Forests and Climate Change Working Paper 5

Definitional issues related to reducing emissions from deforestation in developing countries

Forests and Climate Change Working Paper 5

Definitional issues related to reducing emissions from deforestation in developing countries

Dieter Schoene, Wulf Killmann,
Heiner von Lüpke, Mette LoycheWilkie

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 2007

Foreword

The United Nations Framework Convention on Climate Change and the Kyoto Protocol explicitly recognize the important role of forests in global climate change and, therefore, commit all Parties to protect them and manage them sustainably. After all, the natural growth and expansion of forests buffer the Earth's atmosphere almost as effectively as do the oceans against ever steeper leaps in CO_2 concentrations from our emissions. At present, forests still offer the only practicable means of removing some excess carbon from the atmosphere, an ability reflected simply and convincingly in the famous saw-tooth curve of CO_2 concentrations from Mauna Loa.

According to FAO's most recent Global Forest Resource Assessment, FRA 2005, forests safeguard more carbon, in biomass and soils, than the entire Earth's atmosphere. However, this carbon store is dwindling. During the closing decade of the last millennium, roughly13 Mha of forests disappeared annually. Sooner or later, most of the carbon, an average of roughly 100 t/ha, which is presently tucked away safely in trees and soils, will find its way into the atmosphere, thereby enhancing global warming. Deforestation thus contributes about one quarter of all anthropogenic carbon emissions.

Deforestation continues to haunt mankind. In spite of some twenty years of worldwide activism against deforestation, we are presently at bay. Finally, the global community has come to see this old acquaintance in new light; we cannot succeed in abating climate change without seriously tackling deforestation. As countries debate and negotiate commitments, measures and incentives for the next commitment periods, reducing emissions from deforestation in developing countries is one of the principal challenges.

But what exactly do we mean by deforestation? Which "forests" are considered? Is "deforestation" the issue, or is it "net forest area loss"? Could countries offset some deforestation by afforestation? Surely, emissions from attrition of growing- and carbon stocks within forests by unsustainable use, at present practically unknown, can be as harmful and perhaps as plentiful as those from some forest conversions? Can we afford to ignore them in the climate change context? How do we deal with accrual of carbon stocks in remaining forests through natural growth, through silvicultural enhancement or even through CO_2 enrichment of the air?

It is admittedly a wide leap from the broad issue of global deforestation's impacts on climates to hair-splitting in analyzing relevant terms and definitions, the topic of this paper. However, the step is necessary, as previous negotiations under the UNFCCC have shown. Diverging interpretations of such simple terms as "forest", "afforestation", "reforestation" or "deforestation", and their ramifications for carbon accounting, occupied dozens of pages in IPCC reports and weeks of negotiators' time, with some ambiguities still lingering on.

FAO and international partners, supported by the SBSTA of the UNFCCC, therefore organized several workshops to clarify and harmonize differing definitions of relevant forestry terms ex post. This paper reflects an FAO contribution to the Rome workshop. It analyzes core forestry terms relevant to ongoing negotiations on reducing emissions from deforestation in developing countries and offers supporting terms.

The message is simple: Established and well defined forestry terms should be applied whenever possible and in their correct meaning. New terms that might be needed should be defined ex ante and their use standardised. Consistent, disciplined use of terms will facilitate efficient negotiations, implementation, monitoring and streamlined reporting of a global scourge that we need to tackle.

José Antonio Prado
Director
Forest Management Division
Forestry Department, FAO

Table of Contents

Executive summary

The paper provides background on definitional issues related to reducing emissions from deforestation in developing countries (RED-DC). It reflects the FAO presentation on "Definitional issues, including those relating to links between deforestation and degradation" given during a UNFCCC-organised workshop on RED-DC, held from 30 August to 1 September 2006.

The ad hoc use of the forest-related terms in the UNFCCC and Kyoto Protocol and other processes has, in some instances, complicated negotiations, implementation, monitoring and reporting. This paper analyses existing definitions for forest, deforestation and forest degradation and other forest-related terms and the issues related to their use in the context of the Convention and the Protocol. It discusses the definitions with regard to key criteria for their use in the UNFCCC and Kyoto Protocol processes, i.e. they should be unambiguous, allow for assessment of carbon stock changes and greenhouse gas emission and removals, include measurable parameters and be compatible with definitions used in other international forest-related processes.

The paper concludes that, in order to facilitate efficient negotiations and implementation, as well as streamlined future reporting, Parties to UNFCCC might consider, ex ante, a comprehensive set of definitions for the negotiations on reducing emissions from deforestation in developing countries. Widely used and accepted definitions should be applied wherever possible in their correct meaning. There is an opportunity to select from already established definitions from multilateral agreements, parallel processes, or international bodies, in particular IPCC or FAO. New terms should be clearly defined at an early stage and their use standardized. Consistent terminology will be crucial for efficient negotiations, implementation and future monitoring and reporting.

Mandate[1]

Based on decision FCCC/SBST/2006/L.8 of the Subsidiary Body on Scientific Advice (SBSTA) of the United Nations Framework Convention on Climate Change (UNFCCC), the Secretariat of UNFCCC asked FAO to consider relevant aspects and deliver a presentation on "Definitional issues, including those relating to links between deforestation and degradation" during a workshop on reducing emissions from deforestation in developing countries, to be held at FAO in Rome, 30 August to 1 September 2006.This paper provides background and reflects the FAO presentation.

[1] letter to FAO, 17 July, 2006

1. Introduction

The presentation centres on the following core terms: forest, deforestation and forest degradation. It touches on related terms used by Parties in their submissions, or those covering aspects likely to be relevant for future discussion (italicized terms to be found in the glossary, Appendix 1).

In the past, ad hoc, ambiguous use of terms, e.g. “forest”, “afforestation”, “reforestation”, “promotion of natural seed sources”, or even the term “forest degradation”, have sometimes complicated negotiations, implementation or reporting under UNFCCC Kyoto Protocol and related processes. Some country submissions therefore explicitly requested a comprehensive set of definitions for the negotiations on reducing emissions from deforestation in developing countries.

These negotiations will benefit if Parties select and employ from the very beginning established definitions from multilateral agreements or international bodies, wherever feasible. New terms that might be needed can be clearly defined and their use standardised to facilitate efficient negotiations and implementation, as well as streamlined future reporting.

Criteria for a set of definitions

Key considerations for choosing and defining relevant terms include the following:

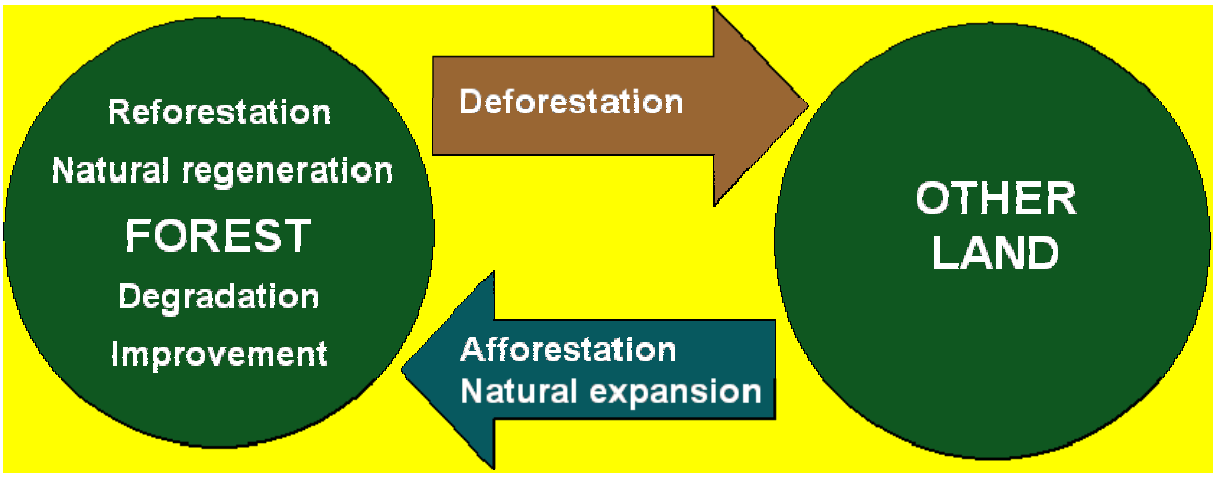
- they should be unambiguous and serve the purpose, i.e. assessment of carbon stock changes and greenhouse gas emissions and removals[2] resulting from an activity;
- definitional parameters should be measurable during assessments;
- definitions should permit synergies and cost effective assessment and reporting, e.g. by being compatible with, or building on, related assessment and reporting processes.

[2] the latter term refers to carbon sequestration and must not be confused with “wood removals”, as used in forest resource assessments; removals are relevant if *net* emissions from forest areas and area loss are considered.

2. Processes causing carbon stock changes and greenhouse gas emissions from forests

Figure 1 illustrates forest change dynamics linked to greenhouse gas emissions and/or removals.

Figure1: Forest change dynamics



Source: FAO, 2006[3]

More specifically, carbon stock changes in, or greenhouse gas emissions and removals by, forests may occur or be affected in the following ways:

- Natural processes in the forest ecosystem (growth, ageing, *mortality*, forest fires or other *disturbances*);
- Indirect human influences, such as climate change, CO_2- fertilization, industrial emissions and their interactions;
- Sustainable management practices, e.g. regeneration, tending and harvesting in forests;
- Conversions of forests to other forest types;
- Unsustainable use, such as *over-harvesting*;
- Conversion of forests to cropland, grassland, wetlands, settlements, or other lands as used by the Intergovernmental Panel on Climate Change (IPCC, 2003a).

A transition matrix (Table 1) illustrates the spectrum and scale of transitions that occurred in the pan-tropics between 1990-2000. It compares area changes for the categories used between 1990 (last two columns) with the corresponding totals in 2000 (last two rows)[4]. Cells of the matrix reflect specific transitions[5]. As per the FAO definition of forest, *agro-forests* and *urban forests*[6] are classified under the category "*other land cover*" in this matrix. If certain urban- and agro-forests are also considered as forests, e.g. in the Marrakech Accords (MA) to the Kyoto Protocol, transition processes will multiply and monitoring could become even more demanding.

[3] "reforestation" and "other lands" as defined by FAO, 2001.
[4] Thus, net loss of closed forests between 1990 to 2000 was 1205.1-1135.2, or 70 Mha; Complete conversion of closed forests to another land cover occurred on 43 Mha.
[5] For example, between 1990 and 2000 1.2 Mha of closed forests underwent a transition to open forests
[6] see Appendix 1.

Table1: Area transition matrix for the period 1900-2000 at pan-tropical level in Mha (FAO, 2001)

1990-2000 area transition matrix Pan-tropical

(Million ha)	Land cover classes in 2000										
Land cover classes in 1990	Closed Forest	Open Forest	Long Fallow	Fragmented Forest	Shrubs	Short Fallow	Other Land Cover	Water	Plantations	Total 1990	% of total land area
Closed Forest	1131.6	1.2	5.7	9.4	1.3	9.8	43.1	1.1	1.9	**1205.1**	*39.3*
Open Forest	0.2	287.3	0.5	6.8	0.7	2.2	6.6	0.1	0.0	**304.5**	*9.9*
Long Fallow	1.1	0.1	63.2	0.2	0.0	4.8	4.7	0.0	0.2	**74.4**	*2.4*
Fragmented Forest	0.5	0.4	0.2	202.1	0.5	2.2	11.2	0.1	0.2	**217.5**	*7.1*
Shrubs	0.1	0.1	0.0	0.1	143.5	0.6	9.7	1.8	0.1	**155.9**	*5.1*
Short Fallow	1.0	0.3	1.2	1.5	0.2	122.7	11.6	0.2	0.4	**139.0**	*4.5*
Other Land Cover	0.6	0.5	0.5	2.3	3.7	4.9	928.4	1.3	2.3	**944.4**	*30.8*
Water	0.2	0.0	0.0	0.0	0.8	0.0	1.2	5.6	0.0	**7.8**	*0.3*
Plantations	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	18.0	**19.3**	*0.6*
Total 2000---->	**1135.2**	**290.0**	**71.5**	**222.5**	**150.6**	**147.3**	**1017.6**	**10.2**	**23.2**	**3068.0**	
% of total land area	*37.0*	*9.5*	*2.3*	*7.3*	*4.9*	*4.8*	*33.2*	*0.3*	*0.8*		

The table illustrates area changes only. Changes within forests, e.g. growing stock attritions or accretions, may also affect net greenhouse gas emissions or removals. In their submissions to UNFCCC, some countries suggest including even *devegetation* as an activity to be covered by an eventual agreement. Parties will have to decide to which of these land-cover categories, area transitions and other change processes an eventual agreement will apply, and if gross or net carbon stock changes, emissions and/or removals should be considered.

The following analyzes definitional options for the terms forest, deforestation and forest degradation in order to facilitate informed choices. For this analysis, definitions may be compared by referring to their exact wording (Boxes 1, 2, 3) or schematically, via comparative matrices, where shaded cells indicate that the definition covers the item, a blank cell that it does not. Any quantitative parameters given are provided in the cells (Tables 2, 3, 4).

In addition, the paper highlights some terms employed by the IPCC in its guidelines for transforming forest change processes into emissions and removals of greenhouse gases (IPCC, 2007).

Forest

Definitions for the term forest have been discussed at length during the *First* and *Second Expert Consultations on Harmonizing Forest–related Definitions by Various Stakeholders*, which were organized by FAO and IPCC jointly with other partners in Rome in 2002 (FAO, 2003). Three globally established forest definitions emerged. They are provided in Box 1, and compared schematically in Table 2.

Box 1: Definitions of Forest

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 having 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.

UNEP/CBD, 2001: Forest is a land area of more than 0.5 ha, with a tree canopy cover of more than 10 percent, which is not primarily under agriculture or other specific non-forest land use. In the case of young forest 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, 2006: Land spanning more than 0.5 hectares with trees higher than 5 metres and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agriculture or urban use.

Explanatory note:

Forest is 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 in situ. Areas under reforestation that have not yet reached but are expected to reach a canopy cover of 10 percent and tree height of 5 m are included, as are temporarily unstocked areas, resulting from human intervention or natural causes, which are expected to regenerate.

It includes areas with bamboo and palms provided that height and canopy cover criteria are met.

It includes forest roads, firebreaks and other small open areas; forest in national parks, nature reserves and other protected areas, such as those of specific scientific, historical, cultural or spiritual interest.

It includes windbreaks, shelterbelts and corridors of trees with an area of more than 0.5 ha and width of more than 20 m.

It includes plantations primarily used for forestry and protection purposes, such as rubberwood plantations and cork oak stands.

It excludes tree stands in agricultural production systems, for example fruit plantations and agroforestry systems. The term also excludes trees in urban parks and gardens.

Table 2[7]: Attributes and thresholds of "forest"

Parameters	MA[8]	CBD[9]	FAO/FRA[10]
Young stands			
Temporarily unstocked areas			
Forestry land use			
Min. area (ha)	0.05-1.0	0.5	0.5
Min. height (m)	2-5	5	5
Crown cover (%)	10-30	10	10
Strip width (m)			20

Major differences between these globally applied forest definitions are

- differing quantitative thresholds for *crown cover*, height, and minimum area;
- treatment of non-forest land uses and temporarily unstocked areas;

Quantitative thresholds

Under MA, only industrial (Annex I countries-AI) are obliged to define forests, by selecting parameter values within the ranges allowed and indicated in the matrix above. These values should be "consistent with the information that has historically been reported to the FAO or other international bodies".

Historically, a full set of parameter values has been reported to FAO only for the Forest Resources Assessment (FRA) 2000 and FRA 2005. Most countries reported data which they themselves had adjusted to FAO standards; some reported based on unadjusted national parameters which, for the year 2000, FAO then adjusted to the globally agreed parameter values with the consent of countries. AI countries should therefore choose parameter values within the allowable ranges, consistent with their "historical" reporting to FAO in 2000, 2005 or both.

Non-Annex I countries (NAI) must currently only define forest if they intend to participate in the CDM, selecting from the same set of parameters values as AI countries (Neef et al., 2006).

Under these new negotiations, many more NAI countries might have to define forests. Their existing national forest definitions reflect specific biomes, biophysical and social conditions; they are anchored in history, law and forestry practice. Applying such a national definition to the current process might appear simple, consistent, and match existing national datasets. However, most countries' definitions do not quantify at least some parameters. Unfortunately, national definitions cannot therefore be simply transposed to the current process[11]. Therefore, all participating developing countries might have to define a complete set of parameters and values which could be common, biome- or country-specific, or may even vary within a country.

[7] for interpretation see text above.
[8] Marrakech Accord.
[9] Convention on Biological Diversity.
[10] Global Forest Resources Assessment of FAO.
[11] Of the 122 NAI countries which reported to FAO, 44 countries employ merely functional definitions; forty countries used at least one quantified parameter to define forest; twenty-one countries applied the FAO definition with 3 parameters; seventeen countries did not provide national definitions.

Land use

Considering predominant land use as a criterion for defining a forest will have implications for negotiations, implementation, monitoring and reporting. Applying the forest definition of the MA could considerably increase the total forest area affected by an agreement. Appendix 2 lists agroforestry systems ranging from quasi closed forests to croplands with sparse trees, covering about 400 Mha worldwide[12]. The difficulties of monitoring such very diverse areas and estimating carbon losses within a certain confidence interval would increase over-proportionally with the areas included.

Supporting terms

Related terms and definitions are found in the glossary (Annex I): *tree, shrub, primary forest, modified natural forest, semi-natural forest, managed forest, planted forest, forest plantation, agro-forestry, other wooded land, other land, other land with tree cover, open forest, closed forest, fallow systems, fragmented forest, urban forest.*

Issues and choices

- Existing national definitions of forest in developing countries are rarely directly applicable;
- To avoid proliferating definitions, incompatibilities, inconsistencies and complications in implementation, monitoring and reporting, a single definition of forest might eventually be considered for all purposes of the climate change regime, which is meaningful in terms of greenhouse gases and satisfies the criteria listed above;
- Given their prevalence in developing countries and ambiguous classification as forest or non-forest, *fragmented forests* and *forest fallow-systems* (long and short fallows*)* must clearly be defined and explicitly in- or excluded ;
- Parties might consider defining additionally a minimum strip width and a maximal spatial assessment unit for deforestation and carbon stock changes within forests.

[12] with an average carbon storage of 9, 21, 50,and 63 t C / ha in semiarid, sub-humid, humid and temperate regions, respectively (Montagnini and Nair, 2004).

Deforestation

Differences between major existing definitions of deforestation from the MA to the Kyoto Protocol under UNFCCC and FAO/FRA (Box 2) are analyzed in Table 3.

Box 2: Definitions of Deforestation

Deforestation is:

Decision 11/CP.7 (UNFCCC, 2001): the direct human-induced conversion of forested land to non-forested land.

FAO 2001: The conversion of forest to another land use or the long-term reduction of the tree canopy cover below the minimum 10 percent threshold.

Explanatory note:

1. 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.

2. It includes areas of forest converted to agriculture, pasture, water reservoirs and urban areas.

3. 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.

4. Deforestation also includes areas where, for example, the impact of disturbance, over-utilization or changing environmental conditions affects the forest to an extent that it cannot sustain a tree cover above the 10 percent threshold.

Table 3: Parameters for "deforestation"

Parameter	M A	FAO/FRA
Transition from forest to non-forest		
Land-use change		
Crown cover change	< 10 - 30 %	< 10 %
Only directly human-induced		
Temporarily non-stocked condition does not constitute deforestation		

In both definitions, deforestation consists in a transition from forest, however defined, to non-forest. The term *forested land*, as used by the MA, is undefined. The *Second Expert Consultation on Harmonizing Forest-related Definitions* (FAO, 2003) recommended use of the term *forest* instead.

In contrast to FAO/FRA, the MA considers only a directly human-induced transition from forest to non-forest as deforestation[13]. All other differences in Table 3 follow the definition of forest and its analysis above.

In both definitions, a temporarily unstocked stage is not considered as deforestation. Only FAO/FRA once suggests a duration[14]. Analogue to the rules for AI countries under the MA, a means of differentiating deforestation from a temporarily unstocked state would be needed for the process on reducing emissions from deforestation in developing countries. Differentiation would be less essential if carbon stock changes within the forest are included in an agreement. Defining a maximum spatial assessment unit to assess deforestation might also be necessary, analogous to rules for AI-countries under the MA.

Supporting terms

Appendix I lists potentially relevant terms and definitions related to deforestation: *net forest area change, forest area loss, natural expansion of forests, devegetation, disturbance, crown cover*

Issues and choices

Beyond the issues related to the definition of forest above, e.g. regarding *agroforestry* and *fallow systems*, the following may be considered:

- Opting for the MA definition may include net emissions from many agroforests, urban forests and other lands with tree covers exceeding minimum thresholds, such as fruit orchards; the costs of monitoring will increase, efficiency decline;
- Opting for the FAO definition which considers predominant land use in addition to crown cover will include only forests as "traditionally" defined; it will raise economic efficiency and allow synergies within assessments;
- If the FAO definition of forest is chosen, incidences where only the predominant land use, but not the land-cover falls below the threshold, will often remain undetected. In terms of emissions, however, this will be irrelevant;
- Should the focus be on deforestation or on net loss of forest area?
- Temporarily unstocked stands represent a dilemma for assessment only if merely outright deforestation, but not carbon stock changes within a forest are considered (see below);
- The term *avoided deforestation* remains to be defined.

[13] In the future, FRAs may differentiate between direct human-induced deforestation and long-term loss of tree cover due to other causes (FAO 2003).
[14] 10 years (FAO, 2000)

Forest degradation

Aware of potential difficulties, SBSTA in Decision 11/CP7 invited IPCC, inter alia, "to develop definitions for direct human-induced "degradation" (sic) of forests … and methodological options to inventory and report on emissions resulting from these activities…."

Box 3 lists different definitions of forest degradation; they are compared in Table 4.

Box 3: Definitions of Forest Degradation

FAO, 2000: a reduction of 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). In a more general sense, forest degradation is the long-term reduction of the overall supply of benefits from forest, which includes wood, biodiversity and other products or service.

FAO 2001, 2006: 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.

Explanatory note:

Takes different forms particularly in open forest formations deriving mainly from human activities such as overgrazing, overexploitation (for fuelwood or timber), repeated fires, or due to attacks by insects, diseases, plant parasites or other natural sources such as cyclones. In most cases, degradation does not show as a decrease in the area of woody vegetation but rather as a gradual reduction of biomass, changes in species composition and soil degradation. Unsustainable logging practices can contribute to degradation if the extraction of mature trees is not accompanied with their regeneration or if the use of heavy machinery causes soil compaction or loss of productive forest area.

FAO, 2003: the long-term reduction of the overall potential supply of benefits from the forest, which includes carbon, wood, biodiversity and other goods and services.

UNEP/CBD, 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 under-canopy vegetation.

ITTO, 2002: Long-term reduction of the overall potential supply of benefits from the forest, including wood, biodiversity and other products or services.

ITTO 2005: a direct human-induced loss of forest values (particularly carbon), likely to be characterized by a reduction of tree crown cover. Routine management from which crown cover will recover within the normal cycle of forest management operations is not included.

IPCC 2003a: a direct human-induced loss of forest values (particularly carbon), likely to be characterized by a reduction of tree cover. Routine management from which crown cover will recover within the normal cycle of forest management operations is not included.

IPCC, 2003b: a direct human-induced activity that leads to a long-term reduction in forest carbon stocks.

IPCC, 2003c: the overuse or poor management of forests that leads to long-term reduced biomass density (carbon stocks).

IPCC, 2003d: a direct human-induced long-term loss (persisting for X years or more) of at least Y % of forest carbon stocks (and forest values) since time T and not qualifying as deforestation or an elected activity under Article 3.4 of the Kyoto Protocol.

Table 4: Parameters of forest degradation

Parameter	FAO 2000	FAO 2001, 2006	FAO 2003	UNEP/ CBD 2001	ITTO[15] 2002	ITTO 2005	IPCC 2003d	IPCC 2003a	IPCC 2003b	IPCC 2003c
Forest type										
secondary forest										
Change within the forest										
structure										
crown cover	10%									
species composition										
stocking										
Reduction of capacity to provide:										
Productivity										
goods										
services										
carbon stocks							> y %			
other functions										
Time scale	long		long		long		long	long	long	long
specified duration							X years			
Cause										
human- induced										
natural										
Reference state										
natural forest										
site										
carbon stock at initial date										
Exclusion										
deforestation										
forest management under Art.3.4										

[15] in FAO 2003

A comparison of attributes addressed (Table 4) illustrates considerable amplitude. Nevertheless, most globally established definitions allude to the basic notion of a human-induced, long-term, negative change in the forest's structure, function and capacity to provide goods and services in general. Degradation has thus the clearly negative connotation of a long-term impairment of a forest.

Such a long-term impairment, however, can realistically only be assessed ex post, after a given observation period. This violates one criterion for a set of useful definitions listed above, in that degradation in this sense is not measurable during a short assessment period.

Moreover, a useful definition should also serve the purpose, namely a strong link to greenhouse gas emissions resulting from an activity. Again, the traditional notion of forest degradation does not meet this criterion: Certain forms of degradation, such as very slowly reversible soil compaction, impacts of acid rain or felling damages to residual trees, may not result in carbon emissions over long time spans. Vice versa, reductions in *crown cover* or *growing stock* that do cause short-term carbon emissions, i.e. in sustainable *selective harvesting*, *thinning* or *shelter-wood cuttings*, do not degrade a forest. On the contrary, these measures may improve it.

Overall, forest "degradation" appears as an unfortunate term for the purpose of addressing emissions from "forests remaining forests" (IPCC, 2003, 2007). Significantly, the IPCC task force established under 11/CP7 (s. above) could not agree on any definition of forest degradation for this purpose. The *Second Expert Meeting on Harmonizing Forest-related Definitions* (FAO, 2003) also recommended using another term than "degradation", such as "stock reduction" in the context of carbon monitoring in forests remaining forests.

Supporting terms

At the management unit, landscape or national level, forest degradation may take the form of *forest fragmentation***,** with or without reaching the threshold for deforestation within a spatial assessment unit. Forest fragmentation is particularly pronounced in the tropics, where affected areas may exceed the area of deforestation. A drastic increase in the length of exposed forest edges induces tree *mortality* and *disturbances* and decreases biomass. Carbon emissions arising from these edges are clearly human induced, would not have happened without fragmentation, and are not negligible (Laurance, 2005).

Other directly human –induced processes, such as *forest rehabilitation*, *forest restoration* and *forest improvement* may lead to possible carbon stock accretion within the forests. .

Moreover, there is evidence for indirectly human-induced carbon stock increases through enhanced *biomass growth* in many tropical forests as consequences of higher temperatures, nitrogen deposition, altered *disturbance*- and competition regimes, and raised CO_2 levels in the ambient air. This sequestration with an estimated magnitude of 0.05 to roughly 0.5 t C/ha yr^{-1} (Laurance 2005; Baker et al., 2005), is not negligible for net emissions.

Finally, growing stocks and carbon stocks may accrue within many logged-over or secondary tropical forests as a result of the natural *biomass growth* through ageing.

Issues and choices

Parties may have to decide

- which processes leading to carbon stock reductions and greenhouse gas emissions in forests, without qualifying as deforestation, should be covered by an agreement;
- whether to continue using the term forest degradation
- how to address forest fragmentation;

- if there should be quantitative thresholds and spatial assessment units;
- whether and how to address direct or indirect human impact;
- whether and how to address and separate human-induced and natural carbon stock changes.

Terms relating forest change processes to greenhouse gas emissions and removals.

The current initiative under UNFCCC centres less on deforestation *per se*, but rather on *the emissions* caused by deforestation or unsustainable use of forests. Conceivably, it could also include greenhouse gas removals by forests if *net* emissions are the concern. In this context, deforestation area or an attrition of growing stock in a forest serves only as proxy variables. Correlation between these variables and related greenhouse gas emissions may be low, because the carbon pools defined by the Kyoto Protocol, that is, *above-ground biomass*, *below-ground biomass*, *dead wood* , *litter* and *soil organic matter*, may vary tremendously in absolute amounts, in relative proportions and in their reaction to human activities. Moreover, parties may resolve to account for other carbon pools, above all harvested wood products, which tend to counterbalance carbon stock changes in the forest.

The 2003 IPCC Good Practice Guidelines (IPCC, 2003) and the 2006 IPCC Guidelines (IPCC, 2007) offer methods, default activity data, parameters and terminology to quantify emissions from all of these pools. Therefore any final accord on reducing emissions from deforestation in developing countries should not only specify the pools and greenhouse gases covered, but also employ consistent terminology. Contrary to past experiences, where terms and definitions had to be harmonized *ex post*, terminology may advantageously be standardized *ex ante*.

The glossary (Appendix I) defines core terms, such as *above-ground biomass, below-ground biomass, dead wood, litter and soil organic matter***,** *biomass expansion factors and biomass conversion and expansion factors*

Supporting terms

Table 5 relates relevant additional terms (IPCC, 2007).

Table 5: Terminology for stocks and changes in forests (IPCC, 2007)

component	stock	stock increase	stock decrease
merchantable volume	growing stock	net annual increment	wood removals
biomass in the merchantable volume	growing stock biomass	increment biomass	removals biomass
total above-ground biomass	above-ground biomass	above-ground biomass growth	above-ground biomass removals
total below-ground biomass	below-ground biomass	below-ground biomass growth	below-ground biomass removals
total above-and below-ground biomass	total biomass	total biomass growth	biomass removals
carbon	carbon in any of the compartments above, e.g. carbon in growing stock or biomass removals, or in litter, deadwood and soil organic matter		

Felling during forest harvesting may damage or destroy additional trees in the *above-ground biomass* which are not removed. Unless *Reduced Impact Logging (RIL*) is applied, typical stand damages in conventional logging in many developing countries range from 10% to 70% of the residual trees (FAO, 2004), depending on logging intensity. Site damage in the form of soil compaction, soil disturbance, or erosion will also release greenhouse gases from other carbon pools.

Only a fraction of the *carbon in the biomass removals* ends up in long-term product storage. *Carbon in the biomass* remaining on site and carbon in conversion by-products, e.g. sawdust, will be emitted relatively quickly. In many developing countries, the *lumber recovery factor* may be as low as 10%, and rarely averages more than 30% of the *removals biomass* (FAO, 2004).

Issues and choices

Parties may consider:

- if and how to relate deforestation and forest change processes within forests to greenhouse gas emissions and removals;
- ♦ using terminology employed and defined in the relevant IPCC Guidelines.

Summary

Ad hoc use of terms in the past history of UNFCCC and Kyoto Protocol and related processes has in some instances complicated negotiations, implementation, monitoring and reporting. Therefore, Parties might consider a comprehensive set of definitions for the negotiations on reducing emissions from deforestation in developing countries ex ante.

The current process offers the opportunity to select from the very beginning established definitions from multilateral agreements, parallel processes, or international bodies, in particular IPCC or FAO. Widely used and accepted definitions should be applied wherever possible in their correct meaning. This applies particularly to the term forest degradation, which is not very well related to the attrition or accrual of carbon stocks in and emissions from a forest. New terms that might be needed should be clearly defined ex ante and their use standardised. Overall, consistent terminology will be crucial for efficient negotiations, implementation and future monitoring and reporting.

References

Baker, T.R., *et.al.*, 2005. Late Twentieth-century trends in the biomass of Amazonian forest plots. In: Malhi, Y. and Phillips, O.L. (ed.): Tropical Forests & Global Atmospheric Change. Oxford University Press: 31-38.

FAO, 2000. FRA 2000 – On definitions of forest and forest cover change. FRA programme, Working paper 33, Rome, Italy.

FAO, 2001. Global Forest Resources Assessment 2000, Rome, Italy.

FAO, 2003. Proceedings. Second Expert Meeting on Harmonizing Forest-related Definitions for Use by Various Stakeholders**.** September 11-13, 2002.

FAO, 2004. Reduced impact logging in tropical forests. Forest Harvesting and Engineering Working Paper No.1. FAO. Rome, Italy

FAO, 2006. Global Forest Resources Assessment 2005, Rome, Italy.

IPCC, 2003a. Definitions and methodological options to inventory emissions from direct human-induced degradation of forests and devegetation of other vegetation types. Institute for Global Environmental Strategies, Japan. Alternative 1, p. 14

IPCC, 2003b. ibidem; Alternative 3, p.14

IPCC, 2003c. ibidem; Alternative 5, p.15

IPCC, 2003d. ibidem; "framework for a definition"; p.16

IPCC, 2007. 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Institute for Global Environmental Strategies, Japan.

ITTO, 2005. Revised ITTO criteria and indicators for the sustainable management of tropical forests including reporting format. ITTO Policy development series No 15.

Laurance, W.F., 2005. Forest climate interactions in fragmented tropical landscapes. In: Malhi, Y. and Phillips, O.L. (ed.): Tropical Forests & Global Atmospheric Change. Oxford University Press: 31-38.

Neeff, T. von Lüpke, H., Schöne, D., 2006. Choosing a forest definition for the Clean Development Mechanism. Under preparation.

Montagnini, F., P.K.R. Nair, 2004. Carbon sequestration. An underexploited environmental benefit of agroforestry systems. In: New vistas in Agroforestry. P.K.R. Nair et al. (eds.). Kluwer: 281-295.

Rakonczay, Zoltán, 2002. Biome-specific forest definitions, UNFCCC/TP/2002/1.

UNEP/CBD/SBSTA. **2001.** Main Theme: Forest Biological Diversity. Report of the Ad Hoc Technical Expert Group on Forest Biological Diversity. Subsidiary Body for Scientific, Technical and Technological Advice, Seventh Meeting, Montreal, 12-16 November 2001.
(www.biodiv.org/programmes/areas/forest/definitions.asp)

UNFCCC, 2003. Modalities and procedures fore afforestation and reforestation activities under the clean development mechanism in the first commitment period of the Kyoto Protocol, Decision 19/CP.9, draft decision CMP1 (*Land use, land-use change and forestry*) UNFCCC/SBSTA 19, 2003.

UNFCCC, 2004. Land-use, land-use change and forestry, Decision11/CP.7, UNFCCC/SBSTA (Marrakech Accords).

UNFCCC, 2006. Issues relating to reducing emissions from deforestation in developing countries and recommendations on any further process. Submissions from Parties. FCCC/SBSTA/2006/MISC.5.

UNFCCC, 2006. Reducing emissions from deforestation in developing countries: Draft conclusions proposed by the Chair, FCCC/SBSTA/2006/L.8.

Appendix 1: Glossary of supporting terms

Term	Source	Definition	Explanatory notes / comments
Above-ground biomass	IPCC 2006 GL FRA 2005	All living biomass above the soil including stem, stump, branches, bark, seeds and foliage.	1. Where the forest understorey is a relatively small component of the above-ground biomass, it is acceptable to exclude it, provided this is done in a consistent manner throughout the inventory time series.
Above-ground biomass growth	IPCC 2006 GL	Oven-dry weight of net annual increment (s.b) of a tree, stand or forest plus oven-dry weight of annual growth of branches, twigs, foliage, top and stump. The term "growth" is used here instead of "increment", since the latter term tends to be understood in terms of merchantable volume.	
above-ground biomass removals			
Agroforestry	ICRAF FAO	Agroforestry is a collective name for land-use systems and practices where woody perennials are deliberately integrated with crops and/or animals on the same land management unit. The integration can be either in spatial mixture or temporal sequence. There are normally both ecological and economic interactions between the woody and non-woody components in agroforestry.	
Avoided Deforestation		*To be defined*	
Below-ground biomass	IPCC 2006 GL FRA 2005	All living biomass of live roots. Fine roots of less than (suggested) 2mm diameter are sometimes excluded because these often cannot be distinguished empirically from soil organic matter or litter.	1. May include the below-ground part of the stump. 2. The country may use another threshold value than 2 mm for fine roots, but in such a case the threshold value used must be documented.
Below-ground biomass growth	IPCC 2006 GL	growth in below-ground biomass including coarse roots and root collar.	Fine root litter excluded
Biomass	FRA 2005	Organic material both above-ground and below-ground, and both living and dead, e.g., trees, crops, grasses, tree litter, roots etc. Biomass includes above – and below – ground biomass.	

	IPCC 2006 GL	Living plant and animal material both above-ground and below-ground (s.a.) usually expressed as dry weight.	Biomass literally means living matter, but the term is also used for any organic material derived from plant and animal tissue. In the context of bio-energy, biomass is any material of biological origin excluding material embedded in geological formations and transformed to fossil.
Biomass conversion and expansion factor (bcef)	IPCC 2006 GL	A multiplication factor that converts merchantable volume of growing stock, merchantable volume of net annual increment or merchantable volume of wood-and fuelwood removals to above-ground biomass, above-ground biomass growth or biomass removals, respectively. Biomass conversion and expansion factors for growing stock ($BCEF_S$), for net annual increment ($BCEF_I$) and for wood- and fuelwood removal ($BCEF_R$) usually differ. As used in these guidelines, they account for above-ground components only. For more detail see box 4.2.	
Biomass expansion factor (BEF)	IPCC 2006 GL	A multiplication factor that expands the dry-weight of *growing stock biomass*, *increment biomass*, and biomass of *wood- or fuelwood removals* to account for non-merchantable or non-commercial biomass components, such as stump, branches, twigs, foliage, and, sometimes, non-commercial trees. Biomass expansion factors usually differ for growing stock (BEF_S), net annual increment (BEF_I) and wood- and fuelwood removals (BEF_R). As used in these guidelines, biomass expansion factors account for above-ground components only. For more detail see box 4.2.	
Biomass removals	IPCC 2006 GL	Biomass of wood- and firewood removals (s.b.) plus oven-dry weight of branches, twigs, foliage of the trees or stands removed.	for most purposes identical to above-ground biomass removals; in rare cases including below-ground biomass removals where all or parts of the root system is removed

Carbon stock	FRA 2005	The quantity of carbon in a "pool", meaning a reservoir or system which has the capacity to accumulate or release carbon.	For FRA 2005 purposes, examples of carbon pools are Living biomass (including Above and below-ground biomass); Dead organic matter (including dead wood and litter); Soils (soils organic matter). The units are mass.
	IPCC 2006 GL	The quantity of carbon in a pool.	
Closed forests	FRA 2000 IPCC 2006 GL	Formations where trees in the various stories and the undergrowth cover a high proportion of the ground (>40%).	
Crown cover/ **Canopy cover**	IPCC 2006 GL	The percentage of the ground covered by a vertical projection of the outermost perimeter of the natural spread of the foliage. Cannot exceed 100%.	
Dead wood	IPCC 2006 GL	Includes volume of all non-living wood not contained in the litter, either standing, lying on the ground, or in the soil. Dead wood includes wood lying on the surface, dead roots, and stumps larger than or equal to 10 cm in diameter or any other diameter used by the country. . Includes dead roots to usually 2mm diameter.	
Devegetation	IPCC, 2003a	A direct human-induced long-term loss of at least Y % of vegetation since time T on vegetation types other than forest. Vegetation types consist of a minimum area of land of Z ha with foliar cover of W%	IPCC Definitions and methodological options to inventory emissions from … and devegetation..
Disturbance	FAO, 2006.	An environmental fluctuation and destructive event that affects forest health, structure, and/or changes resource or physical environment at any spatial or temporal scale. Include biotic agents such as insects and diseases and abiotic agents such as fire, pollution and extreme weather conditions	
Forest area loss	to be defined	**synonym: net loss of forest area**	
Forest fallow systems	FRA 2005	Areas of shifting agriculture where forest, forest fallows and agricultural land appear in a dynamic pattern where deforestation and the return of forest occur in small patches.	FRA: deforestation explanatory note 3.
	FRA 2000	**Short fallow**: Agricultural area with short fallow periods	
	FRA 2000	**long fallow**: Forest affected by shifting cultivation	

Forest improvement	IPCC 2006 GL FRA 2005	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.	(FAO. 2001. Global Forest Resources Assessment FRA 2000 – Main report. Rome)
Forest plantation	FRA 2005 IPCC 2006 GL	Forest/other wooded land of introduced species and in some cases native species, established through planting or seeding.	1. Includes all stands of introduced species established through planting or seeding. 2. May include areas of native species characterized by few species, even spacing and/or even-aged stands 3. Plantation forest is a sub-set of planted forest.
Forest rehabilitation	ITTO	**Forest rehabilitation:** a management strategy applied on degraded forest land that aims at restoring the capacity of a forest to produce products and services.	ITTO Guidelines for the restoration, management, and rehabilitation of degraded and secondary tropical forests (ITTO, 2005)
Forest restoration	ITTO	**Forest restoration:** A management strategy applied in degraded primary forest areas. Forest restoration aims to restore the forest to its state before degradation (same function, structure and composition).	ITTO Guidelines for the restoration, management, and rehabilitation of degraded and secondary tropical forests (ITTO, 2005)
Fragmented Forests	CBD/SBSTA 2001	Forest fragmentation refers to any process that result in the conversion of formerly continuous forest into patches of forest separated by non-forested lands.	
Gross deforestation	*best not used*	*imperils core definition of deforestation*	
Growing Stock	FRA 2005 IPCC 2006 GL	Volume over bark of all living trees more than X cm in diameter at breast height. Includes the stem from ground level or stump height up to a top diameter of Y cm, and may also include branches to a minimum diameter of W cm.	1. The countries must indicate the three thresholds (X, Y, W in cm) and the parts of the tree that are not included in the volume. The countries must also indicate whether the reported figures refer to volume above ground or above stump. 2. The diameter is measured at 30 cm above the end of the buttresses if these are higher than 1 metre. 3. Includes windfallen living trees. 4. Excludes: Smaller branches, twigs, foliage, flowers, seeds, and roots.
Increment biomass	IPCC 2006 GL	Oven-dry weight of merchantable) net annual increment of a tree, stand or forest	

Litter	IPCC, 2006	Includes all non-living biomass with a diameter less than a minimum diameter chosen by the country (for example 10 cm), lying dead, in various states of decomposition above the mineral or organic soil. This includes litter, fumic, and humic layers. Live fine roots (of less than the suggested diameter limit for below-ground biomass) are included in litter where they cannot be distinguished from it empirically.	
Lumber recovery factor	FAO, 2004	Volume of sawn products produced from delivered log volume and expresses as %	
Managed Forest	FRA 2005	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).	The definition was adapted to the different needs of each world region. See: Area under forest management plan in 2000, pages 373-374 of the reference below. (FAO. 2001. Global Forest Resources Assessment FRA 2000 – Main report. Rome)
	IPCC 2006 GL	A managed forest is a forest subject to forest management: Forest management 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.	
Merchantable volume	Helms, J.A. Dictionary of Forestry.1998	Volume of a bole or stem suitable for sale	
Modified natural Forest	FRA 2005	Forest/Other wooded land of naturally regenerated native species where there are clearly visible indications of human activities.	1. Includes, but is not limited to: selectively logged-over areas, areas naturally regenerating following agricultural land use, areas recovering from human-induced fires, etc. 2. Includes areas where it is not possible to distinguish whether the regeneration has been natural or assisted.
Mortality	IPCC, 2006	Trees dying naturally from competition in the stem-exclusion stage of a stand or forest. As used here mortality does not include losses due to disturbances.	
Natural expansion of forest	FRA 2005	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.	(FAO. 2001. Global Forest Resources Assessment FRA 2000 – Main report. Rome).

Natural forest	FRA 2005 IPCC 2006 GL	A forest composed of indigenous trees and not classified as a forest plantation.	
Natural regeneration	FRA 2005	**Assisted natural regeneration**: Natural regeneration of forest/other wooded land with deliberate human intervention aimed at enhancing the ability of desired species to regenerate 1. Interventions may include removal of external pressures, such as weeds and biotic interference; the application of controlled disturbances to trigger germination of native species such as mosaic and or ecological burns; or the preparation of the germination site e.g. through scarification. 2. The source of seed or vegetative reproduction is limited to the site and its immediate surroundings and may comprise both native and introduced species.	
	IPCC 2006 GL	**Natural regeneration**: Re-establishment of a forest stand by natural means, i.e. by natural seeding or vegetative regeneration. It may be assisted by human intervention, e.g. by scarification of the soil or fencing to protect against wildlife or domestic animal grazing.	
Net annual increment	IPCC 2006 GL	Average annual volume of gross increment over the given reference period minus mortality (s.a.), of all trees to a specified minimum diameter at breast height. As used here, it is not net of losses due to disturbances (s.a.).	
Net deforestation	*best not used*	*imperils core definition of deforestation*	
Net forest area change	FAO 2006	Sum of all negative changes due to deforestation and natural disasters and all positive changes due to afforestation and natural expansion of forests	FRA: see deforestation explanatory note 3
Net loss of forest area	FAO 2006	As **net forest area change**, but negative	
Open forests	FRA 2000 IPCC 2006 GL	Forests characterised by crown cover below 40%, and above the minimum canopy cover threshold adopted by the Party.	
Other land	FAO, 2006	All land that is not classified as Forests or Other wooded land.	includes areas classifies under the sub-category Other land with tree cover
Other land with tree cover	FRA 2005	Land classified as Other land, spanning more than 0.5 hectares with a canopy cover of more than 10 percent of trees able to reach a height of 5 metres at maturity.	1. Includes groups of trees and scattered trees in agricultural landscapes, parks, gardens and around buildings, provided that the area, height and canopy cover criteria are met. 2. Includes tree plantations established mainly for other purposes than wood, such as fruit orchards.

Other wooded land	FRA 2005	Land not classified as Forest, spanning more than 0.5 hectares; with trees higher than 5 metres and a canopy cover of 5-10 percent, or trees able to reach these thresholds in situ; or with a combined cover of shrubs, bushes and trees above 10 percent. It does not include land that is predominantly under agricultural or urban land use.	
Planted forest	FRA 2005	Forest/other wooded land in which trees have been established through planting or seeding.	Includes all stands established through planting or seeding of both native and introduced species.
Primary Forest	FRA 2005 IPCC 2006 GL	Forest/Other wooded land of native species, where there are no clearly visible indications of human activities and the ecological processes are not significantly disturbed.	Includes areas where collection of non-wood forest products occurs, provided the human impact is small. Some trees may have been removed.
Reduced Impact Logging	FAO,2004.	Intensively planned and carefully controlled implementation of harvesting operations to minimize the impact on forest stands and soils usually in individual tree selection cutting	
Reforestation	FAO 2005	Establishment of forest plantations on temporarily unstocked lands that are considered as forests	
removals		see wood removals	
removals biomass	IPCC, 2007	Oven dry weight of wood removals.	
Secondary forest	FRA 2005 IPCC 2006 GL	Forest regenerated largely through natural processes after significant human or natural disturbance of the original forest vegetation.	1. The disturbance may have occurred at a single point in time or over an extended period; 2. The forest may display significant differences in structure and/or canopy species composition in relation to nearby primary forest on similar sites.
Selective felling	Helms, J.A. Dictionary of Forestry.1998	A felling that removes only a selected portion of the trees in a stand Synonymous: **selective cutting**, **selective harvesting**	
Semi-natural Forest	FRA 2005	Forest/ other wooded land of native species, established through planting, seeding or assisted natural regeneration.	1. Includes areas under intensive management where native species are used and deliberate efforts are made to increase /optimize the proportion of desirable species, thus leading to changes in the structure and composition of the forest. 2. Naturally regenerated trees from other species than those planted/seeded may be present. 3. May include areas with naturally regenerated trees of introduced species. 4. Includes areas under intensive

			management where deliberate efforts, such as thinning or fertilizing, are made to improve or optimise desirable functions of the forest. These efforts may lead to changes in the structure and composition of the forest.
Shelterwood cutting	Helms, J.A. Dictionary of Forestry.1998	Cutting of most trees, leaving those needed to produce sufficient shade to produce a new age –class	
Shrub	IPCC 2006 GL FRA 2005	Vegetation types where the dominant woody elements are shrubs i.e. woody perennial plants, generally more than 0.5 metres and less than 5 metres in height at maturity and without a definite crown.	The height limits for trees and shrubs should be interpreted with flexibility, particularly the minimum tree and maximum shrub height, which may vary between 5 meters and 7 meters.
Soil organic matter	IPCC, 2006	Includes organic matter in mineral and organic soils (including peat) to a specified depth chosen by the country and applied consistently through the time series. Live fine roots (of less than the suggested diameter limit for below-ground biomass) are included with soil organic matter where they cannot be distinguished from it empirically.	
Thinning	Helms, J.A. Dictionary of Forestry.1998	A cultural treatment made to reduce stand density of trees primarily to improve growth, enhance forest health, or recover potential mortality.	
total biomass growth	IPCC, 2007	sum of above-and below-ground biomass growth	excludes foliage and fine root litter
Tree	IPCC 2006 GL FRA 2005	A woody perennial with a single main stem, or in the case of coppice with several stems, having a more or less definite crown.	1. Includes bamboos, palms, and other woody plants meeting the above criteria.

Urban forest		Urban forestry is the management of trees for their contribution to the physiological, sociological, and economic well-being of urban society. Urban forestry deals with woodlands, groups of trees, and individual trees, where people live – it is multifaceted, for urban areas include a great variety of habitats (streets, parks, derelict corners, etc) where trees bestow a great variety of benefits and problems." Denne, pers. comm. The art, science, and technology of managing trees and forest resources in and around urban community ecosystems for the physiological, sociological, economic and aesthetic benefits that trees provide society"	Grey and Deneke, 1986 Helms, J.A. (Ed.). 1998. The Dictionary of Forestry. Society of American Foresters)
Wood removal	FRA 2005 IPCC 2006 GL	The wood removed (volume of round wood over bark) for production of goods and services other than energy production (fuelwood removal).	The term removal differs from fellings as it excludes felled trees left in the forest. Includes removal from fellings of an earlier period and from trees killed or damaged by natural causes. Includes removal by local people or owners for their own use.

Appendix 2: Agroforestry systems and practices [16]

System	Practice	Combination	Components
Agrosilvicultural systems	1.Improved fallow	trees planted during non-forest phase, if land not expected to revert to forest	t: fast growing h: agricultural crop
	2.Taungya	crops during tree seedling stage	w: plantation species h: agricultural crops
	3. Alley cropping	trees in hedges, crops in alleys	w: coppice trees h: crops
	4. Tree gardens	multispecies, dense, mixed	w: vertical structure, fruit trees h: shade tolerant
	5. Multipurpose trees on cropland	trees scattered, boundaries	w: multipurpose trees h: crops
	6. Estate crop combinations		w: coffee, coconut, fruit trees h: shade tolerant
	7.Homegardens	multistorey combinations around homes	w: fruit trees h: crops
	8. Trees in soil conservation, reclamation		w: multipurpose fruit trees h:crops
	9. Shelterbelts, windbreaks, live hedges	around farmland plots	w: trees h:crops
	10. Fuelwood production	firewood species around cropland plots	w: firewood species h: crops
Agro-silvipastoral; systems	14.Homegardens with animals	around homes	w: fruit trees a : present
	15.Multipurpose woody hedgerows	trees for browse, mulch, soil protection	w: coppicing fodder trees a, h: present
	16. Aquaforestry	trees lining ponds	w: leaves forage for fish
Silvipastoral systems	11.Trees on rangelands	scattered trees	w: multipurpose, fodder f: present a: present
	12. Protein banks	trees for protein-rich cut fodder	w: leguminous trees h: present a: present
	13. Estate crops with pasture	Example cattle under coconut palms	w: estate crops F: present a: present

[16] W: woody species; a: animals; h: herbaceous (crop) species