etc.

Ideally Natural Forest might be defined as forest which has always been naturally regenerated and never artificially regenerated. Such a definition has been attempted (NFNA 1994) but has proven problematical because it is very difficult to know whether a generation preceding the extant stand was planted/sown, e.g. oak and beech forests where planting has been used for hundreds of years at least in Europe.

When a planted stand of native species has later regenerated naturally, the planted origin of the previous generation can usually only be determined by studies of archives or by genetic studies of the trees. Often archives do not exist and they cannot prove whether a pre-archive stand was planted or not. The other method is tedious and cannot give a certain answer either. This seems to be the

reason why all other reviewed definitions which call levels n1-n10 natural forest, only employ features of the extant stand.

The abovementioned documentation problems have been attempted solved in the proposed terminology by incorporating different levels of necessary documentation at the various levels. This should be a help when referring a forest stand to a level, e.g. for inventory purposes.

1.3. Organisms as indicators

Ellenberg (1988) attempted to use field layer flora combined with forest management as determinants of a forest terminology. He found that his system works quite well in intensively investigated parts of Central Europe, but not quite so well in southern and eastern parts of Central Europe where investigations of forest vegetation are somewhat fewer. The requirement for detailed knowledge on flora makes the system less useful internationally.

Even so, field layer flora can be of great importance as indicator of naturalness of forests by having certain plant species absent, present or common. Different indicators can be identified for different levels of naturalness. The same goes for other groups having indicator species for more or less natural forests (e.g. lichens, saproxylic fungi and insects). Sets of indicator species are necessarily local/regional, because of limited distributions of indicator species (Hermy et al 1999). Using all species matching specific forest-related traits as indicators instead of using just a few listed species, might be worthwile in order to widen the geographical scope (Graae & Sunde 2000).

Certain sites at a specific level of naturalness can happen to have a more rare or typical biodiversity than some sites of a higher level. This can especially be the case when looking at limited sections of biodiversity and when comparing ancient woodland with recent woodland. For instance soil organisms and saproxylic organisms react very differently to forest management operations which break continuity of old trees and dead wood.

2. Recommendations - Conservation importance

The main use of terminologies on naturalness of forests relates to discussions of priorities relating to conservation of biodiversity. A sustainable balance between use and protection is an important factor in such discussions.

14 levels of forest naturalness have been identified in this review. Some levels, e.g. Primeval, Virgin and Old-growth Forest, are mainly retrospective and the appeal is to protect them. Other levels, e.g. Newly Untouched and Near-virgin Forest, have relevance in nature restoration activities and give hope for the future of biodiversity alongside wise management of the less natural levels. I find that it is of importance to understand all 14 levels when dealing with sustainable development and biodiversity protection, although aggregate levels will be enough for most reporting purposes.

Much work on forest conservation relates to the setting up of networks of protected areas. Site selection for conservation should benefit from using a stringent terminology and analysing which types of sites have high priority for inclusion in a reserve network. Many countries have so little forest with high levels of naturalness left that reserves need to be selected also in disturbed forests in order to represent ecological variation or just to reach adopted area targets. In such selection schemes

Ancient Woodland should be given high priority because of the importance of continuity for biodiversity.

Other selection criteria for reserve networks include hydrological regime, which is very important for biodiversity. Sites with restored or intact natural hydrology should be ranked higher than sites with modified hydrology. Old stands and trees should be ranked higher than younger ones. In general sites with a rich, typical, unusual or fairly intact biodiversity should be ranked higher than sites with less well-developed biodiversity.

When sites are selected, protection regimes need to be settled. Continuity of management system can be very important for biodiversity, so that changing Specially Managed Forest, e.g. ancient coppice or wood pasture, to Untouched Forest can be detrimental to important parts of site biodiversity. For other site types, the flora and fauna – especially saproxylic species - can benefit by a change to untouched status. Restored or natural hydrology, natural species composition and wildlife including large herbivores are important for the natural structures and functions of the ecosystem to redevelop optimally (Peterken 1996, Vera 2000).

Recommendations on how much forest should be protected in reserves usually range below 10 - 15 % of the forest area. For the remaining at least 85 % of forest areas Natural Forests with forestry and Man-made Forests (levels n3 through p1) are highly relevant in discussions of sustainable management. All production forests sustain some biodiversity. How much depends on how near-to-natural the management and the forest is. The proposed terminology can hopefully enhance and clarify discussions.

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Box 1 Terms on continuity of forest.

Ancient woodland – Forest sites which have been continuously wooded for several hundred years, at least since the time where reliable maps were first made (eg. 1600 or 1750 AD). Some may have continuity back to primeval forests whilst others arose as secondary woodland on ground cleared at some time in the far past. Continuity is not broken by felling, coppicing, planting nor any other forestry operation, provided that woodland of some kind regenerates immediately. Continuity is broken by an alternative land use, such as pasturage (unwooded) or agriculture/cultivation (after Peterken 1996).

Recent woodland – Forest sites which have shorter continuity than ancient woodland. (Peterken 1996).

Box 2 Terms on grazing regime

Ungrazed forest - Woodland showing no structural signs of the presence of large herbivores. This can be because of very low herbivore density or because there are only small herbivores present. In many regions this is an unnatural situation for woodland seen from a biodiversity and evolutionary perspective (Owen-Smith 1988, Vera 2000). Roe deer (Capreolus capreolus) at c. 25 kg is here defined as a "small" herbivore, while all heavier species are defined as being "large".

Grazed forest – Woodland showing structural signs of the presence of large wild/non-domestic herbivores. The signs are often in the form of changes in flora composition and tree regeneration rates, but can also be wallow sites, trampling effects or large trees wounded or even killed by wildlife. The effects on the forest ecosystem are highly dependent on species composition of grazers and on grazing pressure. Roe deer (Capreolus capreolus) at c. 25 kg is here defined as a "small" herbivore, while all heavier species are defined as being "large". *Comm: Large herbivores were an important part of prehistoric and primeval natural woodland ecosystems. The herbivore composition was quite diverse in most continents including different megaherbivores with large potential impacts on the forest (Owen-Smith 1988). In many regions extant large herbivores have relict, patchy distributions, eg. confined to national parks and other refuges (Buffalo, elephants etc.).*

Pasture forest – Woodland showing structural signs of being used for pasturage of domestic livestock either herded or fenced (cattle, horses, pigs, sheep, goats and similar). The forest structure often attains some of the characteristics of grasslands and can include flora and fauna elements from these.

Box 3 Terms on protection regime of forest

Minimum-intervention forest – Site specifically set aside by administrative or legal order as Minimum-intervention (=untouched) woodland from a specified time. Sub-types are Non-intervention and Protective Intervention. Protection and restoration of free dynamics and processes, ideally including natural hydrology, are top priorities. (NFNA 1994, Peterken 2000).

Traditional management – Site managed as it was in the past, preserving historic forms of interaction between people and nature. Due to prolongation of continuity this type often maintains a great diversity of species which would be threatened by a shift to other management or protection regimes. Important sub-types are coppice, wood-pasture and pre-industrial type selective cutting (NFNA 1994, Peterken 1996).

Designed management – Management is designed to meet some explicit nature conservation objective, such as maximising diversity, providing for a particular species, creating a mature stand or providing facilities for research and demonstration. (Peterken 1996).

Special management – Traditional and Designed Management can be grouped with similar low-intensity management types (e.g. for environmental protection) into Special Management. One purpose of this grouping is discerning these forest stands from stands with normal economically based forestry (NFNA 1994).

Gene-ressource protection forest – Forest stands specifically designated for gene-ressource protection of tree or shrub species. Management measures usually include buffer-zones in order to minimize risks of unwanted pollen incursion.

Appendix 1: 14 levels of forest naturalness with definitions

n10 Ultimate degree of naturalness – **Primeval Forest** – Forest ecosystems never modified by modern man/civilisation even indirectly, where the degree of impact on the ecosystem by indigenous people has not been significantly higher than the impacts of natural wildfire and of large wild animals (e.g. beaver (*Castor spp.*) or megaherbivores). The fauna includes a rich host of large animal species and is not significantly affected by human-induced extinctions or changes to animal population densities. Size is landscape-scale. *Comm: In Europe and America this type belongs in prehistorical times (before megaherbivore extinctions in stoneage), while examples might still occur in other parts of the world (e.g. perhaps some African National Parks). For prehistoric forests the time-period can be specified, e.g. Pleistocene forest or early-Holocene forest.*

n9 Extremely high degree of naturalness - **Virgin Forest** - Forest ecosystems virtually unmodified by man, and where the degree of former human impact on the forest - including soil and hydrology - has been only slightly more significant than the impacts of wildfire and animals (e.g. beaver (*Castor spp.*) or megaherbivores), and is no longer obvious. Wildlife inhabits the area with a fairly natural density and species composition including large herbivores and carnivores. Size is forest-scale. *Comm: In Europe this term has been used by many authors and lay people for the most extremely natural forests of Europe (Bialowieza and several others, see Peterken 1996) well knowing that they have been impacted somewhat by people in former times (grazing, selective cutting, fires etc).*

n8 Very high degree of naturalness - **Frontier forest** – A frontier forest is an area meeting the following criteria:
It is primarily forested and predominantly consists of indigenous tree species. It is big enough to support viable populations of all indigenous species associated with that forest type -- measured by the forest's ability to support wide-ranging animal species (such as elephants, harpy eagles or brown bears). It is large enough to keep these species' populations viable even in the face of the natural disasters -- such as hurricanes, fires, and pest or disease outbreaks -- that might occur there in a century. It is home to most, if not all, of the other plant and animal species that typically live in this type of forest. Its structure and composition are determined mainly by natural events, though limited human disturbance by traditional activities of the sort that have shaped forests for thousands of years -- such as low-density shifting cultivation -- is acceptable. As such, it remains relatively unmanaged by humans, and natural disturbances (such as fire) are permitted to shape much of the forest. In forests where patches of trees of different ages would naturally occur, the landscape exhibits this type of heterogeneity. (Rearranged/shortened from World Ress. Inst.:http://www.wri.org/ffi/lff-eng/).

n7 Very high degree of naturalness - **Near-virgin forest** – Forest ecosystems (forest scale) untouched long enough to have attained structures, dynamics and species composition similar to virgin forest, even though they may have been significantly modified, e.g. by clearcutting or agriculture at some time in the past. They are distinguished by a mixture in time and space between different seral stages, e.g. between old-growth stages and younger stages. Human impact on the forest structures is not obvious to see. The time necessary in untouched development before this level can be reached depends on how modified the situation was at the start. It is at least several hundred years if the starting point is a plantation-like forest.

n6 High degree of naturalness - **Old-growth forest** – Ecosystems (stand scale) distinguished by old trees and related structural attributes. Old growth encompasses the later stages of stand development

that typically differ from earlier stages in a variety of characteristics which may include tree size, accumulations of large dead woody material, number of canopy layers, species composition, and ecosystem function. The age at which old-growth develops and the specific structural attributes that characterize old growth will vary widely according to forest type, climate, site conditions, and disturbance regime. For example, old-growth in fire-dependent forest types may not differ from younger forests in the number of canopy layers or accumulation of down woody material. However, old-growth is typically distinguished from younger growth by several of the following attributes: 1) large trees for species and site, 2) wide variation in tree sizes and spacing, 3) accumulations of large-size dead standing and fallen trees that are high relative to earlier stages, 4) decadence in the form of broken or deformed tops or bole and root decay, 5) multiple canopy layers, and 6) canopy gaps and understory patchiness. Old-growth is not necessarily "virgin" or "primeval." Old-growth can develop following human disturbances. (USFS 1989, Wells et al 1998). If the stand is known to be planted/sown or predominantly consists of exotics it is referred to level p4, Partly-natural planted forest or p1/p2, Exotic forests.

n5 Quite high degree of naturalness - **Long untouched forest** – Relatively intact forest (stand level) that has been essentially unmodified by human activity for the past sixty to eighty years or for an unknown, but relatively long time. Signs of former human impacts may still be visible, but strongly blurred due to the decades without forestry operations. The time limit depends on how modified the forest was at the starting point. If the stand is known to be planted/sown or predominantly consists of exotics it is referred to level p4, Partly-natural planted forest or p1/p2, Exotic forests.

n4 Moderately high degree of naturalness – **Newly untouched forest** – Forest stands where forestry operations have been discontinued or never occurred since stand establishment, and which are known to have been left untouched for less than sixty to eighty years. Signs of former human management are usually easily visible, becoming more blurred with time. In principle any stand would belong here between forestry operations. If discontinuation of operations is only because of long management intervals, the stand is referred to lower levels. If the stand is known to be planted/sown or predominantly consists of exotics it is referred to level p4, Partly-natural planted forest or p1 p2, Exotic forests.

n3 Medium degree of naturalness – **Specially managed forest** – Forest stands with low-intensity use (allowing for presence of significant old-growth attributes) or where long continuity of pre-industrial type traditional use has given rise to a more or less characteristic forest structure, often with an interesting biodiversity and also often of cultural value. Examples are coppice, pasture forest, non-industrial selective logging and various stands of low accessibility or with protective or recreational functions. Excludes stands where the characteristic structures and attributes have been lost due to discontinuation or to large changes in the traditional use. If the stand is known to be planted/sown or predominantly consists of exotics it is referred to level p4, Partly-natural planted forest or p1/p2, Exotic forests.

n2 Fairly low degree of naturalness –**Exploited natural forest** – Forest stands used and modified by humans so that the forest structure and species composition is more or less heavily changed from the originally natural situation, but still predominantly consisting of self-sown native trees, and without a plantation-like structure. Can be exploitation without preceding silviculture (e.g. modifying old-growth forest), or stands with medium-intensity forest management (e.g. near-to-nature forestry). If a significant proportion of the stand is known to be planted/sown it is referred to level p4, Partly-natural planted forest.

n1 Low degree of naturalness – **Plantation-like natural forest** – Forest stands predominantly consisting of self-sown native trees with high-intensity forest management, so that the forest structure has become plantation-like by being even-aged, having relatively low tree ages, fairly regular tree spacing and only one or two tree species in the canopy layer. If it is not certain that the stand is self-sown it is referred to level p3, Native plantation.

p4 Low degree of naturalness – **Partly-natural planted forest** - Forest stands predominantly consisting of planted or sown native trees, and having somewhat natural structure by being un-evenaged, with mixed species or having significant ingrowth of self-sown trees (e.g. because multiple species have been planted and not intensively managed for timber and/or because of old age and low intensity of forestry). In certain cases such stands are left untouched long enough to correspond to levels n4, n5 or n6. They may be called newly untouched, long untouched and old-growth planted forest respectively.

p3 Extremely low degree of naturalness – **Native plantation** – Intensively managed, basically even-aged forest stands predominantly consisting of native trees, established artificially by planting or sowing with regular spacing. Often monocultures, but sometimes two or more species are established together. Usually the genetic variety of the plantation trees differs from the original genetic variety of the locality.

p2 Almost no degree of naturalness – **Exotic plantation** – Forest predominantly consisting of non-native tree species, where the stand origin is artificial by planting or sowing. In certain cases such stands (or p1) might be left untouched long enough to correspond to levels n4, n5 or n6. Such stands may be called newly untouched, long untouched and old-growth exotic forest respectively.

p1 Variably low degree of naturalness – **Exotic self-sown forest** - Forest stands predominantly consisting of self-sown non-native tree species. In certain cases this category can spread at an undesirable scale, e.g. to the extent that it has replaced or seriously suppressed the species previously occupying the specific area. Such cases can be called forest of invasive species. If it is not certain that the stand is self-sown it is referred to level p2, Exotic plantation.

Any forest stand should be possible to refer to level by a field visit supplemented by general historical and biological knowledge of the area.

Appendix 2: Definitions of terms covering multiple levels

n1 - n10 = **Natural forest** – Forest stands predominantly composed of self-sown native trees. They are in other words naturally regenerated and complementary to planted/sown stands and exotic self-sown stands. (After FAO 2001a). *Comm: They range from undisturbed by humans (e.g. virgin forest) to heavily utilized for grazing, wood production etc. The degree of naturalness can be described by referring to more detailed levels or subclasses of natural forest. Stands which have natural processes or structures present are taken to be self-sown if no information indicates otherwise. "Natural forest dynamics" refer to the natural dynamics of natural forest undisturbed by humans. They often include a cycle of seral stages of growth.*

p3, 4 + n1 - n10 = **Native forest** – Forest stands predominantly consisting of native trees. These can be planted, sown by man or self-sown. They can be used/managed or not. *Comm: Native trees means species which have evolved in the same area, region or biotope where the forest stand is growing and are adapted to the specific ecological conditions predominant at the time of the establishment of the stand (FAO 2001a).*

p1, 2 = **Exotic forest** – Forest stands predominantly consisting of non-native trees. These can be planted, sown by man or self-sown. They can be used/managed or not.

p2 + p3 **Forest plantation** – Intensively managed forest stands established artificially by planting or seeding and having regular spacing and even-aged structure. Usually only one tree-species is planted, but sometimes two or more are planted together. (After FAO 2001a). *Comm: They can be either native or exotic species or mixed. Excludes native stands which were established as plantations but which have lost the specific structure of plantation later, e.g. because of long time without intensive management or because many of the planted trees have been cut and self-sown trees have been allowed to take their place.*

p2 - p4 = **Planted forest** – Forest stands established artificially by planting or seeding. (After ITTO 2002).

p1 + n1 - n10 = **Self-sown forest** – Forest stands predominantly consisting of trees which have germinated and grown from spontaneous seedfall, either wholly naturally or influenced by various silvicultural activities, e.g. scarification.

p1 - p4 = **Man-made forest** - Forest stands which are either predominantly consisting of non-native (introduced, exotic) tree species or which have been established artificially by planting or seeding.

n4 - n1= **Secondary forest** – Forest stands of native species regenerated largely through natural processes after significant human and/or natural disturbance of the original forest vegetation at a single point in time or over an extended period, and displaying a major difference in forest structure and/or canopy species composition with respect to primary forests on similar sites. (After Chokkalingam & Jong 2001). *Comm: Typical disturbance types are clearcutting, logging, flood, fire and deforestation in general. Continued modification often takes place, e.g. forestry. Can revert to primary forest if untouched natural development proceeds for a sufficiently long time.*

n5 - n10 = **Primary forest** - Relatively intact forest areas that have always or at least for the past sixty to eighty years been essentially unmodified by human activity. Human impacts in such forest

areas have normally been limited to low levels of hunting, fishing and harvesting of forest products, and, in some cases, to historical or pre-historical low intensity agriculture. (After World Bank 1991, EU 1996)

n4, n5, n7, n9, n10, most of n8 and n6 and minor parts of p1, p2, p4. = **Untouched forest** (since specified year/decade/time) A common denomination of forests uninfluenced by forestry activities (felling, planting etc.) from a specified time. Is not affected by research, hunting or recreational activities etc. Usually the length of time is minor except in woods designated as untouched (=minimum-intervention) forest by administrative or legal order.

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V. Stocktaking, objectives, expected results and mechanics of meeting
Wulf Killmann

Stocktaking

The first meeting on harmonizing forest-related definitions held here in Rome in January this year indicated that the current definitions related to the Kyoto Protocol and the Forest Resources Assessment (FRA) are largely compatible in spite of some inconsistencies. In order to improve the comparability between the two sets of definitions, the Meeting recommended the following:

- Parties to the Protocol may wish to consider, in the second or subsequent commitment period, dropping the requirement of a 50-year non-forest condition for afforestation. This would eliminate the need for a definition of reforestation distinct from that of afforestation and bring the KP afforestation figures into closer agreement with the FRA results.
- FAO should take action to ensure that all the relevant bodies are aware of the final version of forest-related definitions of FRA 2000 and of the long international process in which they were derived
- FAO may wish to consider expanding the FRA definition of afforestation (i) to include assisted regeneration not involving direct seeding or planting; and (ii) to differentiate direct human-induced deforestation and permanent forest loss due to other causes. This would make the FRA data compatible with the needs of the Kyoto Protocol;
- In deciding about adopting the AHTEG definition of forests, the Convention on Biological Diversity (CBD) may wish to verify that it is using the FRA 2000 definitions of afforestation and reforestation correctly.

The Expert Meeting made the following recommendations for follow-up action:

(i) The process of harmonizing forest-related definitions should be continued and completed urgently under the umbrella of the Collaborative Partnership on Forests (CPF), with FAO acting as the secretariat, in cooperation with IPCC, IUFRO, CIFOR and the Secretariats of the CBD and UNFCCC.

(ii) Other stakeholders should be invited to participate in the process, including those who have not yet been part of the process (e.g., ILO).

(iii) The results of the Meeting (the Meeting Report and the Discussion Paper) should be transmitted by FAO to the interested parties, including the international and regional C&I processes. In particular the following meetings should be informed: COP-6 of CBD, IPCC meetings on Good Practice Guidance, and the Kotka IV meeting on FRA.

(iv) A Task Force of knowledgeable experts should be formed without delay to plan and implement identified follow-up work.

(v) FAO, in cooperation with the Task Force, should prepare a comprehensive analytical framework, including compilation and analysis of similarities and differences between different definitions and their relationships, in order to facilitate the follow-up process.

(vi) The draft report on the framework should be submitted to the participants of the Meeting and other experts for review and comment. Based on the comments received, the final version would be prepared.

(vii) A second Expert Meeting should be arranged, preferably in June 2002. The Meeting should review the report on the framework and decide on further action that may be required to harmonize forest-related definitions.

As we have learnt this morning, a number of other processes are connected with this meeting in one way or another, such as:

- the Kotka process led by FAO (about which we will hear later);
- the UNFCCC/SBSTA process on developing definitions for afforestation and reforestation under article 12 of the Kyoto Protocol;
- the IPPC- led process on Good Practice Guidance for LULUCF (task1);
- the IPCC task 2 on developing definitions for human-induced 'degradation' of forests and 'devegetation' of other vegetation types and methodological options to inventory and report on emissions resulting from these activities
- the work of the CPF Task Force on harmonizing and streamlining Forest-related reporting.
- IUFRO's recent work on forest terminology, e.g. on urban forestry, electronic discussion groups on key terms, and terminological awareness

We hope to avoid diverging results, e.g. with IPCC tasks through mutual participation in the processes, and through sharing ideas via regular reporting.

The June SBSTA 16 of UNFCCC and major Parties have recognized the work of the expert group. They have recommended close cooperation of IPCC with FAO. The output of our definitions process will be considered by the SBSTA in its work on defining afforestation and reforestation under the CDM.

As agreed upon during the first expert meeting in January, FAO has prepared, with the help of a consultant, a draft analytical framework, which has been circulated and will be presented later this morning. During this meeting we will discuss this draft framework further.

Objective

The objective of the meeting is to recommend options for harmonizing forest-related definitions, and thus contribute towards improving efficiency of processes in different international policy fora related to forests.

It has to be stated clearly that harmonization does not mean standardization. Harmonization can include adjustments for improved compatibility and consistency, establishing comparability, linkages and hierarchies between terms, but also documenting differences.

Scope

The field of forest-related definitions is wide. The first meeting agreed upon a series of core definitions to be tackled, such as:

Forest, forest land, other wooded land, afforestation, reforestation, deforestation, forest degradation, forest improvement, devegetation, revegetation, forest management, forest type, forest ecosystem, biome.

Additionally, some supporting terms and concepts should be looked at, such as:

Forest rehabilitation, forest restoration, forest fragmentation, natural expansion of forest, natural regeneration, assisted regeneration, primary forest, natural forest, virgin forest, semi-natural forest, secondary forest, regenerated forest, plantation forest, old growth forest, young forest, trees outside forest, low forest cover, natural seed sources, natural causes.

A further group of terms relates to the Kyoto Protocol and the Good Practice Guidance for assessing, reporting and accounting carbon stock changes, which urgently require harmonization, e.g. biomass, density and expansion or conversion factors. We may not be able to work on these definitions during this meeting. Nevertheless, there may be a window of opportunity now to avoid a profusion of conflicting or ambiguous terms later. We wanted to bring this issue to your attention and, for this purpose, have distributed a brief compilation of terms to be tackled in this context. In case there is time, we could devote some space to discuss this issue further on Friday.

Expected Results

The expected result of this meeting is a list of options/recommendations on how to deal with the different forest-related definitions to be submitted to different international fora, like the Subsidiary Bodies of CBD, UNCCD and UNFCCC, UNFF, COFO and others.

Mechanics of the Meeting

As was the case during the last meeting, it is suggested to split the plenary into four working groups, each of which should discuss the definitions falling under one of the following groupings:

- Forest and change processes between forest and non-forest classes
- Classification of forests
- Forest management and forest condition
- Change processes within forests

It is obvious that many terms are interconnected, and interchange amongst the groups would be required. Some terms like reforestation and forest fragmentation reappear even under different headings.

As you can deduct from the Agenda, we intend to spend a fair amount of time in the different working groups, but need to touch base in-between to take stock about progress. The major part of Friday is supposed to be used for finalizing the results in plenary.

VI. Terminology in assessing and reporting forest carbon change

Dieter Schoene

Background

Assessing, reporting and accounting carbon stock changes in forests necessitates new terminology. However, although the measurement of carbon release and sequestration are new themes in forestry, they can build on established concepts of traditional forestry and on existing terms for these concepts. Thus, the "annual carbon stock change" of a growing stand corresponds to its "net annual increment"; "mean carbon storage" of a forest translates into its "average growing stock" in terms of timber. It will be essential to use the new terms consistently and to employ traditional forestry terms in this new context correctly.

More importantly, an opportunity may still exist at this early stage to standardize terms *a priori* instead of having to go through the effort of harmonizing and adjusting a profusion of ingrained terms *ex post*. The following is a first attempt in that direction.

The need for consistency is already evident. Examples of muddled use of traditional and new terms and the negative consequences abound. Thus, the 1996 Revised IPCC Guidelines prescribe a method for calculating "gross annual growth increment", meaning "net annual increment" of a forest; mistakenly, "tree density" is used as a synonym for "wood density", disregarding the fact that wood density can be expressed in several measures, which lead to different values. The term "biomass expansion factors" is at times used incorrectly as a synonym for "biomass conversion factors". Biomass expansion factors, derived from, and only valid for, specific measures of growing stock, are indiscriminately applied to growing stock, increment or fellings, leading to flawed carbon stock changes in the latter cases. Which parts of trees are tallied as growing stock varies as widely as the components of biomass included in carbon stocks.

Forestry terms used in carbon assessment

The 1996 Revised IPCC Guidelines for LULUCF formula derive carbon stock changes in forests by the basic formula:

Gross annual growth increment = average annual growth per ha in biomass * hectares of land in the respective category
Gross annual biomass loss = total harvest by category incl. fuelwood *expansion ratio to treat slash
Annual biomass changer = total annual growth increment – total annual biomass loss

Therefore, the following forestry terms play a role in carbon assessment. National definitions of these terms can differ substantially; however, as they are firmly anchored in the national systems, harmonization and adjustment may be the most realistic approach.

Growing stock:

Standing volume (TBFRA 2000): Volume of standing trees, living or dead, above stump measured over bark to top (0 cm). Includes all trees with diameter over 0 cm (dbh). Includes tops of stems, large branches, and dead trees lying on the ground, which can still be used for fibre or fuel. Excludes small branches, twigs and foliage.

Growing stock (TBFRA 2000): The living tree component of standing volume.

Growing stock (FRA 2000): Stem volume of all living trees more than 10 cm diameter at breast height (or above buttresses if these are higher), over bark, measured from stump to top of bole. Excludes all branches.

Growing stock (USDA Forest Service Handbook): The main part of growing stock trees between a one foot stump height and the growing stock top. Also called merchantable stem. The minimum growing stock top is 4.0 inches diameter outside bark, or the point at which the main stem breaks into branches if this occurs before it reaches the top diameter.

Proposal for harmonization: Volume of all living trees more than *x cm* diameter at *breast height* (or above buttress if these are higher) *over* or *under bark* measured from *ground* or *stump* height to a top of *y cm*, *excluding* or *including branches* to a minimum diameter of *z cm*. Excludes smaller branches, twigs, foliage, seeds, roots. Also called merchantable stem[1].

Growing stock losses: Harvest, fellings, removals, natural losses

IPCC Guidelines: They do not differentiate fellings from removals and use the generic term "harvest" without defining it. Yet, an exact definition is important for carbon accounting, as evidenced from the following.

Fellings (FRA 2000): Average volume of all trees, living or dead, measured over bark to a minimum diameter of 10 cm dbh, that are felled during a given period (e.g. annually), whether or not they are removed from the forest or other wooded land. Includes silvicultural and pre-commercial thinnings and cleanings of trees more than 10 cm dbh left in the forest and natural losses of trees above 10 cm dbh.

Fellings (TBFRA 2000): Identical, but with diameter of 0 cm.

Removals (FRA 2000): (Annual) removals that generate revenue for the owner of the forest or other wooded land or trees outside the forest. They refer to "Volume Actually Commercialized", i.e. volume under bark actually cut and removed from the forest. This volume may include wood for industrial purposes (e.g. sawlogs, veneer logs, etc.) and for local domestic use (e.g. rural uses for construction). Includes removals of trees felled during an earlier period and removal of natural losses. Excludes bark, stumps, branches, treetops, harvesting waste and removals of fuelwood.

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[1] Various measures of growing stock can be adjusted and converted rather easily, based on known mensurational relations among tree components, e.g. taper curves, form classes, etc.
As shown below, these differences do not present a major problem in carbon assessment. Parties should merely specify the parameters chosen from the general, harmonized definition above.

Removals (TBFRA 2000): Average annual fellings that are removed from the forest, other wooded land or other felling site during the given reference period.

Natural losses (TBFRA 2000): Average annual losses to the growing stock during the given reference period, measured to a minimum diameter of 0 cm dbh, due to mortality from causes other than cutting by man, e.g. natural mortality, diseases, insects, fire, windthrow or other physical damage.

The difference between the terms related to harvesting is relevant for carbon assessment.
In a given year, substantial amounts of timber, which have been felled in previous years, may be removed. If such is the case, calculating carbon losses from removals may result in an overestimate of carbon drain[2]. Removals disregard biomass from pre-commercial harvests, small-diameter thinnings and cleanings, which may constitute a substantial fraction of fellings in young forests. On-site chipping of timber as fuel for heating and energy plants plays a growing role, yet fuelwood is excluded from removals. In this case carbon loss is underestimated.

The 1996 IPCC Good Practice Guidelines refer to the FAO Forest Products Yearbook for default "harvest" data. Yet, this annual report refers to *removals*, whereas the term *fellings* would be the one more closely related to carbon drain.

Proposal: Accept TBFRA separate definitions for removals and fellings and employ fellings in carbon stock change assessment wherever possible.

Growing stock gains: Growth, increment

The **1996 IPCC Guidelines** use "gross annual growth increment" and calculate it from "average annual growth per ha in biomass", without defining the terms and without specifying treatment of mortality. Growth is a well-established general term in forestry and used when speaking of growth in general. Increment is more specific and preferred usage when applied to the increase stand parameters over time (Davis, 1966, p. 64). It is a technical term, referring to the increase in girth, diameter, height, basal area, volume, quality or value over a specific period (Helms, 1998), and is defined below.

Gross annual increment (TBFRA 2000): Average annual volume of increment over the reference period of all trees measured to a minimum diameter breast height of 0 cm. Includes the increment of trees which have been felled or have died during the reference period.

Net annual increment (TBFRA 2000): Average annual volume over the given reference period of gross increment less that of natural losses of all trees to a minimum dbh of 0 cm.

Proposal for harmonization: Procedure consistent with that proposed for growing stock (by necessity).

[2] On the other hand, removals are measured under bark. Many biomass expansion factors expand volume over bark. Applying the latter would underestimate biomass drain by 5-25 percent.

Terms in biomass stock and change assessment

Woody biomass (TBFRA 2000): The mass of woody parts (wood, bark, branches, twigs, stumps and roots) of trees, alive and dead, shrubs and bushes, measured to a minimum diameter of 0 cm dbh. Includes above-stump woody biomass, stumps and roots; excludes foliage. Also excludes non-woody vegetation.

Above-ground woody biomass (TBFRA 2000): The mass of the woody part (stem, bark, branches, twigs) of trees, alive or dead, shrubs and bushes, excluding stumps and roots.

Stumps and roots (TBFRA 2000): Parts of the whole tree volume, which excludes the above-stump woody biomass. Height of stump is taken to be that at which tree would be cut under normal felling practice in that country. Excludes small roots.

Woody biomass (FRA2000): As above. Includes stumps and roots, no explicit exclusion of small and fine roots

These terms from FRA 2000 are useful, but do not represent all necessary terms for biomass and carbon assessment. Some additional concepts are defined in the following, based as a first approach on the USDA Forest Service Handbook (cited in Wharton and Griffith, 1997).

Forest ecosystem biomass: Woody and non-woody biomass of a forest ecosystem.

Growing stock biomass (GB): The oven-dry weight (including or excluding bark) of growing stock. Also called merchantable stem biomass.

Timber[3] biomass (TB): Growing stock biomass plus branches, twigs, foliage, seeds, coarse and fine roots. Differentiation into above-ground or above-stump biomass and below-ground or below-stump biomass.

Timber biomass volume (TBV): Volume of growing stock plus volume of branches, twigs, foliage, seeds, roots.

Fellings biomass (FB): Timber biomass of fellings.

Timber biomass increment (TBI): Oven-dry weight of annual (gross/net) increment plus net increment of branches, twigs, foliage, roots. (Smaller than net primary productivity of biomass from timber trees, which includes turnover of foliage, branches and fine roots.)

[3] Timber, as used here, is defined in the USDA Forest Survey Handbook as all living trees 5 inches DBH and larger, including growing stock trees and cull trees. The term is not quite appropriate, as "timber" apparently has a dual meaning: a) forest crops and stands containing timber; b) wood, other than fuelwood, potentially usable for lumber. Perhaps one might consider replacing timber by the more neutral term "tree" or "stand", e.g. tree biomass, stand biomass.

Proposal: Besides woody biomass, growing stock biomass and timber biomass might be used in carbon inventories and introduced separately into TBFRA to increase transparency, since these are the biomass and carbon pools directly calculated from growing stock. Non-timber woody and non-woody vegetation biomass and carbon stores should not be included in the biomass expansion or conversion factors since added variability and error may occur. The term "timber" might be replaced by "tree" or "stand".

TBFRA biomass definitions may include foliage and fine roots, as they are usually included in biomass studies and biomass expansion factors. They can represent a significant fraction of the biomass of young stands. Fine roots in particular represent a high fraction of primary productivity of these stands and are not included in soil organic matter.

When referring to carbon in the respective biomass, the expression "carbon in ..." might be used, e.g. carbon in fellings biomass, carbon in timber biomass or carbon in growing stock.

Defining conversion and biomass expansion factors

Currently, "biomass expansion factor" is a generic term used rather inconsistently to describe a multiplication factor, which expands growing stock or growing stock biomass to account for non-merchantable biomass components of the forest ecosystem. There is no consensus on the exact definitions of either the base for the expansion or the non-merchantable components to be included, or on the units of measurement of the product. The following exemplifies current practice.

- ☐ One of the first applications (Johnson and Sharpe, 1982), transformed *growing stock* biomass *under bark* to total *biomass*, including upper bole, branches, foliage, bark, stump, roots , non-commercial species, seedlings, saplings, other vegetation, standing dead biomass, forest litter and soil organic matter.
- ☐ The Revised 1996 IPCC Guidelines expand "average annual *growth rate* of *stemwood over bark* (m^3/ha) to total tree biomass growth rate (t)", and indicate that in addition to "stem and branches" Parties may include other unspecified components to arrive at the total tree *biomass volume*.
- ☐ TBFRA 2000 expanded net annual increment (m^3/a), to timber biomass increment (t biomass/m^3/a) using *growing stock* expansion factors and then converted to carbon stock change (t C/a).

Biomass expansion factors have been applied indiscriminately to growing stock, increment, fellings or removals of individual trees, entire stands, individual age classes or entire forests to derive stocks and changes of ecosystem biomass or its components (e.g. leaves, roots, above- or below-ground compartments).

Figure1 provides a systematic overview of the most important ways of employing or deriving biomass expansion factors.

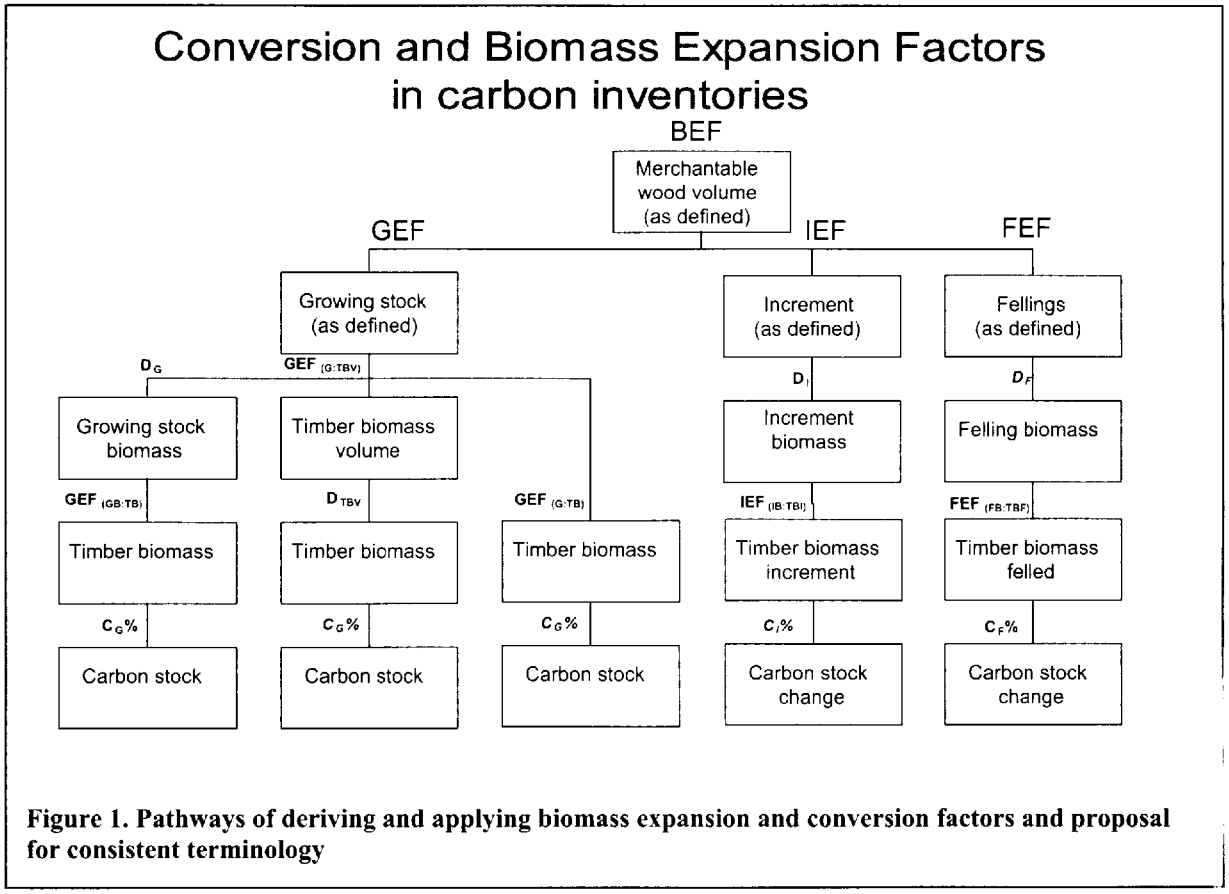

Figure 1. Pathways of deriving and applying biomass expansion and conversion factors and proposal for consistent terminology

The nomenclature for biomass expansion factors chosen in Figure 1 follows recently proposed patterns (Snowdon *et al.*, 2000; Wirth and Schumacher, 2002). Besides the above *expansion* factors, several *conversion* factors facilitate carbon inventories:

Specific densities[4] (D) convert volumes to biomass oven-dry weight:

D_G = wood density, usually defined as the ratio of oven-dry weight of wood over its green volume (Ilic *et al.*, 2000, p.2; Reyes *et al.*, 1992)

D_I = wood density of increment, not necessarily identical to D_G

D_F = density of fellings, not necessarily identical to D_G or D_I

D_{TBV} = density of timber biomass volume, likely to deviate from D_G, D_I,, D_F

Carbon fractions (C%) convert biomass to carbon:

C_G % = carbon fraction of timber biomass, not necessarily identical to the carbon content of timber biomass increment (C_I%) or to the carbon content of the fellings biomass (C_F%).

Parties define and measure growing stock, increment or fellings differently. Therefore, variations in biomass expansion factors may not reflect different biomass allocation in trees, but rather different minimum top and breast-height diameters, stump heights, measurement points, volume formulae, or dissimilar treatment of bark, defects, branches and harvest losses. Frequently, merchantable volumes can be adjusted to account for these different definitions by using established conversions or expert

[4] When it comes to carbon in wood products, the term density has to be defined very clearly, as oven-dry, green, basic density and specific gravity may be considered.

judgement (Kramer, 1982; Koehl, 2000). Where this cannot be accomplished, the expansion factors themselves may compensate for these different definitions, and will then differ for a legitimate reason. There are, therefore, two possible approaches for carbon stock change assessment:

- ☐ Locally derived biomass expansion factors or allometric equations will compensate for different local definitions of growing stock automatically;
- ☐ Growing stock volumes can be adjusted to the definitional standard implicit in "borrowed" expansion factors or allometric equations.

Proposal: Currently there are no generally accepted ways of deriving or applying biomass expansion and conversion factors in carbon assessments or generally accepted definitions of terms and concepts. On the other hand, a definite need for consistent terminology is emerging and will become more urgent as the GPG enter into force and the first Commitment Period approaches. The framework for expansion and conversion factors, proposed here elaborating some approaches found in current literature, might be considered.

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