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MATTERS RELATED TO THE KYOTO PROTOCOL

MATTERS RELATED TO DECISION 1/CP.3, PARAGRAPH 5

LAND-USE CHANGE AND FORESTRY

Submissions by Parties

Note by the secretariat

1. At its eighth session, the Subsidiary Body for Scientific and Technological Advice (SBSTA) considered matters related to land-use change and forestry under the Kyoto Protocol, in accordance with decision 1/CP.3, paragraph 5 (a).

2. At that same session, the SBSTA invited Parties to submit information related to the implementation of Article 3.3 of the Kyoto Protocol, particularly on data and methods, and questions and issues identified in FCCC/SBSTA/1998/INF.1, by 15 August 1998 for compilation into a miscellaneous document by approximately 30 August 1998.

3. Ten such submissions have been received.* In accordance with the procedure for miscellaneous documents, these submissions are attached and are reproduced in the language in which they were received and without formal editing.

* In order to make these submissions available on electronic systems, including the World Wide Web, these contributions have been electronically scanned and/or retyped. The secretariat has made every effort to ensure the correct reproduction of the texts as submitted.

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PAPER NO. 1: AUSTRALIA

IMPLEMENTATION OF ARTICLE 3.3 OF THE KYOTO PROTOCOL

The Kyoto Protocol in Article 3.3 provides that:

"The net changes in greenhouse gas emissions by sources and removals by sinks resulting from direct human-induced land-use change and forestry activities, limited to afforestation, reforestation and deforestation since 1990, measured as verifiable changes in carbon stocks in each commitment period, shall be used to meet the commitments under this Article of each Party included in Annex 1. The greenhouse gas emissions by sources and removals by sinks associated with those activities shall be reported in a transparent and verifiable manner and reviewed in accordance with Articles 7 and 8."

Several other Articles in the Kyoto Protocol are closely linked to implementation of Article 3.3, notably:

- C Article 3.4 relating to additional human-induced activities which could be used to vary Parties' assigned amounts of emissions in the second and subsequent commitment periods, and optionally in the first commitment period;
- C Article 3.7 which sets out the basis for calculating the assigned amount of emissions of Annex 1 countries in the first commitment period 2008-2012;
- C Articles 5.1 and 5.2 dealing with establishment of national systems for estimating emissions and sinks of greenhouse gases and the methodologies to be applied for the first commitment period (and subsequently):
  - in particular Article 5.2 requires that methodologies applied shall be those contained in the revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Any elaboration of Article 3.3 needs to accord with these IPCC guidelines.
  - SBSTA 8 reached a conclusion, the text of which is quoted below, clarifying the steps to be followed in adjusting the assigned amount of a Party through the application of Article 3.3. SBSTA also clarified that the phrase "since 1990" means since 1 January 1990. It is recommended that this draft conclusion be submitted to COP4 in Buenos Aires for adoption.

> "(The SBSTA) understands the meaning of Article 3.3 in the Kyoto Protocol to be as follows: The adjustment to a Party's assigned amount shall be equal to verifiable changes in carbon stocks during the period 2008 to 2012 resulting from direct human-induced activities of afforestation, reforestation and deforestation since 1 January 1990. Where the result of this calculation is a net sink, this value shall be added to the Party's assigned amount. Where the result of this calculation is a net emission, this value shall be subtracted from the Party's assigned amount."

In developing the Protocol, it was recognised that differing circumstances apply in Parties' biophysical, economic and social conditions. For example, Australia is unique among Annex 1 countries in many respects.

In the continent of Australia, climate spans zones from the cool temperate to the hot tropics, and from high rainfall to desert. Ancient soils, often low in micro and macro nutrients, generally low terrain and long isolation from other continents has produced an often unique biota.

In contrast to other Annex 1 countries, Australia has extensive areas of grassy woodlands. Open and closed forest formations range from temperate and tropical rainforests to open forests. Where soils are poorer and rainfall less abundant, forest height is lower, canopies less dense and the number of species of trees in the canopy is often higher.

Fire is a significant element in the environment, whether started by people or by lightning. Some Australian vegetation types have adapted to fire such that many plants are 'fire resistant' and resprout from main branches and trunks, or from special below-ground woody structures called lignotubers. For some forest species fire plays a necessary part in triggering the sprouting of seeds.

These elements of the environment underpin as well as powerfully shape the kinds of land uses found in the continent. These factors need to be kept in mind when formulating strategies to address environmental management for carbon sequestration and emission.

Definitions

Implementation of Article 3.3 requires clear definitions of key terms used in the text. In particular these terms relate to the phrases afforestation, reforestation, deforestation, direct human induced and carbon stocks. There are also secondary issues arising from some of these terms that require clarification or definition.

Consistent with Article 5.2, the foundation for these definitions must be the IPCC 1996 Revised Guidelines. However, in some instances the IPCC guidelines are incomp lete or do not deal with the issue and further elaboration is required.

Forest, Afforestation, Reforestation and Deforestation

The definitions of forest, afforestation, reforestation and deforestation should be consistent with each other and consistently applied among key related articles. Consistency also needs to be maintained with the IPCC guidelines.

C Forest

A country should be able to employ a recognised definition of forest appropriate to its particular biophysical conditions.

IPCC definitions rely on the term 'forest' without defining it. There are various and somewhat inconsistent international definitions of the term 'forest'. The most widely used is that of the FAO.

Australia employs in its National Forest Inventory a definition[1] that is close to that of the FAO, but with small changes to make it appropriate to the unique character of parts of its forests, as well as practical to map with modern satellite technology and traditional techniques. This definition is sufficiently broad to encompass Australia's diverse forests including its native forests, plantations and areas often referred to as woodlands. It uses this definition in its reporting to the international Montreal Process for Sustainable Forest Management.

From a carbon accounting perspective, the carbon stocks of a forest should include all above and below ground living and non-living vegetation, litter, soil carbon and (consistent with Inventory practice) an appropriate proportion of the carbon in wood products removed during the commitment period.

C Afforestation and reforestation

The IPCC guidelines (Glossary) provide definitions of both afforestation and reforestation expressed in terms of a land use change.

Both definitions refer to 'planting' of forests. Clarification is needed to reflect that deliberate tree establishment can occur by a variety of techniques other than direct planting (eg. aerial seeding, burning to promote seed germination and regeneration of some Australian forest species).

It is noted that the terms 'afforestation' and 'reforestation' do not include replantings in existing forest areas. Similarly, plantations established by removal of native forest would not meet a definition of 'reforestation'. In neither case is there a land use change.

The IPCC definitions rely on interpretation of afforestation and reforestation of lands which historically have not contained forest. The situations of afforestation and reforestation will vary according to the circumstances of a country. 'Historical' is best interpreted in the local context.

C Deforestation

The IPCC guidelines (Volume 3, p 5.6, footnote 7) provide an interpretive definition of deforestation.

> "Conversion of forests [to another land use] is also referred to as 'deforestation' and it is frequently acc ompanied by burning."

[1] Forest is an area, incorporating all living and non-living components, that is dominated by trees having usually a single stem and a mature or potentially mature stand height exceeding 2 metres, and with existing or potential projected cover of overstorey strata about equal to or greater than 20%.

Deforestation is regarded as essentially the same as 'land use change' as used in Article 3.7 and which is reported by Australia in its National Greenhouse Gas Inventory under IPCC reporting category 5B 'Forest and Grassland Conversion'.

Harvesting of forests does not qualify as 'deforestation' because there is no change in land use.

C Direct human induced

Guidelines are needed to clarify interpretation of the term 'direct human induced'. The guidelines should be based on the core premise that all deliberate actions that result in land use change constitute direct human induced activities. The guidelines should clarify the boundaries between human and natural phenomena (eg. fire regimes) and between direct and indirect human induced activity.

The IPCC should provide technical advice on 'direct human induced activities' in the IPCC Special Report on Land Use, Land Use Change and Forestry and Carbon Emissions.

Data and Methodology

C Activity since 1990

The specified activities of afforestation, reforestation and deforestation since 1990 require identification of those areas of land which have undergone land use change since 1 January 1990. This feature must be factored into national inventories and reporting.

C Measurement of change in carbon stocks

The areas of land which have been afforested, reforested and deforested since 1990 need to be measured as changes in carbon stocks over the period 2008 to 2012. Methodologies need to be elaborated on the procedure for calculating these changes in carbon stocks, consistent with the 1996 IPCC Guidelines. Operationally this may be different from the requirements under Article 3.4 for a Party to establish its level of carbon stocks in 1990.

C Verifiable

Article 3.3 provides that:

> "The greenhouse gas emissions by sources and removals by sinks associated with those activities shall be reported in a transparent and verifiable manner and reviewed in accordance with Articles 7 and 8."

All sectors and sub-sectors of inventories are subject to a degree of uncertainty, in some cases high uncertainty, in estimation of emissions and sinks. Nevertheless there was general agreement at the recent IPCC experts meeting in Dakar that uncertainties associated with land use change and forestry, and soil carbon in particular, were no worse than for some other

aspects of the inventories such as methane and nitrous oxide which are fully included in the Kyoto Protocol.

Australia has produced National Greenhouse Gas Inventories based on transparent and verifiable methodologies and is currently making a substantial investment in establishing a world-class National Carbon Accounting System for terrestrial sources and sinks.

Estimation of emissions and sinks from terrestrial systems presents inherent uncertainties. The IPCC Special Report should provide guidance on interpretation of estimates of emissions and sinks associated with afforestation, reforestation and deforestation, so that the results meet the criterion of verifiability.

Additional Activities

Other activities associated with land use, land use change and forestry are to be dealt with in addressing the implementation of article 3.4 and through the IPCC Special Report on Land Use, Land Use Change and Forestry and Carbon Emissions.

PAPER NO.2: AUSTRIA
(ON BEHALF OF THE EUROPEAN COMMUNITYAND ITS MEMBER STATES)

METHODOLOGICAL ISSUES : (b) LAND-USE CHANGE AND FORESTRY IMPLEMENTATION OF ARTICLE 3.3

Information related to the implementation of Article 3.3 of the Kyoto Protocol and the IPCC Special Report on land-use and land-use change and forestry issues, particularly on data and methods, and questions and issues identified in FCCC/SBSTA/1998/INF.1, requested by the 15 August 1998 according to FCCC/SBSTA/1998/6

Introduction

Austria, on behalf of the European Community and its Member States, submits information related to the implementation of Article 3.3 of the Kyoto Protocol and the IPCC Special Report on land-use, land-use change and forestry issues, particularly on data and methods, and questions and issues identified in FCCC/SBSTA/1998/INF.1 as requested according to para 45(c)(i) in FCCC/SBSTA/1998/6.

The information provided includes the following items:

1. General remarks
2. Information on data and methods relevant to the implementation of Art.3.3
3. Issues identified in FCCC/SBSTA/1998/INF.1 relevant to Art.3.3 issues and to the IPCC Special Report

1. General remarks

The EU reaffirms its position at COP-3 that inclusion of sink activities should not undermine incentives for action on gross emissions mitigation. The EU has also always maintained that sinks require careful technical and scientific consideration before deciding how they can be included in ways to meet commitments under the Kyoto Protocol. The EU wants to emphasise the importance of the conclusions of SBSTA 8. They include a clarification of Art. 3.3 and how to handle the implementation of Art. 3.4:

- The meaning of Art 3.3 is clarified.
- Information is requested for the purpose of a workshop on data availability based on definitions used by Parties and international organisations in relation to Art. 3.3.
- Information is requested on modalities, rules and guidelines as to how and which additional human induced activities might be included under Art. 3.4.
- IPCC is requested to prepare a Special Report on land-use, land-use change and forestry in order to enable the COP to take decisions on recommendations on these issues to the COP/MOP.

The EU believes that the outcome of the Special Report is an indispensable basis for conclusions and decisions of COP/MOP relating to Art.3.3 and the possible addition of activities and categories under Art. 3.4.

Regarding verifiability of changes in carbon-stocks and transparency of reporting the EU endorses a system of full reporting which gives insight into **all** changes in **all** carbon-pools during the commitment period but limited use to meet the commitments under Art. 3 (i.e. the use is limited to the activities under Art. 3.3 of the Kyoto Protocol and possible additional activities to be decided under Art.3.4).

SBSTA 8 has clarified the interpretation of Art. 3.3 (see para 45 (b) of FCCC/SBSTA/1998/6). However, some issues remain open , e.g. whether or not Art. 3.3 includes the carbon stocks in forest soils. The Special Report should give guidance on the implications of in- or excluding forest soils (see also comments on para 16 and 17 in the table under item 3). In this respect, the EU strongly feels that no use can be made of activities leading to an increase of a certain carbon-pool, while depleting another (for instance carbon in forest soils) to meet commitments under Art.3.

In the view of the EU the Reference Manual and the Workbook of the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories are a good starting point for guidance on methodologies by which emissions according to Art.3.3 could be estimated. Item 2 of the EU's submission includes some further requirements which should be met to establish a reliable, consistent and accurate emission inventory for the land-use change and forestry sector, independent of the final definition of afforestation, reforestation and deforestation.

2. Information on data and methods relevant to the implementation of Art.3.3

According the opinion of the EU several refinements within the context of the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories have to be made to allow for a reliable, consistent and accurate emission inventory for the land-use change and forestry sector in view of Article 3.3 of the Kyoto Protocol. The following two principles have been identified as important:

1. The aim has to be to install a carbon accounting method for over sufficient time scales to reflect changes in long-term carbon storage as the appropriate basis for the partial accounting system which has to be established for the implementation of Art.3.3 of the Kyoto Protocol, and consistent with full carbon stock accounting for relevant activities in the longer term. More specific information is required to calculate CO2 uptake over delayed time frames in the case of increases in forest area.
2. The simple default approach, which is based on very aggregate data and assumptions, does not provide a basis for a credible final inventory.

The EU plans to elaborate in greater detail some refinements in line with the principles specified above. These refinements could be a contribution of the EU to the FCCC and IPCC workshop planned prior to the fourth session of the Conference of the Parties (COP 4). The

EU would like to point out that further refinements of the Revised 1996 IPCC Guidelines might be necessary after decisions on relevant definitions.

3. Issues identified in FCCC/SBSTA/1998/INF.1 relevant to Art.3.3 issues and to the IPCC Special Report

General comment

The EU welcomes the request to the IPCC to prepare a Special Report (SR) on land-use, land-use change and forestry. This will enable the COP to take decisions on recommendations on these issues to the COP/MOP. The EU believes that the following points should be addressed in the IPCC Special Report and when considering issues relevant to Article 3.3.

Comments to individual paragraphs

For the sake of clarity first the addressed paragraphs according to FCCC/SBSTA/1998/INF.1 are printed in italics and then the comments provided by the EU are given. Comments to paragraphs 52, 54, 63-67 and 74-75 will be addressed by the EU in the information requested by the 1 October 1998 according to FCCC/SBSTA/1998/6 as those paragraphs refer mainly to issues under Article 3.4.

15 The following terms need clear definition: forests, afforestation, reforestation, deforestation, carbon stock, and (direct) human-induced activities. The discussion that follows notes whether the term has been defined in the IPCC Guidelines, explores the use of alternative definitions, and, where possible, suggests optional definitions of the terms.

The IPCC SR should include discussion of and data illustrating the consequences of alternative definitions of the terms forest, afforestation, reforestation, deforestation, carbon stocks, direct human induced activities. The discussion should include the implications of different definitions not only in terms of climate change and in terms of quantitative impacts on emission budgets of Parties but also in terms of other issues like biodiversity and forest management.

16 How should forests be defined?

17 There are several definitions of forests but the IPCC Guidelines do not provide any. One source identified five definitions(1)
Many operational definitions refer to forests as "land areas with a minimum of 10 per cent crown coverage of trees or bamboo". Some emphasise the existence of wild or natural conditions, others a minimum area size and the absence of agricultural practices. Still others define a forest as an area of tree-covered land typically consisting of hundreds or thousands (or more) of individual stands comprising trees of similar species composition, age-structure and management regime.2,3,4
From a carbon accounting perspective, the term "forest" is often interpreted to also include "below ground vegetation", forest floor detritus (litter) and soil as part of the

forest ecosystem. Clearly, the definition adopted has important implications for the Kyoto Protocol. For example, if literally interpreted, the conventional operational definition leaves out areas that have been clear-cut (that is, those that for many years will have less than 10 per cent crown cover) as part of a forest management system and components (such as litter and soils) that may contribute substantially to carbon reservoirs and changes in them.

The definition of forests will need to be linked to data on the dynamics and equilibrium or time average values of carbon uptake and storage. Definition in terms of crown cover would not be useful unless linked to carbon stock data in this way. The SR would also have to address the differences on crown cover percentage in forest-definitions and the inclusion or exclusion of forest soils. The SR should take into account the forest definition of the UN-ECE/FAO TBFRA 2000 and other current definitions. The EU expects valuable further input on this important issue from the workshop and a comprehensive discussion of it in the SR.

18 *How should afforestation be defined? For the purposes of the first commitment period of the Kyoto Protocol, would it suffice to specify that afforested land pertains to areas which were not covered by forests in 1990? What date might apply to the subsequent commitment periods?*

No, the proposal would not suffice. For instance, the definition of afforestation in the IPCC Inventory Methodology according to page 5.14, footnote 10 of the Reference Manual, includes land which has not historically contained forests. That recognises that replanting after harvesting should not count as afforestation. This exclusion would apply in 1990 as well as in subsequent years, so it would not suffice to simply specify that afforestation should not apply to lands not covered by forests in 1990.

19 *The Kyoto Protocol permits consideration of "afforestation, reforestation, and deforestation" without providing definitions for these three words. The words "afforestation" and "reforestation" (but not "deforestation") are defined in the Glossary of the IPCC Methodology for National Greenhouse Gas Inventories.*

The definitions given can only be preliminary ones. A decision about final definitions should be made by the SBSTA on the basis of the Special Report to be prepared by the IPCC. The EU notes that, although 'deforestation' is not defined in the Glossary of the IPCC 96 Guidelines (GL), the GL do equate deforestation to the conversion of forests to other managed uses in footnote 7 on page 5.6 of section 5 of the Reference Manual.

20 *The word "afforestation" does not appear to create a problem, and the intent of the Protocol seems consistent with conventional definitions of this word. The IPCC Guidelines define afforestation as the "planting of new forests on lands which historically have not contained forests". Accepting a link to the IPCC methodology, Parties could choose to use this definition. Given the language in Article 3.3, it appears that afforestation activities begun in 1990 and subsequent years could be counted (also see paragraph 51). The date to be used for subsequent periods could*

also refer to 1990 or another year, depending on the definition of the second and subsequent commitment periods.

The definitions in the GL should be the starting point for consideration of definitions relevant to the afforestation, reforestation and deforestation (ARD) activities specified in Art. 3.3 of the Kyoto Protocol, but the existing GL are not sufficient for the purposes of Art. 3.3, if only because of the reference to activities since 1990. Also the definitions of ARD to be used under Art. 3.3 need to be mutually consistent in the sense that neither are sustainable forestry management practices which do not lead to depletion of carbon stocks penalised, nor can practices which do not lead to increases in carbon stocks be used to meet the commitment under Art.3. See also comment to para 24a and 24b.

21 How should reforestation be defined? What time period is appropriate for other land-use prior to reforestation; for example, would 20 years be appropriate? Should this be different for the first and subsequent commitment periods?

22 The IPCC Guidelines define reforestation as "planting of forests on lands which, historically, previously, contained forests, but which have been converted to some other use". Most other definitions, including the one used by the United Nations Food and Agriculture Organization (FAO), do not imply a previous conversion to other land-use. Annex I contains several published definitions of "reforestation" which suggest that many foresters would include the natural or enhanced regeneration of trees immediately following harvest in their definition.

23 Under the IPCC definition, some forest management systems, common in the boreal and temperate zones (where planting is done after clear-cutting), might not be included as reforestation, since land-use change is not involved. This would limit the land area available for offsets. Alternatively, if a definition of reforestation is adopted that allows for planting after harvesting in a forest management system, it would cover most managed forests, and the area that could potentially be claimed as a sink would increase substantially.

25 Considering these two issues, the SBSTA may wish to consider whether reforestation could be defined as establishing forests on lands which have, historically, previously contained forests, but which have been converted to some other use. This other land-use must have prevailed for at least 20 (or some other number to be determined) years. The other land-use can be shorter if the land has been counted as "deforested" within a commitment period specified under the Protocol.

The EU does not want to reduce the flexibility of the IPCC in offering consistent combination of definitions. However, any definition of reforestation assessed by the IPCC should take into account that forest management that does not lead to an increase in carbon stocks, should not be used to meet the commitments under Art.3.3. The SR should present implications of different options with regard to the time-interval between land-use conversion and reforestation as well as absolute time-limitations.

24a How should the term "planting" be defined?

Natural revegetation should not be excluded from direct human induced forest activities. It might be a policy of human forest management. However, natural revegetation needs clear

criteria for when natural vegetation is to be regarded as a consequence of direct human induced activity.

24b How should the term "historical" be defined?

This is a very critical question. In order to avoid perverse incentives, the term ?historical? should be quantified. It is expected that the SR explores various options which should include a range of years. See also comment on para 20 above.

26 How should deforestation be defined? What time period is appropriate for land to be defined as deforested? Should this be different for the first and subsequent commitment periods?

See comments to para. 20 above about the importance of consistent definitions of ARD. In any case, deforestation after 1990 of any forests (and not just of those which have been planted after 1990) should be penalised.

27 The IPCC Guidelines do not provide a definition of deforestation. One source has identified nine definitions.(5) It is difficult to find a definition that encompasses the diversity of situations present in industrialized and developing countries. In order to construct a consistent definition, consideration must be given to what constitutes a forest and to the period during which land might be used for an alternative purpose. The definition of the word deforestation is also linked to that of reforestation. If the aforementioned definition of reforestation is adopted (paragraph 25), then deforestation could be defined as "the conversion of forest land to other land-use".

28 If the IPCC definition of reforestation is retained, then the following two alternative definitions of deforestation could be considered:
- "The direct human-induced change of land-use from forest to other land-use OR the depletion of forest crown cover to less than 10 per cent". This definition would cover activities leading to an actual land-use change and the unsustainable management of forests or clandestine logging leading to a substantial impoverishment (crown cover less than 10 per cent), but it does not accommodate degradation. Sustainable logging (including clear-cutting after harvesting) is to be excluded from consideration.
- "The direct human-induced change of land-use from forest to other land-use AND the depletion of forest crown cover to less than 10 per cent". In this case, while sustainable logging (for example, systems including clear-cutting and enhanced regeneration) would still be excluded from the definition, neither degradation nor unsustainable or clandestine logging would be reported as deforestation.

29 In either of the above two cases, a time interval during which lands remain without forest cover might need to be added to avoid claiming a "reforestation" project on previously deforested land within the first commitment period.

The wording ?The conversion of forest land to other land-use? may be a good starting point for the definition of deforestation. However other items like the time period item and the definition of forests will have to be addressed as well. The definitions have also to be

designed in such a way that incentives are provided for sustainable forest management and disincentives to deforestation as this was one of the intentions of Art. 3.3.

30 Should policies and programmes be counted as direct human-induced activities or only the physical activities on the land? Should the prevention or suppression of natural phenomena that destroy forests be included in this definition? Is it necessary to distinguish between intent and consequence of human-induced activity?

The direct effects (in terms of physical activities on the ground) of policies and measures on ARD within agreed definitions of these terms should be counted, provided these can be reflected in a verifiable manner in the national inventory, and in any supplementary information produced in accordance with the Art. 7 of the Protocol. However, double-counting has to be avoided. Activities such as those to prevent forest fires would seem to be part of sustainable forestry management practices and would not be expected to be used to meet the commitments under Art.3.3. The EU also recognises the difficulty of defining the baseline for prevention of forest fires. See also comment on para 32 below.

31 Article 3.3 includes the term "direct" before human-induced activities. The term direct could refer to policies or programmes; the physical activities of afforestation, reforestation or reducing deforestation; or both of these. For example, governments could change tax policy to accelerate the rate of conversion of agricultural land to forests, or initiate large-scale programmes to increase the planted area. However, in such cases, there may be a time lag between adoption of a policy and the induced physical activity. Alternatively, governments could choose to better protect forests through improved monitoring and physical barriers to encroachment in order to reduce deforestation. Interventions to prevent or suppress forest fires could also constitute direct activities to reduce deforestation. In each case, the change in carbon stocks would be the measure of whether the human-induced activities had an impact and not merely the announcement of policies, programmes and direct intervention activities.

Actions to reduce deforestation will automatically be reflected in reduced or zero deforestation rates under the provisions of Art.3.3. Additional accounts to meet commitments under Art.3 would not be appropriate.

32 Yet another type of challenge is posed in defining "direct" in instances where the boundary between human- and naturally-induced phenomena is unclear. Human-induced fires may be used to clear land for plantations or other agricultural activities. If these fires, assisted by natural elements, were to spread to other neighbouring areas, the fires could destroy a much larger area than originally intended. The area covered by the original intent and the eventual consequence could thus be very different.

Similarly human induced fires to clear land would presumably count as deforestation, and actions to reduce or contain them would be reflected in reduced deforestation rates. The wider question of fire management and the separation between human and natural carbon fluxes in the case of fire ecosystems is problematic and will presumably be an important part of the

SR. In dealing with this item, it is recommended that the IPCC liases with the FAO/ECE Team of Specialists on Forest Fires.

33 How many carbon pools should be included in the definition of carbon stocks, and under what circumstances?

All pools of non-fossil carbon linked to the activities in Art. 3.3 should be counted so long as they can be verified and reported in a transparent manner. The EU endorses the system accounting for all changes of all carbon stocks and claiming limited use to meet commitments under Art.3 for real changes. (Full reporting but limited use to meet the commitments under Art.3).

34 Article 3.3 states that net emissions and sinks from land-use change and forestry activities will be "measured as verifiable changes in stocks in each commitment period"; Article 3.4 asserts that each Annex I country shall provide data to "establish its level of carbon stocks in 1990 and to enable an estimate to be made of its changes in carbon stocks in subsequent years".

The EU notes that the requirement under Art. 3.4 for each Annex I Party to provide for consideration by SBSTA 'data to establish its level of carbon stocks in 1990 and to enable an estimate to be made of its changes in stocks in subsequent years' has yet to be operationalised. The EU regards the provision of this data as an important hedge against possible perverse incentives under Art. 3.3. The 1996 IPCC Guidelines do not define the term ?carbon stock? . The two activities ?changes in forests and other woody biomass stocks? and ?CO2 emissions and removals from soil? can be used to estimate changes in above- and below-ground carbon stocks, but guidelines and recommendations to Parties are needed.

35 The term carbon stocks is not defined in the IPCC Guidelines. An important issue is to determine which carbon pools are to be included in the carbon stock. Carbon influenced by human-induced LUCF activity may be considered to be stored in five pools: above- and below-ground biomass, soils, wood products and landfills. The fossil-fuel carbon pool, while influenced by LUCF activities, is generally not considered as a terrestrial carbon pool.

The Special Report should focus on Land-Use Change and Forestry and not on landfills and harvested wood products. However, it would be useful to have some reflection in the report about the role of harvested wood products in the carbon balance, both generally and also about the country-specific variation of this issue.

36 Not all pools are easily measured and quantified, which may create a tendency to focus on those that can be assessed and to ignore the rest. While it is useful to quantify all pools to the extent possible, it is critical, when estimating pools whose carbon stock is increasing, to ensure that the remaining pools are not depleted due to the activities being pursued.(6) In tropical forests, for example, soil carbon stocks may not increase or increase very little and a Party might choose to avoid the expense of verifying changes in these pools by not claiming credit for them. In such cases,

however, it may be necessary for the Party to demonstrate that these other pools are not degraded by the reported activity. Similarly, some activities, such as silviculture, may increase timber biomass stocks at the expense of carbon in litter, soil or other vegetation, resulting in little or no real increase in withdrawal from the atmosphere. To avoid inaccurate accounting, it may be important for Parties to report both the increase and depletion of carbon stocks, or at a minimum, to demonstrate that carbon is not lost from pools for which no improvement is being claimed.

In the EU's view all carbon stocks associated with the ARD activities under Art. 3.3 should be counted, including the soil C stock. This is because of the possible loss of soil carbon under some circumstances following tree planting. It is expected that the SR also addresses gaps in the knowledge on soil carbon including time frames of changes in soil carbon and litter.

37 Deforestation can yield forest products which may store carbon for decades. The current IPCC approach does not account for forest products.

Treatment of wood products is under consideration by the IPCC. The SR might give options and implications to the addition of harvested wood products under Art. 3.

38 *Question: How should emission reductions and removals by sinks from the LUCF activities, as stipulated in Article 3.3, be interpreted and estimated?*

39 Emission reductions and removals by sinks from the LUCF activities could be estimated on the basis of Article 3.3 in two ways. A third approach is also presented.

40 The first clause in Article 3.3 states: "The net changes in greenhouse gas emissions by sources and removals by sinks resulting from direct human-induced land-use change and forestry activities, limited to afforestation, reforestation and deforestation since 1990, ... shall be used to meet the commitments under this Article ...". This phrase is limited by an additional clause, which specifies that these net changes in emissions will be "measured as verifiable changes in carbon stocks in each commitment period". This italicised clause leads to the first interpretation for accounting changes in carbon stocks:

41 Interpretation 1 (method 1): The net change in emissions, as measured by changes in carbon stock from afforestation, reforestation and deforestation activities, that may be used to offset emissions in the commitment period = (carbon stock on 31 December 2012) - (carbon stock on 1 January 2008).

42 A second interpretation of Article 3.3 comes about if the net changes in greenhouse gas emissions by sources and removals by sinks from afforestation, reforestation and deforestation activities are to be measured with respect to 1990. The phrase "? since 1990,.." coupled with change in changes in carbon stocks suggests the following interpretation:

43 Interpretation 2 (method 2): The change in changes in carbon stock (CCCS) to offset emissions from other sectors during the commitment period = (average rate of change in carbon stock in 2008-2012) - (rate of change in stock during 1990).(7)

44 These interpretations and associated methods would provide estimates of changes in carbon stock during the commitment period. The second interpretation gives credit to

a Party only if it has improved its rate of stock accumulation during the commitment period compared to that during the base year 1990. If the rate has not changed, the Party will not receive a credit for net greenhouse gas removals during the commitment period. For this reason, if the 1990 rate of carbon stock change is anything other than zero, the two methods give different answers.

45 The accounting approach of the second interpretation parallels the approach stated in Article 3.7 for the estimation of the assigned amount for each Party. Article 3.7 states that the assigned amount shall be equal to the percentage inscribed in annex B of its aggregate CO2 equivalent emissions in the base year. Interpretation 2 compares the emissions rate during the commitment period with that during the base year (1990). While the first interpretation would give credit to any net GHG removals during the commitment period, the second method would do so only if a Party had shown an improvement compared to 1990.

46 A third approach (method) might be to measure the cumulative change in carbon stock between 1990 and the average value during the commitment period. This may be stated as:

47 Interpretation 3 (method 3): The cumulative change in carbon stock = (average stock in 2008-2012 period) - (carbon stock in 1990).

48 This approach provides a cumulative measure of a project's contribution to reducing the atmospheric accumulation of greenhouse gases since 1990. The cumulative value cannot be compared with the assigned amount as stated in Article 3.7, but may be compared with the cumulative emissions from the non-LUCF sectors between 1990 and the commitment period. It would be analogous to crediting the cumulative emission reduction since 1990 below a baseline from an automobile fleet against the average emissions in the commitment period. 49 Each approach provides a different estimate of the changes in carbon stock. The amount would depend on the magnitude of the emissions or removals from the LUCF sector resulting from the afforestation, reforestation and deforestation activities of each Party. It would also depend on the definitions that Parties may wish to adopt. The secretariat does not have information from Parties on all LUCF emissions from sources and removals by sinks, and therefore can not provide numerical examples of the implications of each of these approaches to meet commitments. However, in general, it is likely method 1 will generate higher offsets than method 2 for countries that are net LUCF sinks in 1990. Also, method 2 will probably generate higher offsets than method 1 for countries that are net LUCF sources in 1990.

53 The first sentence of Article 3.4 stipulates that each Annex I Party shall provide, for consideration by the SBSTA, data to establish its level of carbon stocks in 1990 and to enable an estimate to be made of its changes of carbon stocks in subsequent years. This sentence seems to imply that interpretation 2 above should be used for calculating the changes in carbon stocks. Interpretation 2 would require, at a minimum, the establishment of data on stocks affected by activities to afforest, reforest or reduce deforestation, which are a subset of total forestry activities. Parties would need to consider whether such data would need to be more detailed than that provided for under current IPCC Guidelines.

SBSTA 8 agreed that, subject to the important caveat that the activities referred to shall have taken place since 1990, Interpretation I is the correct interpretation. There is therefore no reason to reopen the issue on how to interpret Art.3.3.

50 Do the words "since 1990" in Article 3.3 mean beginning in 1991, or including 1990?

51 The term "since 1990" in the protocol is interpreted to mean that the year 1990 is to be considered as the base year for all estimations. It is also possible to interpret the word to mean a period beginning in 1991, in which case the activities will have to be those that are initiated in 1991 and not in 1990. A clarification of the term "since 1990" is needed.

Similarly SBSTA 8 agreed that the ARD activities referred to under Art. 3.3 shall have taken place since 1 Jan 1990.

53 The first sentence of Article 3.4 stipulates that each Annex I Party shall provide, for consideration by the SBSTA, data to establish its level of carbon stocks in 1990 and to enable an estimate to be made of its changes of carbon stocks in subsequent years. This sentence seems to imply that interpretation 2 above should be used for calculating the changes in carbon stocks. Interpretation 2 would require, at a minimum, the establishment of data on stocks affected by activities to afforest, reforest or reduce deforestation, which are a subset of total forestry activities. Parties would need to consider whether such data would need to be more detailed than that provided for under current IPCC Guidelines.

SBSTA 8 agreed that Interpretation I is the correct interpretation of Art. 3.3. See response to 34 above on the need to operationalise the request under Art. 3.4 for Parties to report data on carbon stocks and changes in subsequent years. The EU believes that supplementary data will be required under the provisions of Art. 7 to monitor activities under Art. 3.3 which are relevant to compliance with commitments. This is because the IPCC inventory methodology is not sufficient for the reasons given under 20 above.

55 What is meant by the term "uncertainty"?

56 Uncertainties associated with Article 3.4 may need to be considered in the broader context of other articles, for example Articles 5, 7 and 18. Uncertainties vary widely among different greenhouse gases, source categories of each gas, the type and length of an activity and projects. Uncertainty could refer to the technical reliability of emission estimates, and to institutional soundness of organizations conducting afforestation, reforestation, deforestation and other activities. Examples of the first type of uncertainty are:

- *Differing interpretations of source and sink categories or other definitions, assumptions, or units;*
- *Use of simplified data formats and average values (especially emission sequestration factors);*
- *Uncertainties introduced by changing national models for estimating activities, or random errors in reporting; and*
- *Inherent uncertainty in the scientific understanding of the basic processes leading to emissions and removals.*

57 Institutions affect uncertainties through project development, construction and operational procedures. Institutional uncertainty is affected, among other things, by financing, management, legislation, and rules and regulations that govern the conduct of projects. Parties may need to consider institutional uncertainties in the context of Articles 6 and 12.

The treatment of uncertainties should be part, both of IPCC's ongoing work on emissions inventories, and SBSTA's programme on methodologies. The SR will be relevant, though the discussion of handling of uncertainties in a general methodological sense will probably be beyond its scope.

58 What is meant by transparency in reporting?

59 Heretofore, in the context of the Convention, transparency in reporting has been generally taken to mean that the assumptions and methods of analysis should be easily understood and/or replicable by international experts using information provided in the national communications. Parties may need to determine whether the reporting of data, assumptions and methods used in the LUCF activities would need to be different from those in the current UNFCCC guidelines. In this context, how should "work sheets" or "equivalent information", required under current guidelines, be defined.

The definition of transparency offered in para 59 is the generally accepted one, and will also be relevant to any supplementary information called for under the provisions of Art. 7.

60 What is meant by verification of LUCF and agricultural soil emissions by sources, and sequestration by sinks?

61 Verification is a generic issue that may need to be discussed in a wider context. Parties may need to determine whether LUCF and agricultural soil activities would need to be verified in a similar or different manner than other emission sources. In the LUCF area, verification could refer to establishing whether the activities and the associated changes in carbon stocks actually occurred.(8) The following are few examples of verification approaches:

- Review of the data, documentation, procedures and methodologies;
- Comparative analyses of procedures and methods; and
- Repeat sampling and measurements.

Verification in the context of inventories has also been defined by the OECD in document ENV/EPOC/98/5. The EU expects that the Special Report will address and discuss also methods for verification of emission data of the LUCF activities taking into account possible cost implications of data collection also and notes that direct field measurement of greenhouse gas fluxes might also be relevant to verification.

62 To some extent, verifiability of LUCF and agricultural soils may have to be flexible and based on the pools that are quantifiable. However, there may be no incentive to verify and report negative stock-changes, such as in deforestation, although the word "shall" in Article 3.3 implies that stock-changes have to be reported, even if they are

negative. Thus, if carbon gains are eligible, reporting and verification of such carbon losses might have to be obligatory.

The definition of verification must be even handed with respect to both gains and losses of carbon stocks. It would be unacceptable to use different verification criteria amongst the ARD activities. This too is a matter for methodological development, both by SBSTA and under the IPCC inventories programme.

68 Forests store carbon in a cyclical pattern in which carbon removed from the atmosphere over a period of years is later released through natural and human-induced phenomena. The practices of afforestation and reforestation will increase forest carbon stock in the short run, but eventually these could be depleted as trees die as part of their natural cycle. It is therefore important to consider both the carbon that will be sequestered (credits) by the afforestation, reforestation and reduced deforestation and activities and that which could be released (debits) at a later stage. In Article 3.4, for the additional activities, the entire cycle, that is, both credits and debits, may therefore need to be considered among the five carbon pools mentioned in paragraph 36.

The EU expects that the Special Report addresses the impacts on time scales, which show all the possible impacts over all life phases of forests taking into account the succession or in case of managed forests the possible impacts over rotation periods. Much of the subjects indicated in para 68 will depend on definitions of forest, deforestation and afforestation. It is on the IPCC to propose which time scale(s) is (are) appropriate for the specific activity. The long term nature of the carbon cycle will require careful accounting for periods which go further beyond one commitment period so that amounts of carbon are neither lost nor gained.

69 Question: "Is the term "land-use change and forestry" to be used consistently in Article 3.7?"

70 Article 3.7 stipulates that "for Parties included in Annex I for whom land-use change and forestry constituted a net source of greenhouse gas emissions in 1990 shall include in their 1990 emissions base year or period the aggregate anthropogenic carbon dioxide equivalent emissions by sources minus removals by sinks in 1990 from land-use change for the purposes of calculating their assigned amount. Given the criteria stipulated in the first phrase, is it reasonable to assume that forest emissions would also be included in the 1990 base year amount?

The omission of 'forestry' after the second reference to 'land use change' in Art. 3.7 is deliberate in the Kyoto Protocol, and is necessary to avoid possible double counting of forestry between Arts. 3.3 and 3.7.

71 Question: To what extent can the Revised 1996 IPCC Guidelines for estimating GHG removals and sinks for LUCF (or for estimating changes in carbon stocks) serve as a basis for complying with Article 5 of the Kyoto Protocol? If needed, how should the IPCC Guidelines be modified in a manner consistent with their application by the UNFCCC?

72 The current 1996 IPCC Revised Guidelines for assessing LUCF inventories propose a methodology that is based on two linked themes: the flux of CO2 to, or from, the atmosphere is assumed to be equal to changes in carbon stocks in existing biomass and soils; and, the changes in carbon stocks can be estimated by determining the rate of change in land-use and the activity used to bring about the change. Simple assumptions are then applied about their impact on carbon stocks and the biological response to a given land-use. The 1996 Guidelines assess carbon stock changes, but use information about carbon flux (such as forest growth and harvest) to do so. In applying the IPCC Revised Guidelines, different assumptions could cause a forest to be classified as either a source or a sink.(9)

73 The 1996 Revised Guidelines provide information about how to account for some of the carbon pools, such as aboveground biomass and soil carbon. Few countries have reported information about these pools in their national communications to date. The other carbon pools, in belowground biomass, wood products, and landfill, are not accounted for in the Guidelines.

Art. 5 clearly says that the methodologies for estimating anthropogenic emissions by sources and removals by sinks shall be the IPCC 96 Revised GL. However these GL do not distinguish activities which have taken place since 1990, and moreover they offer considerable flexibility. Therefore supplementary information is likely to be required, as agreed by the Parties under the provisions of Art 7. In the view of the EU it is beyond the scope of the Special Report to address the issue of updating the UNFCCC Guidelines for estimating GHG removals and sinks as well. This issue might be tackled separately according a conclusion of SBSTA 8 (see para 45 (f) of FCCC/SBSTA/1998/6).

76 Question: Should Article 6 cover the same activities stipulated in Article 3.3 and 3.4?

77 Article 6 of the Protocol states that an Annex I Party may transfer to, or acquire from, any other such Party emission reduction units. It does not specify that projects in another country need to include the same LUCF activities provided for under Article 3.3. A paradox could arise if this were not the case. Without this understanding, country A could pursue a project (other than afforestation, reforestation, or deforestation) within country B and country B could pursue the same kind of project within country A, and both might receive more credits than if they pursued the same projects at home.

79 Article 12 of the Protocol addresses a clean development mechanism (CDM). Parties may wish to refer to the discussion of this issue in document FCCC/SB/1998/2. The article mentions certified emission reductions accruing from projects, but it does not refer to sequestration by sinks, as is the case in Article 6. A point to be considered on this matter is that curbing deforestation is a mean of reducing emissions.(11)

78 Question: Should Article 12 cover the same activities stipulated in Article 3.3 and 3.4?

80 Question: Should the type of data required for projects under Article 6 be different from, or consistent with, the type of data received for national GHG inventories?

81 Currently, data provided with national inventories is quite general. Detailed information on the IPCC categories at either the national or sub-national level is usually not submitted in worksheet format to the secretariat. Article 6, which is based

on projects, suggests a level of detail not so far provided by Parties. It may be necessary to consider whether a consistent format is desirable.

82 Question: How can the maintenance of carbon pools be ensured once a project ends?

83 Article 6 does not specify the fate of carbon pools after a project ends. The continued maintenance of carbon pools is important, as the stored carbon would otherwise be released to the atmosphere, thereby potentially affecting the basis of any emission reduction units. This issue may need to be considered in the context of modalities and procedures for these articles.

These are important and recognised issues relevant to sinks, trading, the CDM and project based JI. In general they will need to be answered in the context of the relevant Articles rather than in the context of Arts. 3.3, 3.4 and the SR. However clearly there will need to be consistency in inventory procedures to avoid double counting or the apparent creation of carbon stocks which do not exist in reality.

PAPER NO.3: FINLAND

INFORMATION RELATED TO THE IMPLEMENTATION OF ARTICLE 3.3 OF THE KYOTO PROTOCOL, PARTICULARLY ON DATA AND METHODS, AND QUESTIONS AND ISSUES IDENTIFIED IN FCCC/SBSTA/1998/INF.1.

1. GENERAL

Finland welcomes the recent developments in the discussion on sinks. The SBSTA's decision (FCCC/SBSTA/1998/6) last June to request a Special Report from the IPCC on sinks and the planned IPCC/SBSTA workshop before COP 4 will strengthen the role of much needed scientific advice in future decisions.

Finland believes that sink calculation methods should be supportive of sustainable development, and, thus should help to protect and enhance sustainable management of carbon pools and forests. Furthermore, any calculation system which aims at estimating CO_2 emissions and removals from land use change and forestry should be accurate, simple, scale-independent and should provide the right kinds of incentives (Apps et al. 1997).

In addition to Austrian's submission on behalf of the European Community and its member states, Finland presents in this submission some methodological issues related to Article 3.3 of the Kyoto Protocol. The emphasis is mainly on country-specific case-study-type issues but a few general methodological questions are also dealt with. In particular, the role of existing information systems, sectoral authorities and national focal points are addressed.

2. DATA AND METHODS FOR COMPILING INFORMATION ON AFFORESTATION, REFORESTATION AND DEFORESTATION AREAS

Definitions

Finland recognises the ongoing discussion on definitions in Art. 3.3. It would be imperative to take into consideration national practices as well as ongoing international work on the harmonisation of forest-related terms and definitions, for example work by the UN's Food and Agriculture Organisation (FAO) and the International Union for Forest Research Organisations.

The definition of forest is needed for assessing the change in carbon stocks. According to the Finnish system, forestry land (86 % of land area) is grouped into three classes according to site productivity:

1) forest land, where the potential annual increment is at least 1 m^3/ha (20.0 mill. ha or 66% of land area).
2) scrub land (unproductive forest land), where the potential annual increment is between 0.1 - 1.0 m^3/ha (3.0 mill. ha or 10 % of land area).
3) waste land, unless naturally treeless, produces less than 0.1 m^3/ha per year (3.1. mill. ha or 10% of land area).

and *other forestry land*, mainly forest roads, etc (approximately 0.2 mill. ha)
The National Forest Inventory is the source for this data in Finland. The measurement accuracy for the above classifications is ± 0.5%.

The international definition of forest land, as applied in the Global Forest Resources Assessment 2000, sets a 10% canopy cover as the threshold between forest land and other lands. The estimation of the Finnish forest area based on the Forest Resources Assessment 2000 (FRA 2000) definition can be done by using measured basal areas for the plots stands and partly by interpretation of areal photographs. Thus the respective Finnish forest area equals 21.7 mill. ha, to the FRA definition.

In Finland, the term afforestation is used in accordance with the terminology in the Forest Resources Assessment 1990: *"Artificial establishment by planting or seeding of forest on an area of agricultural or other (non-forest) land"*. Similarly, reforestation is defined *as "Artificial or natural re-establishment of forest on previously forest or other wooded land. Artificial reforestation may be by planting or seeding"*. For the term deforestation, there is no equally precise definition, but the FAO definition corresponds to the Finnish national practice: *"Deforestation refers to change of land use with depletion of tree cover to less than 10 %"* (FAO Forestry paper 112, p 10. FAO, Rome 1993). It would mean that land now considered as forest land would become non-forest land.

Afforestation

In light of the above-mentioned definitions, the following data collection methods are applied. In Finland, almost all afforestation activities (minimum area over 0.5 ha) are supported by the Government of Finland and, since 1995 when Finland joined the European Union, also through measures to encourage the afforestation of agricultural land (EC Regulation No. 2080/92). These activities on private lands are closely supervised by regional forest and agriculture authorities and are also in accordance with EC procedures. Both forestry and agriculture authorities will verify a minimum of 5% of the data provided by landowners. Verification will be done by field measurements and, increasingly also, by remote sensing techniques.

Data will be further collected by regional authorities and thereafter by national authorities. Data from state-owned and private company owned areas will be aggregated at the national level. A professional estimate is that the error margin on afforestation land area is less than ± 5% at the national level, and, in practice, it cannot be improved much more without a substantial increase in costs and resources. Data on afforestation activities are further collected and combined in the annual Statistical Yearbook of Forestry by the Finnish Forest Reseach Institute, as part of an official statistical system in Finland.

Reforestation

In accordance with the new Forest Act which came into force in 1997, after regeneration felling, a seedling stand shall be established in the area within a reasonable period of time. The landowner must submit a declaration to regional forest authorities concerning plans to

carry out forest fellings. Providing data on reforestation activities is voluntary, but regional forest authorities are responsible for guaranteeing the legal obligations regarding the establishment of a seedling stand. Local forest management associations are able to collect data on most reforestation activities (approximately 95%) by private landowners. An estimated error on land area is around ± 10% for each reforestation project.

Data are further compiled by regional forest authorities and thereafter aggregated with data from other forest-owner groups by national forest authorities. A professional estimate is that at the national level the error margin on reforestation land area is also approximately ± 5%. Data on reforestation activities are further collected and combined in the annual Statistical Yearbook of Forestry.

Deforestation

The new Forest Act (1997) does not prevent forestry land from being taken up for other purposes (i.e. deforestation) and the law is applicable on most forestry land unless a land area is under other laws or regulations (e.g. the Nature Conservation Act, the Building Act, building and town plans). Some deforestation takes place in Finland annually, for example because of infrastructure development.

No comprehensive and up-to-date monitoring method for assessing all individual land use changes from forestry or forest lands to other use is available. Nevertheless, changes in forest land area can be identified at the national level through the National Forest Inventory. This inventory provides information about changes in the forest area at approximately eight-to-ten-year intervals. Data on forest or forestry land area are very precise (error ± 0.5%) but the estimate for the the rate of deforestation is less precise, (about ±7% error). Also deforestation data are available in the Statistical Yearbook of Forestry.

Challenges to the verification of activities in 2008-2012

The time element is very important when considering carbon sequestration. Both "afforestation" and "reforestation", according to the IPCC definitions, are linked to the length of the time during which the area has been without forest cover. Under the Finnish monitoring system, it is not possible to distinguish between afforestation and reforestation if the IPCC definitions are used because precise data are lacking on historical land use or its changes.

Assessing which changes are human-induced and which are not is also difficult. For example, if remote sensing is used as a basis for the inventory, the images do not indicate if the forest has been established by human activity or not. Another problem with remote sensing-based inventories is the lack of data and images from situations several decades ago.

Additionally, determining the effect of which human-induced activities are taken into account, is problematic. In Finland, for instance, natural revegetation is allowed to occur on former agricultural lands. Yet it is uncertain whether this generation of new forests will be

considered as direct human-induced activity although it is land owners' decision not to carry out agricultural practices any more.

3. CARBON STOCKS

Measurement of carbon stocks

The National Forest Inventory (NFI) of Finland is the basis for the monitoring of the carbon storage of forests. NFIs have been carried out since 1921 and the accuracy of the estimates of the growing stock has been developed to a very high level: the sampling error for the total volume of the growing stock for the whole country is approximately ± 0.6%. Data can be provided at the regional level by combining the use of satellite imagery and numerical data. At the regional level, the sampling error for the total volume of the growing stock is approximately ± 2 - 5 %.

Forest inventories provide data on stemwood increment, volume and drain. However, for carbon emission and removal inventory purposes, the whole-tree biomass as well as soil carbon, and, in particular, changes in these pools are of interest. Present forest inventory techniques do not take all carbon pools into account, and, partly therefore, the methodologies are less developed and their accuracy is much more modest.

Forest inventory results and wood consumption statistics allow the conversion of stemwood volume, increment and drain into carbon amounts. Species-specific conversion factors to dry matter, total tree biomass and carbon can be applied (Karjalainen & Kellomäki 1996). In Finland, approximately 58% of the carbon in tree biomass is in stemwood, 23% in roots, 14% in branches and 5% in foliage. These proportions vary, however, between tree species, and at different phases of stand development. Error in the total tree biomass estimate is currently ±10%.

Forest soils in the northern latitudes contain large amounts of carbon but these estimates are less accurate, ± 50%. It has been estimated that the average carbon stock in forest soils in Finland is approximately 300 Mg C/ha, while the above- and below-ground tree biomass is approximately 29.5 Mg C/ha.

Carbon sequestration in regenerated areas

In regenerated areas in the northern latitudes, carbon accumulates slowly in the tree biomass. Forests which have been established since 1990, would actually sequester very little carbon during 2008-2012. The average rotation length in Finland is 60-130 years, depending on the tree species, site type and location of the forest. The average accumulation of carbon in the tree biomass is approximately 0.76 Mg C/ha per year during the first 20 years in Finland.

Theoretically, even if a certain forest area would be cleared for other purposes and an equal areal would be afforested elsewhere, i.e. total forest area would remain constant, there would be a negative CO_2-balance during the first budget period. If we assume that some forest would be cleared annually for infrastructure purposes (a source of 29.5 Mg C/ha) and a

corresponding area would be afforested (a sink of 0.76 Mg C/ha/yr), the source factor in the CO_2 balance would be about 40 times the sink during the first commitment period.

Focus on the whole carbon stock

Article 3.3 of the Kyoto Protocol only takes a fraction of the total carbon stock of forests into account. The Convention emphasises the requirement to protect and enhance greenhouse gas sinks and reservoirs in general, including sustainable forest management. The whole forest stock and changes to it should be viewed from the long term.

The present method in Art 3.3 may give a calculated sink while the country's whole forest carbon stock may be decreasing. It may also happen that a country whose forests as a whole are a carbon sink, may get a negative balance if only the change in the forest area only is taken into account and not the change in the carbon stock. As described above, this may also happen even if the country's forested area would remain constant.

REFERENCES

Apps M., Karjalainen T., Marland G., Schlamadinger B. (1997) Accounting system considerations: CO_2 emissions from forests, forest products and land-use change, a statement from Edmonton. see http://www.joanneum.ac.at/IEA-Bioenegy-TaskXV.

Karjalainen, T. & Kellomäki, . 1996. Greenhouse gas inventory for land use change and forestry in Finland based on international guidelines. Mitigation and Adaptation Strategies for Global Change 1:51-71.

Finnish Statistical Yearbook of Forestry 1997. Finnish Forest Research Institute: Helsinki, Finland.

Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. IPCC, 1996.

UN-ECE/FAO Temperate and Boreal Forest Resources Assessment 2000. Terms and definitions. United Nations New York 1997.

The Forest Act. 1093/1996. Helsinki, Finland.

The Forest Resources of Temperate Zones. Vol. 1. General Forest Resources Information. UN-ECE/FAO 1990 Forest Resources Assessment. United Nations.

PAPER NO. 4: ICELAND

IMPLEMENTATION OF ARTICLE 3.3

SBSTA at its eighth session requested Parties to submit information related to the implementation of Article 3.3. of the Kyoto Protocol, particularly on data and methods, and questions and issues identified in document FCCC/SBSTA/1998/INF.1.

Definitions

Currently, activities to sequester carbon are limited to forest activities. This restrictive list introduces uncertainties on definitions. A broad definition of forests should be used. A narrow definition would introduce the danger of exclusion by Parties of deforestation activities on the grounds that an area being cleared does not meet the definition of a “forest”. Restrictive definitions, which might be appropriate for the mapping of economically important forest resources (such as the FAO definition for forests in developed countries quoted on page 19 in document FCCC/SBSTA/1998/INF.1), should be avoided.

The capacity of a forest to sequester carbon is to be quantified by the Parties. If a given forest being planted does not sequester carbon, this will be reflected in the sequestration rates determined by the Parties and reported to the Secretariat. The contribution of a forest to the assigned amount will therefore be determined by its capacity to remove carbon, not by arbitrary defining criteria such as tree height or cover.

Direct human-induced activity

Parties to the United Nations Framework Convention on Climate Change have undertaken general commitments to preserve reservoirs of carbon and to enhance uptake of carbon dioxide from the atmosphere by sinks. There were different views and difficult negotiations on how uptake by the biosphere should be included in calculation of assigned amounts. The outcome of these negotiations was that uptake which could be attributed to direct actions taken by Parties should enter into the calculations. This outcome reflects a delicate balance that must not be lost in the work that remains to be done to make the Kyoto Protocol operational.

This restriction makes the term &anthropogenic removals by sinks 8 used in Article 4 (1.a) of the Convention operational. Implementation of Article 3.3. of the Protocol and interpretation of the term “direct human-induced activity” should take note of this fundamental principle. The limitation of sink credits to uptake which results from actions taken by Parties was a prerequisite for the agreement reached in Kyoto to include sinks. This restriction should not be carried to the extreme, however.

By limiting sink credits to removals of carbon dioxide resulting from actions by Parties, an incentive is created for the Parties to take further action to sequester carbon. The implementation of Article 3.3. should be guided by this intent. The introduction of

uncertainties in interpretation or other complications should be avoided to preserve this incentive for action by the Parties.

The implementation of Article 3.4. of the Protocol, which sets up a process to add activities to the list, will create further incentives for Parties to take action to sequester carbon through actions not covered in Article 3.3. Many of these additional activities can result in high rates of removals from the atmosphere which can be quantified with the same certainty as forest-related activities.

Policies and programmes should be counted as direct human-induced activity as long as the link between the policy and the resulting removals can be demonstrated. The consequence of the activity in terms of carbon dioxide removal is what matters, not the original intent behind the action. Actions to reverse activities that have negative impact on the uptake of carbon should also be included.

Verifiable and transparent reporting

The removal of carbon dioxide from the atmosphere will be measured as verifiable changes in stocks of carbon. The IPCC inventory guidelines are to be used for this. It is important that reporting rules take note of the rapid development in techniques to measure exchanges in carbon dioxide between the atmosphere and the biosphere. In many cases is the quantification of flows of carbon between the biosphere and the atmosphere is the most effective way of measuring changes in carbon stocks.

The five year commitment period is a short time compared to the turnover time of most of the important carbon pools. Measurements outside the commitment period coupled with modelling of the dynamics of carbon pools will therefore be required. It will not be possible to quantify all terrestrial carbon pools affected by direct human-induced activity at the beginning and end of the commitment period. Methods of estimation and time averaging will have to be applied. Such methods can be just as verifiable as direct measurements few years apart.

The Protocol does not spell out which carbon pools should be quantified. No carbon pools are excluded either. The coverage of carbon pools should be as comprehensive as possible. Limited coverage of carbon pools, such as the exclusion of the soil carbon pool, can result in situations where the overall carbon stock of a site is going down at the same time as the carbon stored in a reported pool, such as wood, is increasing. Classical forest inventories commonly ignore important carbon pools such as litter and soil carbon. Parties should be required to demonstrate that pools which are not reported are not degraded by the reported activity.

Reporting of project sinks

When the transparency, accuracy and verifiability of the quantification of the removal of carbon dioxide by sinks is evaluated, it is useful to make a distinction between project-based and inventory-based accounting. Sink enhancement resulting from direct human-induced

activity will often be associated with projects on a given area of land initiated at a given point in time. The quantification of carbon removals from such projects is technically simpler and generally more transparent than inventory-based accounting and can be verified more directly.

Reporting of carbon stocks in 1990

Article 3.4. requires Parties to report on the carbon stocks in 1990 “and to enable an estimate to be made of its changes in carbon stocks in subsequent years”. The relationship of this reporting requirement to the calculation of changes in carbon stocks during the commitment period is not clear. As was reaffirmed by SBSTA at its eighth session (document FCCC/SBSTA/1998/CRP.3), only the change in stock during the commitment period enters into the calculation of removals by sinks. The measurement of carbon stocks in 1990 is not required for that purpose.

The intent of this reporting requirement was presumably an effort to address the danger of a perverse incentive being created by the period prior to the first commitment period. It is not clear how this reporting requirement solves the problem, however. The likelihood of perverse actions can be reduced through the definition of “reforestation” as suggested in document FCCC/SBSTA/1998/INF.1.

The effect of perverse incentives can be further reduced through careful review of Parties , land use policy by the expert review teams provided for in Article 8 of the Protocol. Compliance should be evaluated with the general commitments in the Convention to adopt national policies and measures aimed at “protecting and enhancing its greenhouse gas sinks and reservoirs”, which are reaffirmed in Article 2 (1.a.ii) in the Protocol. In Article 12 (2.b.) of the Convention, Parties are required to estimate the effect policies and measures have on removals by sinks. The guidelines for the expert review teams should include efforts to enforce this commitment.

PAPER NO. 5: JAPAN

INFORMATION RELATED TO THE IMPLEMENTATION OF ARTICLE 3.3 OF KYOTO PROTOCOL, PARTICULARLY ON DATA AND METHODS, AND QUESTIONS AND ISSUES IDENTIFIED IN FCCC/SBSTA/1998/INF.1

1. Basic perspective

To stipulate clarification of Article 3.3, it is important to decide the interpretations of the details of the Article based on the following basic perspectives.

C **Contribute not only to the short term goal but also to the achievement of the ultimate objective of the Convention**

As the ultimate objective of the UN Framework Convention on Climate Change is to achieve stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system, it is necessary to contribute not only to achieve the reduction commitment of each Party articulated in Kyoto Protocol but also to achieve the ultimate objective of the Convention in the long run.

C **Sustain the consistency among three activities with regard to the estimation of the amount of changes in carbon stocks**

It is necessary to sustain the consistency in accounting of the changes in carbon stocks between the activities designated as afforestation, reforestation and the ones defined as deforestation.

Some type of definitions of three activities could generate incentives for so-called running-in felling of the trees before 2007 in order to rush into conversion of forest to other land use such as golf course without getting emission counted or to acquire credit of great amount of carbon removal by planting on cleared land within the first commitment period. It is necessary to arrange the mechanism to prevent such kinds of loop holes.

Furthermore it is important to be careful not to appreciate certain activities too much (or too little) when calculating their short term effect on greenhouse gas removal. For example, in case of sustainable forest management, which has no effect in the emission or removal of CO2 in the long run, it is necessary not to overestimate the temporal carbon emission of the tree felling by focusing on the short term carbon balance.

C **Be direct human-induced activities**

Reflecting the factors such as the objectives of the Convention to limit the anthropogenic greenhouse gas emissions, the target is limited to the direct human-induced activities. As in some cases carbon fixation will proceed as a natural phenomena without human intervention, it is required to distinct these processes from direct human-induced activities clearly with regard to sinks set out in Article 3.3.

C **Keep high level of transparency and verifiability in the accounting methods**

To keep high level of transparency and verifiability in the accounting methods, it is necessary to adopt the evaluation methods using measurable parameters as much as possible

and to reduce the possibility of intervention of intention. And in sustaining the verifiability, it is important that others can verify the data.

C **Guarantee the fairness in achieving the quantified emission limitation**

Each nation has different forest with regard to the scale, age, and type of the forest. Therefore it is necessary to be very careful to the fact that some type of definitions of the activities described in Article 3.3 could give advantage or disadvantage to certain nations unfairly.

C **Prevent to generate disincentive for sustainable forest management**

Forest has many roles such as timber production, preservation of biodiversity, cultivation of water source, conservation of the soil and supply of recreation fields.

Therefore in defining the activities articulated in Article 3.3, it is necessary to be careful not to provide disincentive for sustainable forest management under which forests are managed as an ecosystem so that the health and vitality of forests are maintained while at the same time various human needs are met sustainably.

"Sustainable Forest Management" is the concept set forth at the UNCED in 1992, which aims at sustainably using forests while properly conserving them, and is stipulated also in Article 2 of the Kyoto Protocol on policies and measures. Hereinafter, "Sustainable Forest Management" in this paper always includes the notion of the conservation of forests.

2. Definitions of the terms

2-1. Forests

2-1-1. General suggestion

Among the various existing definitions of the forest, the following definition by UN-ECE/FAO, 1997 defines the forest most rigorously.

"Land with tree crown cover (or equivalent stocking level) of more than 10 percent and area of more than 0.5 ha. The trees should be able to reach a minimum height of 5 m at maturity in situ. May consist either of closed forest formations where trees of various stories and undergrowth cover a high portion of the ground; or of open forest formations with a continuous vegetation cover in which tree cover exceeds 10 percent. Young natural stands and all plantations established for forestry purposes which have yet to reach a crown density of 10 percent or tree height of 5 m are included under forest, as are temporarily unstocked as a result of human intervention or natural causes but which are expected to revert to forest. Includes: Forest nurseries and seed orchards that constitute an integral part of the forest; forest roads, cleared tracts, firebreaks, and other small open areas within the forest; forest in national parks, nature reserves and other protected areas such as those of special environmental, scientific, historical, cultural, or spiritual interest; windbreaks and shelterbelts of trees with an area of more than 0.5 ha and a width of more than 20 m. Rubberwood plantations and cork oak stands are included. Excludes: Land predominantly used for agricultural practices." (Source: UN-ECE/FAO 1997)

This definition has the following issues to be discussed.

(i) As this definition defines the forest with the land use purpose (ex. line 4: "for forestry purposes"), the lands which has the same carbon removal effect as forests could be excluded from the "forests." For example, orchard may satisfy the physical conditions of this definition but is excluded from the "forests" because the land use purpose of this land (the main objective of the land use) is "agriculture."

(ii) In the last 3 sentences, examples included or not included in the forests are listed up. However, as these examples are not comprehensive, it is not clear whether some land use (for example, city park) should be included in the forests or not.

(iii) In reality, in many countries, the definition of the forests used in national statistics may not be consistent with this definition.

2-1-2. Suggestions

The cases that do not fit in this definition but can be considered as sinks such as orchards and city parks could be examined in Article 3.4.

Or it is also possible to make a new definition of the forests that can include orchards and city parks etc.

2-2. Afforestation, reforestation and deforestation

There are various definitions of afforestation, reforestation and deforestation. Among them, the definitions by IPCC and by FAO seem to be the most well-accepted ones. Hence, we will analyze several issues regarding these 2 types of definitions in the following discussion. In this discussion, we use the definition of forests by UN-ECE/FAO, 1997 mentioned earlier.

[Definitions by IPCC]

The definitions shown in "Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories" are as follows.

Afforestation:	Planting of new forests on lands which, historically, have not contained forests.
Reforestation:	Planting of forests on lands which have, historically, previously contained forests but which have been converted to some other use.
Deforestation:	(Not defined)

These definitions have several issues to be resolved.

<Issues to be resolved >

1. The distinction between "afforestation" and "reforestation" is not clear. The term "historically" is not defined clearly under these definitions. As the lands which have never contained forests historically could be in the very severe natural conditions for forests, the

"afforestation" in this definition would not be given to real situation theoretically. However, in the Reference Manual of the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, the two activities are distinguished by whether the lands have not supported forests for more than 50 years or less (Brown et al., 1986).

2. The IPCC Guidelines do not provide a definition of deforestation. It is necessary to make a definition of deforestation consistent with the definitions of afforestation and reforestation.

3. Even if deforestation is defined as "converting forests to some other use", it could cause some confusion as follows, since the criteria of "conversion of use" allows willful interpretations and does not directly link to the emission/removal of CO2. Some adjustments are required.

i) It is possible to declare some land use change as "reforestation" or "deforestation", even though it results in little net change in carbon stocks due to direct human-induced activities. For example, in case of a land where is used for a orchard before (with crown cover of more than 10 per cent), it is possible to interpret the land which is not used for forestry purpose is "reforested" only with planting a few trees additionally and declaring that the use of that land has converted to forestry use.
ii) Unsustainable or destructive manner of logging leading the forest to a substantial impoverishment with reduction of the crown cover to less than 10 per cent (that is a substantial CO2 source), would not be reported as deforestation, as long as it is not accompanied with any land-use change.

4. If deforestation is defined as "Converting forests to some other use and making the physical conditions of the land not to meet the definition of forests" to resolve the above issue 3.1), then another problem arises especially in identification of the land of deforestation. Under this definition, whether a certain activity would be regarded as deforestation or not will depend on whether we will pay attention to a large forest area or to a small area surrounding that converted area. This problem could be resolved if the unit area (0.5ha, for example) is specified to judge these activities.

5. Incentives for a kind of loop hole such as so-called running-in felling of the trees before 2007 would be generated. If deforestation is defined as "Converting forests to some other use", the CO2 emission caused by deforestation will be counted only at the time when the conversion occurs, whereas the CO2 removal caused by afforestation or reforestation would last for a long time after those activities. So this definition could generate incentives for so-called running-in felling of the trees before 2007. However, such incentives would be weakened to some degree by taking into account of CO2 emission from soil continuously after the tree felling. If the following commitment periods are set continuously from the first commitment period, this kind of loop hole would be prevented after 2008. Any agreement on commitment periods, however, is not obtained among the Parties at this stage.

Following is an example of the definitions which are modified to resolve some of the issues mentioned above. It should be noted that this example is not to show the view which Japan supports but to present a cue for further discussion.

[Example]

Afforestation: Planting of new forests on lands which have not been containing forests for more than 50 years.

Reforestation: Planting of forests on lands which have previously contained forests within last 50 years, but which have been converted to some other use and the physical condition not to meet the definition of forests.

Deforestation: Converting forests to some other use and making the physical conditions of the land not to meet the definition of forests.

Common condition: these activities are to be judged by the unit area of 0.5ha.

< Evaluation of this example in the light of basic perspectives >

- Does it contribute not only to the short term goal but also to the achievement of the ultimate objective of the Convention?

Under this example, the target is strictly limited to the direct human-induced activities which cause the change of forests area, that is, planting of forests on the lands other than forests and conversion of forests to some other use. So the amount of CO2 removal evaluated under this example would be relatively small. Due to this restriction, some other types of activities related to CO2 emission or removal, such as human-induced forest fire, cannot be evaluated properly. Besides, the activities related to agroforestry would be also excluded according to the definition of the forest.

Under this example, the issue 3. ii) mentioned above still remains to be resolved. This issue could be treated under the Article 3.4.

- Is the consistency sustained among three activities with regard to the estimation of the amount of changes in carbon stocks?

The conceptual consistency is sustained due to modification of original IPCC definitions. This example does not generate the incentives for so-called running-in felling of the trees before 2007.

- Are these direct human-induced activities?

The target is quite clearly limited to direct human-induced activities because of the term "planting".

- Does it keep high level of transparency and verifiability in the accounting methods?

Limitation of the scope of target activities in the definitions in this example would enable to keep high level of transparency and verifiability in the accounting methods. In addition, the term "planting" clearly limits the target activities to direct human-induced activities and this fact would also contribute to the high level of transparency and verifiability.

On the other hand, the arbitrariness of the term "convert to some other use" would allow different interpretations of target activities by the Parties, which would degrade the level of transparency and verifiability.

- Is the fairness in achieving the quantified emission limitation guaranteed?

Under this example, as the scope of the target activities is strictly limited and the Article 3.3 focuses on the activities after 1990, incidental factors will have little impact on evaluation of the CO2 removal. So this example will fairly well guarantee the fairness in achieving the quantified emission limitation.

- Does it avoid disincentives for sustainable forest management?

This example does not provide incentive for cutting natural forests to make plantations. On the other hand, it does not provide incentive for intervention to suppress forest fires which is one of the human-induced activities contributing to the reduction of GHG emission, because such an activity cannot be positively evaluated under this example. However, this issue should be treated under the Article 3.4.

[Definitions by FAO]

The definitions shown in "State of the World's Forests, FAO, 1997" are as follows.

Afforestation: The establishment of a tree crop on an area from which it has always or long been absent.
Reforestation: Establishment of a tree crop on forest land.
Deforestation: (Developed countries): Change of forest with depletion of tree crown cover to less than 20 percent.
(Developing countries): Change of forest with depletion of tree crown cover to less than 10 percent.

These definitions have several issues to be resolved.

< Issues to be resolved >

1. **Afforestation and reforestation do not cover all activities for establishing forests.**

Establishment of tree crops on an area from which it has been absent for a while does not fall into both afforestation and reforestation. The term "very long" in the definition of afforestation is not clearly defined.

2. **There is inconsistency in the relation among afforestation, reforestation and deforestation.**

i) During negotiations at the Kyoto conference, it was examined whether not only the three activities (afforestation, reforestation and deforestation) but also harvesting was to be included into the limited direct human-induced activities or not from the viewpoint of proper balance among the activities concerned. And the conclusion was to exclude harvesting. The three activities are put out of balance at present because deforestation does not include harvesting trees while reforestation includes planting trees after harvesting.

ii) Afforestation and reforestation are defined without the notion of tree crown cover while deforestation is defined in accordance with the change of tree crown cover.

3. **If deforestation is defined as change of forest with depletion of tree crown cover to less than 10 (20) percent, whether a certain activity would be regarded as deforestation or not will depend on whether we pay attention to a large forest area or to a small area surrounding that converted area. This problem could be resolved if the unit area is specified to judge these activities**.

4. **Incentives for a kind of loop hole such as so-called running-in felling of trees before 2007 would be generated.**

The CO2 emission caused by deforestation would be counted only at the time when the conversion occurs, whereas the CO2 removal caused by afforestation or reforestation would last for a long time after those activities. So this definition could generate incentives for so-called running-in felling of the trees before 2007. However, such incentives would be weakened to some degree by taking into account of CO2 emission from soil continuously after the tree felling.

If the following commitment periods are set continuously from the first commitment period, this kind of loop hole would be prevented after 2008. Any agreement on commitment periods, however, is not obtained among the Parties at this stage.

5. **Afforestation, reforestation and deforestation include not only direct human-induced activities but also activities hardly regarded as direct human-induced ones. For instance, natural regeneration is included in reforestation according to these definitions. The stipulations of Article 3.3, that restricts the target activities to direct human-induced ones, possibly raises arguments in this regard.**

Following is an example of the definitions which are modified to resolve some of the issues mentioned above.

[Example]

Afforestation: Planting of forests on lands which do not contain forests.
Reforestation: Planting of tree crops on forest lands where the crown cover has become less than 10 percent.
Deforestation: Making the physical conditions of land not to meet the definition of forests or making tree crown cover to less than 10 percent.
Common condition: These activities are to be judged by the unit area of 0.5 ha.

< Evaluation of this example in the light of basic perspectives >

- Does it contribute not only to short term goals but also to the achievement of the ultimate objective of the Convention?

Because CO2 emissions due to clear-cut harvest under sustainable forest management are also accounted in accordance with this example, promotion of use of wood products, which has the great potential to mitigate climate change by substituting for fossil fuels, cement and energy intensive materials such as aluminum and iron, will be seriously hampered by inclusion of harvesting into deforestation. Therefore, this example is considered to adversely affect the achievement of the ultimate objective of the Convention.

Activities to be accounted is not limited in this example compared to the example of IPCC. Under this example, CO2 emission and removal are able to be fairly widely caught and evaluated. However, there are issues to be resolved such that activities like human-induced forest fire and agroforestry are not included.

- Is consistency achieved between the three activities regarding accounting for changes in carbon stocks?

The conceptual consistency seems maintained. However, if clear-cut harvest is included in deforestation according to the above-mentioned example, it is also necessary to include CO2 removals by forests established before 1990 from the viewpoint of proper balance of carbon stocks. Furthermore, this example can not prevent to generate the incentives for so-called running-in felling of trees before 2007. However, such incentives would be weakened to some degree by taking into account of CO2 emission from soil continuously after the tree felling.

In this example, planting after direct human-induced activities, that will lead to reduction of the crown cover to less than 10 per cent, is included in reforestation. As a result, the estimated amount of CO2 removal will become greater than that of the example of IPCC. On the other hand, as deforestation includes direct human-induced activities that will lead to reduction of the crown cover to less than 10 per cent, counted CO2 emission would increase sharply if harvested wood is not included in carbon stocks. In almost all the countries, forests will be identified as a CO2 source as the effect of deforestation(harvest) is greater than that of reforestation. However, if harvested wood is included in carbon stocks, this effect will be mitigated to some degree.

- Are these direct human-induced activities?

The target becomes clearly limited to direct human-induced activities because of the change of the term "establish" into "planting." However activities such as well-managed natural regeneration and complementary planting in existing forests become excluded.

- Does it maintain a high level of transparency and verifiability in the accounting methods?

At present it is probably difficult to capture the fact that the crown cover is reduced to less than 10 per cent by harvesting. Under this example, enormous effort is needed to evaluate deforestation and reforestation accurately.

Therefore it is difficult to maintain a high level of transparency and verifiability at this time.

- Is fairness in achieving the quantified emission limitation guaranteed?

If harvested wood is not included in carbon stocks, forests will be identified as a CO2 source as the effect of deforestation (if harvest is included) is greater than that of reforestation in almost all the countries. As this effect is greater in the countries where harvesting interval is very long, such countries tend to suffer relative disadvantage. However, if harvested wood is included in carbon stocks, this problem will be mitigated to some degree, because the greater effect of deforestation compared to reforestation will be reduced.

- Does it avoid disincentives for sustainable forest management?

This example does not provide incentive for cutting natural forests to make plantations if harvested wood is not included in carbon stocks. However, because if harvested wood is included in carbon stocks, incentive to change natural forests to artificial ones may be generated depending on the treatment of harvested wood. Adequate attention should be paid so that sustainable forest management will not be hampered.

On the other hand, this example does not provide incentive for intervention to suppress forest fires which is one of the human-induced activities contributing to the reduction of GHG emission, because such an activity cannot be evaluated under this example. However, this issue should be treated under the Article 3.4.

<Remaining issues>

In the definitions of the three activities previously mentioned, there remain common issues as follows.

- It remains unclear how to evaluate the baseline carbon stocks that is necessary to account for the net change of carbon stocks.

Under the Article 3.3, only the net change in carbon stocks resulting from the respective activities in the Article should be evaluated as emission or removal. Nevertheless, how to calculate baseline carbon stocks is not clear. For example, when a forest was changed into agricultural land, the difference of carbon stocks between forest and agricultural land needs to be estimated.

- Concerns Over Developing Countries' Situations

It is agreed that all states have the sovereign right to exploit their own forest resources (cf., Forest Principle). Some countries may set their national development goals which necessitate exploitation of their forest resources resulting in less forested area in the future than the current level.

If developing countries are to owe their share of responsibilities to combat global warming in the future (in fact we are encouraging developing countries' participation), some of them might be inhibited from exploiting their forests since it could be counted as a significant source of carbon emission, thus could lead to an argument that their sovereign national rights are violated.

In this respect, special attention should be paid to the situations in some developing countries, where this sovereign right may have to be significantly limited as a result of containing activities related to exploitation of forest (e.g. deforestation as far as Article 3.3 is concerned) in the Article of the Protocol.

2-3 Carbon stocks

It should be verifiable change in carbon stocks resulting from afforestation, reforestation and deforestation that are evaluated relating to forests and forestry in the Article 3.3 of the Kyoto Protocol. However, as the Kyoto Protocol does not provide definitions for the carbon stocks, it is possible to make different interpretations. Clear definitions may be

necessary to determine which carbon stocks are to be included. An example to solve these issues is shown below.

Example:

Six types of carbon stocks are classified as follows.

1. above-ground biomass (trunk, leaves, branches etc.)(excludes farm products)
2. below-ground biomass (roots)
3. slash (fallen leaves, branches)
4. soils
5. wood products (harvested wood, pulp, wooden products, construction materials, houses, firewood)
6. wooden wastes (landfills etc.)

Note: In the Paragraph 35 of FCCC/SBSTA/1998/INF.1, carbon stocks are classified into five. Slash is included in the soil category there.

One example of the definition is to consider 1 to 4 of above classifications as carbon stocks. However the following points are needed to be paid attention.

1. Further discussion is necessary regarding how to account for changes in carbon stocks.
2. The accuracy of data should be improved to increase verifiability with respect to the change in volume of carbon stocks in each categories of No.1 to No.4 as forests grow.
3. Estimation methodologies of CO2 emissions and removals by below-ground biomass, slash and soils are still very poor. Therefore, in the case of below-ground biomass and slash, further measurement and data collection are needed to improve the default values. In case of soil, it is also necessary to develop measuring method on carbon flux from ecosystem including soil respiration.
4. It is one option to multiply discount factors to the elements with great uncertainties such as soil for a safety estimation while current measuring method is not satisfactory.

Japan's comments
on draft outline of "IPCC Special Report on Land Use,
Land Use Change and Forestry and Carbon Sink (SRLFC)"

1. In considering carbon sink issues, it is important to clarify basic criteria at first before starting discussion on each topics concerning Articles 3.3 and 3.4 of Kyoto Protocol. After that the discussion should be proceeded based on these criteria. Therefore we suggest the replacement of "III. Implications of definitions and generic issues (for example)" with "III. General Criteria." Also we suggest that the general issues should be analyzed at Chapter III including the following topics. (i)"land use, land use change and forestry", (ii)"human-induced activities", (iii)"uncertainties", (iv)"transparency and verifiability", (v)"carbon stock (including implications to importing and exporting countries)",

2. Uncertainties, transparency in reporting and verifiability are important elements to be considered when discussing Articles 3.3 and 3.4. Therefore we suggest that the possibility of adoption of capping and/or discounting should be considered when discussing uncertainties and human-inducedness in Chapter III.

3. What should be included in the "additional activities" of Article 3.4 of the Protocol should be scrutinized based on the discussions in Chapter III etc. Hence it is not appropriate to treat "arable, pastoral and forestry land management, restoration of degraded lands, protected areas, agroforestry, and modern biomass energy, etc. " as if they are already approved as additional activities. Therefore we suggest the deletion of these examples. We also suggest to add a section named "a. List of possible additional human-induced activities in the light of general criteria" at the beginning of Chapter V and to make discussions on what kinds of activities can be included in Article 3.4 based on the general criteria etc.

We think the following elements should be investigated in Chapter V.
(i) forest management practices such as forest fire control, pest control, silviculture practices including thinning etc, changes in rotation periods, low impact harvesting practices, and assistance in natural regeneration, (ii) forest conservation including soil carbon management, (iii) conservation of natural ecosystems, (iv) vegetated area in urban region such as city park, (v) agroforestry and (vi) use of wood as substitutes for energy intensive materials and fossil fuel.

4. With regard to "projects" planned to be analyzed in Chapter VI, it is very important to secure fairness etc. in implementing them. Therefore, we suggest the following issues should be included in the discussion of Chapter VI, as are very important elements.

(i) additionality, (ii) project longevity, (iii) consistency with Articles 3.3 and 3.4 activities, (iv) temporal, spacious leakage and (v) verifiability.

5. If harvested wood will be included in carbon stocks, that policy could be inconsistent with the policy to account for only three activities in Article 3.3 depending on the way of definitions of these three activities. In that case, what kind of modification of inventory is needed should be handled in Chapter VII.

6. Other issues

(i) We suggest the replacement of "Implications of definitions:" at the beginning of Chapter III with " Implications of possible definitions: Forest, afforestation, reforestation and deforestation " and transfer it to Chapter IV as one of the sections of Chapter IV.
(Reasons) Since SBSTA, not IPCC, will make any decision on definitions of each terms, the outline of SRLFC should be in line with this situation. Also these terms are relating only to Article 3.3.

(ii) We suggest the replacement of "Differentiating between pre-1990 and post-1990 direct activities" in III c with "pre-1990 and post-1990 activities".
(Reasons) The issue of classifying pre 1990 or post 1990 activities and the issue of classifying direct or indirect activities should be dealt with separately.

(iii) We suggest the addition of "Significance of the setting of commitment periods consecutively" to the sections of Chapter III next to e.
(Reasons) Considering about the setting of commitment periods after 2008-2012 should be important issue for discussing both Articles 3.3 and 3.4.

(iv) We suggest that "-costs and benefits in the short- and long-term" in IV e and in V e should be transferred to IV f and V f respectively and transfer draft IV f and V f to IV g and V g respectively so that sections IV e and V e will seem to make more sense.

(v) We suggest that the title of Chapter V should be changed to "Article 3.4 Activities" following to the title of Chapter IV.

(vi) We suggest the inclusion of "Implications of possible definitions for the selected activities" at V b. Following order of sections should be amended in accordance with this inclusion.
(Reasons) Issues concerning Article 3.4 should be dealt with in line with Chapter IV.

(vii) We suggest the replacement of the part of V c."....(uncertainties, verification) resulting from Article 3.3 activities...." with the part of V e"....(uncertainties, verification, level of human-inducedness) resulting from Article 3.4 activities..".
(Reasons) Issues related to human-induced activities should be explicitly addressed in this Chapter.

PAPER NO. 6: NEW ZEALAND

IMPLEMENTATION OF ARTICLE 3(3) OF THE KYOTO PROTOCOL

1. This submission responds to the invitation from the SBSTA for Parties to submit information related to the implementation of Article 3(3)[1], particularly data and methods, and questions and issues identified in FCCC/SBSTA/1998/INF.1 by 15 August.

2. This submission does not, however, directly address data and methods for the implementation of Article 3(3). In our view, the data and methods required to give effect to Article 3(3), and in particular how "*verifiable changes in carbon stocks"* are to be calculated, are matters that are more properly considered by SBSTA in the context of Article 5(1).

3. It is clear from the provisions of Article 3(3) and paragraph 2 of decision FCCC/SBSTA/1998/CRP.3 that "adjustments to a Party's assigned amount shall be equal to verifiable changes in carbon stocks during the period 2008 to 2012 resulting from direct human-induced activities of afforestation, reforestation and deforestation since 1 January 1990".

4. We welcome the clarification by SBSTA that changes in carbon stocks are to be assessed during the period 2008-2012 as a result of activities since 1 January 1990. Providing for changes in carbon stocks to be assessed during the commitment period will also enable more timely accounting of changes in assigned amounts to be made. We note that SBSTA has clearly resolved the issues about alternative methods which were canvassed in FCCC/SBSTA/1998/INF.1 and that no further debate on these matters is required. However, the decision did leave a number of issues as matters for further consideration by Parties. Comments on these issues are outlined below.

5. During the course of the negotiations of Article 3(3) of the Protocol it had been our understanding that the activities of "*afforestation, reforestation and deforestation*" would be interpreted on the basis of land-use changes that have occurred since 1 January 1990. Hence, a land-use change based interpretation of these activities should apply unless and until SBSTA adopts an alternative interpretation. As noted in FCCC/SBSTA/1998/INF.1, interpretation of these terms on the basis of changes in land-use is consistent with the current IPCC definitions for afforestation and reforestation, although we would note that any definition for these two terms should be based on the "establishment" (rather than solely "planting") of a forest.

6. As noted in FCCC/SBSTA/1998/INF.1, there are several possible *definitions for forests*. In our view, any definition should take into consideration the context or purpose for which land is being managed. We would also note that some 'operational' definitions could potentially exclude significant carbon stocks if the vegetative cover has only recently been established (and hence a defined crown layer or a specified canopy height has yet to develop).

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[1] All references to "Articles" in this submission are to the relevant articles of the Kyoto Protocol to the UN Framework Convention on Climate Change

In short, the issue for any definition will be how can the establishment (or removal) of a "forest" be distinguished from other land-use activities?

7. Defining the length of *time required before a change in land-use can be said to have occurred* is an issue that applies to "deforestation" as well as to "reforestation". As noted in FCCC/SBSTA/1998/INF.1 there is a desire to avoid creating incentives to deforest prior to the first commitment period by defining a specified length of time between "deforestation" and "establishment" in order for any "reforestation" to be counted. However, once the commitment period has commenced, all deforestation would potentially be accounted for and having to wait some arbitrary length of time before deforested land could be reforested would clearly be inequitable and ultimately not in accord with the intent of Convention or the Protocol. We have noted these points in order to emphasise that care needs to be exercised when attempting to address issues which may only arise prior to the start of the first commitment period.

8. When defining the term "*direct human-induced*" it should be recognised that decisions by humans to intervene in, or withdraw from, the management of areas of land can directly lead to changes in carbon stocks. For example, the withdrawal or cessation of agricultural land-use practices can allow natural revegetation to occur on such land.

9. We look forward to further consideration of the above issues by SBSTA and welcome the opportunity to provide appropriate input at the workshop being organised by the Secretariat for September.

10. Finally, we would note that the issues discussed above, and our views on them, relate to Article 3(3) and are made without prejudice to consideration of a more complete treatment of carbon stocks under Article 3(4). In this regard we welcome the opportunity to provide views on how and which additional human-induced activities might be included under Article 3(4) by 1 October 1998.

PAPER NO. 7: PHILIPPINES

VIEWS ON METHODOLOGICAL ISSUES
(Refer to FCCC/SBSTA/1998/INF.1)
On Articles 3.3, 3.4, 3.7, and articles 5 and 7

Definitions:

a.) On how forests should be defined.
"Forests" should be viewed as ecosystems. Thus, a forest ecosystem includes all living organisms (flora and fauna) as well as non-living components (litter, soils, water, etc.). If this concept is adopted, it will solve the issue of having a too narrow definition of forests.

"Forests" could then be generally defined as ecosystems predominated by trees and other woody vegetation. More specifically, the following characteristics should be present:

- a minimum crown cover of 10%
- must exist in wild or natural conditions (although human disturbance may be present as in the case of illegal cutting of trees ans collection of fruits)
- absence of agricultural cultivation (although the forest may have regenerated from a previously shifting cultivation area); area that are under fallow only and which will be cleared for cultivation after a few years should not be included.

Other components within the ecosystem are included: nurseries, seed orchards, rivers, etc. Young natural stands which are in the process of regeneration are also included.

b.) On how afforestation should be defined.
Afforestation should be defined as: "the intensive planting of trees (instead of forest) on lands which historically have not contained forest". Such areas include, among others, sand dunes and grassland. If we are however, to consider that in the Philippines almost all lands have been previously forested and that it is estimated that when the Spaniards came in 1521, there were 90% forest cover, then there is hardly any area that may be considered for afforestation.

c.) On how reforestation should be defined.
We agree with the IPCC definition provided "some other land use" includes grasslands/pastures and agricultural farms which are the common uses in Philippine forest lands.

We also favor use of the word "establishing" rather than "planting" to include both natural and artificial means. In the Philippines, the use of assisted natural regeneration (ANR) as a reforestation strategy is a good example of combining natural and artificial means.

On the issue of whether planting after clearcutting can be considered for offset projects, it depends on whether the area would have replanted anyway or not. If the area will not be replanted without the offset project, then it should qualify for credit.

On how the term ”historical” will be defined, the Philippines does not have any regulation on specific number of year between deforestation and establishment to qualify as reforestation. However, the setting of 20 years as the minimum is agreeable as it will qualify most of our denuded lands for reforestation having been without forest cover for a long time (>20 years). One possible problem though is how individual country reports will be verified. In other words, one country may claim an area has been deforested for more than 20 years even if this is not so. This problem is compounded by inadequate records in many developing countries.

d.) On how deforestation should be defined.
Consistent with the above, we agree that deforestation refers to the change of land-use from forest to other land-use and the depletion of forest crown cover to less than 10% (para. 28). However, we do not see the reason for distinguishing human-induced and natural causes of forest loss. For instance, in the Philippines, forest fires may lead to loss of forests. Fires may be caused by man or by natural factors (e.g. lighting). In addition, this distinction may simply add to confusion. It might be better to just lump them together.

para. 28(a)
It is suggested that the last sentence should be “Sustainable logging (including planting after harvesting) is to be excluded from consideration”.

para. 29(a) Direct human-induced activities
Policies are not to be counted: only the physical activities since not all policies are religiously implemented.

para. 33 On carbon stocks
Ideally, C in all the five pools should be included in the analysis of C stock. However, there are very limited information available for humid tropical forests in developing countries like the Philippines. Of the five pools, only the above-and-below ground biomass and soils could be measured with some ease. C in wood products and land fills may be harder to trace since there are so many possible uses and lifespans of wood. In the future when more research data is available, it might be possible to have a uniform factor to compute C in wood products for countries of the same level of development and agro-climatic conditions.

para. 35
Landfills should not be considered as poll for carbon stock under forestry. It is more appropriate if it is considered under another sector which deals on waste management.

3. Other issues

para. 50

While 1990 is considered as the base year, the activities to be considered should be starting in 1991.

para. 69

The term land-use change and forestry should be used consistently.

para. 71-73

Because of the need for standardization and the amount of scientific work already spent, the 1996 IPCC guidelines should be the main basis for complying with Article 5 of the Kyoto Protocol. A period should be provided for each country to study possible modifications.

para. 74 and 75

"Sustainable forest management practices" could be defined as those practices which insure that the use of forest products and services does not exceed the capacity of the forest to regenerate them. Additionally, the ecological functions of the forest should not be adversely affected. For instance, the volume of wood harvested should not exceed the ability of the forest to regenerate the same volume within a reasonable period of time and without affecting the ecological benefits from the forest. A more comprehensive treatment of the subject is found in the guidelines of the ITTO (International Tropical Timber Organization) on sustainable forest management.

Annex II

While the inclusion of all these activities will theoretically make the GHG inventory more complete, the main problem is how accurate will estimate be. Of the 13 activities listed in the annex, harvesting may be the most easily estimated if there are records of the volume of wood extracted (even this is usually underestimated). For the others, the methodology will have to be developed and standardized.

- Specific Comments:
- (5) Forest management practices are too general. Each practice may have varying or even opposite effects on C stocks (e.g. silvicultural treatments that increase growth promote C sequestration while thinning will cause emission).
- (6) Forest conservation is the same as preservation (not using forest at all)? If this means protection of existing C stocks, then it should be included in the computation since (a) C protected is not released to the atmosphere and (b) this could be more easily determined from the change in area of protected forests.
- (11) Revegetation of degraded lands. How is this different from afforestation/reforestation?
- (8) and (12) are very related. How do they differ?

PAPER NO. 8: SAMOA
(ON BEHALF OF THE ALLIANCE OF SMALL ISLAND STATES (AOSIS)

QUESTIONS AND ISSUES FOR THE IPCC RELATED TO A SPECIAL REPORT ON LAND-USE CHANGE AND FORESTRY

The Alliance of Small Island States (AOSIS) is pleased to present its initial views on the relevant questions and issues for the Intergovernmental Panel on Climate Change (IPCC) to consider in their preparations for a special report on land-use change and forestry. In general, AOSIS is in favour of very strict considerations to be met if land use change and forestry activities are to be included in the mitigation efforts of the industrialised countries. The involvement of the IPCC in seeking to resolve the numerous scientific, technical and economic uncertainties and problems associated with land-use change and forestry and their subsequent implications on how to operationalize the Kyoto Protocol is therefore most welcome. In order to assist the Secretariat in their work, AOSIS has based this submission on the original Annex A presented by the Secretariat in the discussions of this matter at SBSTA-8.

It is the view of AOSIS that the IPCC in its special report should examine the technical and scientific issues related to forests, other land uses, and land-use change, including implications of forest and land-use change activities, and sequestration strategies and practices on water (including freshwater, surface water and ground water), soils, biodiversity, and other environmental and socio-economic effects; and the overall contribution of forests, land-use, and land-use change to global emissions by sources and removals by sinks. The special report should also consider the issues of direct human induced activities in the most comprehensive sense, for example to cover issues such as forest fires being set early in the dry season to avoid much larger fires later in the dry season, how to differentiate such activities from the purely accidental, as well as issues relating to the establishment of baselines for these activities. The IPCC special report should address the implications of the use of carbon stock changes from the land-use change and forestry activities to offset fossil fuel emissions on the ultimate objective of the Convention of stabilizing the concentration of greenhouse gases in the atmosphere so as to prevent dangerous climate change, on long and short time scales.

Article 3.3:

1. Forests

How could forests be defined?

2. Afforestation, reforestation and deforestation

How could afforestation be defined?

How could reforestation be defined? How could reforestation be distinguished from other forest management practices? How long must an area exist as another land-use type prior to

reforestation in order to assist in the definition of reforestation? What are the implications for the first and subsequent commitment periods?

What methodologies are required for assessing species succession as carbon sinks after forest fires? Will this be considered as reforestation? What time period is appropriate to establish that reforestation is taking place vis-à-vis species succession?

How should the term "planting of forests" be defined?

How would different definitions of the term "historical" affect accounting during the first commitment period?

How could deforestation be defined? How long must an area exist as another land use type prior to deforestation? What are the implications of having the first and subsequent commitment periods not conjunct? How could forest degradation be included in the definition of deforestation? Could reforestation and deforestation be defined in a symmetrical fashion between 1990 and the first commitment period?

What are the implications of different definitions for the protection of primary forests and other natural carbon reservoirs such as wetlands?

What are the potential perverse incentives resulting from different definitions in combination with the accounting of carbon stock changes during commitment periods?

3. Direct human-induced activities

What data, information and methodologies are available to estimate changes in carbon stock from direct human-induced activities?

What data, information and methodologies are available to estimate non-anthropogenic changes in carbon stock?

How can one distinguish between the changes in carbon stock due to non-anthropogenic phenomena and direct-human-induced activities?

How does one define and categorise direct human-induced activities?

How can one distinguish between unintended and deliberate human-induced activity on changes in carbon stock, including indirect human effects such as changes in fire frequency, pest and disease outbreaks, air pollution and effects of anthropogenic climate change?

4. Carbon stocks

What are the implications of the different time-scales governing the terrestrial biosphere, carbon stocks and changes in relation to:

a) the different timescales of fossil fuel emissions; and

b) the accounting during commitment periods and possible gaps between commitment periods, and the period before the first commitment period?

What is the present emphasis given by Parties, and what emphasis should be given to the protection of important national carbon or ecological stocks, such as wetlands, coral reefs, coastal and marine areas, peatlands, mangroves and mangrove forests, primary forests and other forest ecosystems?

What are the implications of feedbacks between the terrestrial biosphere and climate change for the use of land-use change and forestry activities to meet permanent emission reduction objectives?

Article 3.4:

What are the implications of adding a range of additional activities under Article 3.4?

What framework could be used to guide the inclusion of additional activities?
How could the "additional activities" referred to in Article 3.4 be determined?

What definitions, data, information and methodologies are needed to estimate changes in carbon stock of such activities?

What is the range of uncertainty associated with each activity?

Which institutions are likely to be engaged in additional 3.4 activities?

Are the accounting approaches discussed for Article 3.3 valid for additional activities under Article 3.4?

What information is available to assist the SBSTA in its consideration of which additional activities should be included?

Questions related to both Article 3.3 and 3.4

What methods and data are available for realistically estimating changes in carbon stock for each activity identified by the IPCC?

Which methods or combinations of methods have to be applied to account for the long term carbon flux of ecosystems, including disturbances like fires?

Are complete carbon balances necessary to assess the real carbon stock changes due to activities under Articles 3.3 and 3.4?

How many carbon pools, such as above-ground and below-ground biomass, soils, landfill, products and fossil-fuel substitutes, should be included in the definition of carbon stocks, and under what circumstances? What are the methodologies for estimating or measuring changes

in these respective carbon pools? What are the implications of including/excluding different pools for the initial and possible subsequent periods.
What are the potential impacts of land-use change and forestry activities on indigenous peoples and local communities?

What are the implications to biological diversity of additional and current land-use change and forestry activities?

Are adjustments required to the Revised 1996 IPCC Guidelines for estimating green house gas removals and sinks for land-use change and forestry or for estimating changes in carbon stocks? If needed, how should the IPCC Guidelines be adjusted in a manner consistent with their application by the UNFCCC? What are the implications of using (or not using) the revised 1996 guidelines in the first commitment period?

What methods are available to quantify uncertainties? How could uncertainties be reported? What approaches could be used to "discount" estimated values?

What are the implications of uncertainties to the verifiability of compliance with the commitments under Article 3?

What options and methodologies exist to monitor and verify changes in carbon stocks for each specific activity under Articles 3.3 and 3.4? Are they sufficient? What institutional or technical needs would be required for such monitoring and verification?

What options and methodologies exist to provide transparency in reporting under Article 3.3 and 3.4? How can the responses to this question be linked to the first item in this paper?

What are the economic implications of the previous two questions?

Should the type of data required for projects be different from, or consistent with, the type of data received for national green house gas inventories? What could be the format for reporting each type of data?

What are the potential perverse incentives resulting from different definitions and methodological approaches and application of the 1996 revised guidelines?

What types of supplementary information and/or new regimes (i.e. reporting, enforcement, verification, etc.) for land-use change and forestry activities might be required under Article 7.1 for the purposes of demonstrating compliance?

Full-accounting approach

Is it possible to develop a full accounting approach rather than an activity-specific approach as described in Article 3.4? What would be the implication for assigned amounts? Are methods available and if not when could they be available?

PAPER NO.9: SWITZERLAND

IMPLEMENTATION OF ARTICLE 3.3 OF THE KYOTO PROTOCOL

In response to the call at the eighth session of the Subsidiary Body for Implementation for comments concerning the implementation of the Article 3.3 of the Kyoto Protocol, Switzerland presents the following views.

1. The discussions on Article 3.3 during the eighth session of SBSTA put in evidence many open issues. Switzerland welcomes the preparedness of IPCC to accept the mandate from SBSTA to conduct a thorough analysis of the methodological, scientific and technical implications of the sink related articles in the Kyoto Protocol. Decisions on the implementation of Article 3.3 (and 3.4) should not be taken before the conclusion of the work of IPCC on its Special Report.

2. Switzerland would like to highlight a number of issues it considers particularly important in the context of the implementation of Article 3.3. In doing so, Switzerland is led by the principle, that the implementation of the Kyoto Protocol should be guided by the objective of the FCCC, i.e., contribute to the timely and lasting stabilization of GHG emissions at levels that prevent dangerous anthropogenic interference with the climate system.

(i) The application of the Kyoto Protocol should not lead to incentives for deforestation and forest degradation. Furthermore, sustainable forest management practices which contribute to high carbon sequestration, preserve biodiversity and soil quality and serve important socio-economic ends (e.g., as shelterwood) should be duly recognized in the context of the implementation of the Protocol. The terms reforestation, afforestation and reforestation need to be defined accordingly.

(ii) In considering carbon stock changes, a comprehensive approach needs to be applied. This implies the accounting of all relevant carbon pools. As a minimum, the organic layer and soil carbon must be included in calculations.

(iii) In order to maintain consistency in inventory data quality, methodologies need to be identified that achieve a degree of uncertainty in the LUCF sector that is comparable to the average quality reached in the other activity sectors.

(iv) The implementation of Article 3.3. should respect the goals of the Biodiversity Convention as well as the Framework Principles for the Protection of Forests.

(v) The same principles and standards on LUCF related activities should be applied throughout the Kyoto Protocol. The accounting of activities under Articles 6 and 12 of the Protocol should not be in contradiction with the accounting of activities under Article 3.3.

(vi) On the basis of the IPCC Special Report and taking into account relevant existing guidelines (e.g., the Guidelines for Sustainable Forest Management adopted by the Ministerial Conference of the Protection of Forests in Europe), adequate guidelines need to be worked out before the accounting of activities in the LUCF sector is authorized under the Kyoto Protocol.

PAPER NO. 10: UNITED STATES OF AMERICA

METHODOLOGICAL ISSUES RELATED TO LAND USE CHANGE AND FORESTRY AND THE KYOTO PROTOCOL

At the eighth session of the Subsidiary Body for Scientific and Technological Advice in Bonn, Germany, the Parties agreed in FCCC/SBSTA/1998/CRP.3, paragraph 5,

> *The SBSTA invites Parties to submit information related to: (a) The implementation of Article 3.3, particularly on data and methods, and questions and issues identified in FCCC/SBSTA/1998/INF.1, by 15 August 1998 for compilation into a miscellaneous document by approximately August 30, 1998;*

The U.S. notes the progress made in Bonn regarding LUCF activities, in particular, the decisions to: 1) clarify Article 3.3 (FCCC/SBSTA/1998/CRP.3, paragraph 2); invite parties to submit information relating to LUCF activities; 3) task the IPCC with a special report; and 4) request SBSTA to organize workshops on LUCF activities.

This U.S. submission covers the following general areas:

1) Kyoto Protocol language related to forests, land use, and land use change;
2) Recommendations for the IPCC Special Report;
3) Guidance on the Article 3.3 workshop, September, 1998;
4) Recommendations for the workshop to focus on Article 3.4; and
5) A timetable for moving forward on Articles 3.3 and 3.4 of the Kyoto Protocol

1) Kyoto Protocol language related to forests, land use, and land use change:

The United States continues to seek full and comprehensive treatment of all anthropogenic emissions and sinks of greenhouse gases under the Framework Convention and under the Kyoto Protocol. Comprehensive treatment of forests and other lands uses, including agriculture, range, and pasture lands, is necessary to ensure that:

- all human activities that influence the concentration of greenhouse gases in the atmosphere are adequately addressed; and

- the most cost-effective mitigation strategies are pursued.

The U.S. recognizes the limited set of activities outlined in Article 3.3 are a step in that direction. However, many questions remain regarding the current language. The informal document FCCC/SBSTA/1998/INF.1 prepared by the FCCC Secretariat, outlines many of the technical and policy questions that we face. The document prepared by the Secretariat goes beyond summarizing the issues regarding land use change and forests in the Kyoto Protocol and offers interpretations of the language. The United States believes that ultimately, the job of interpretation of the text is best left to the Parties. We recognize that, while not explicit in the Kyoto Protocol, it is desirable to seek a common approach among Parties in defining the

activities referred to in Articles 3.3 and 3.4 of the Kyoto Protocol. We also recognize the value of the planned IPCC Special Report on LUCF activities and acknowledge that the IPCC's technical work is important to meet the aim of a consistent, scientifically based approach to implementing Articles 3.3 and 3.4 of the Kyoto Protocol. A number of options are available with regard to the language in Articles 3.3, 3.4 and 3.7 especially with respect to key terms. An examination of these options must be guided by the following:

1. **Interpretations should be consistent with the level of commitment Parties agreed to for the first commitment period**. Interpretations adopted for the first commitment period should not produce a departure from the targets negotiated in Kyoto.

2. **Interpretations of key LUCF terms should be based on sound science.** Terms in the Kyoto Protocol should have grounding in the scientific and technical literature. Countries should employ the best practicable technical methods for measuring carbon and other greenhouse gas emissions and sequestration on land use and forestry, and ensure that the emissions and sequestrations reported are monitorable and verifiable. Where data gaps and uncertainties exist, countries should seek to improve understanding and measurements of greenhouse gas emission activity.

3. **Interpretations should promote other environmental objectives related to land use, recognizing tradeoffs and complementarities among environmental goals.** Land use changes and forestry have significant environmental impacts beyond their effects on greenhouse gases. Parties should be alert to creating incentives that affect the broader environment. For example, activities should implicitly encourage sound forest and agricultural management practices along with carbon sequestration. To the extent that optimizing carbon sequestration conflicts with, say, improvements in biodiversity, appropriate balances should be considered and addressed.

4. **Interpretations of land use and forest activities should create appropriate incentives.** To a large extent, the only way to provide the proper environmental and economic incentives is to have an accounting system for sinks that is as comprehensive as possible. Important cost savings may be lost if certain land use activities sequester carbon more cheaply than others, but are excluded from the treaty.

***2) Recommendations on the IPCC Special Report*:**

In FCCC/SBSTA/1998/CRP.3, paragraph 7, SBSTA requested the IPCC to prepare and provide information to the SBSTA and the Conference of Parties, in particular a Special Report as defined by IPCC procedures, on land use, land use change and forestry. The focus of the Special Report should be on the methodological, scientific, and technical implications of alternative interpretations of the relevant articles of the Protocol, particularly Articles 3.3 and 3.4. The special report should use full anthropogenic carbon stock accounting as the reference point for consideration of key terms in the Protocol related to land use, land use change and forestry activities.

In order to meet the needs of the Parties, the special report should include assessments of:

- C The overall contributions (short and long run) from land use activities, land change and forestry;

- C The implications of the potential approaches for key terms in Article 3.3 of the Kyoto Protocol (including forests, afforestation, reforestation, and deforestation);

- C Other activities that should be considered under Article 3.4, including: soil carbon management on forest lands, crop lands, range lands, and pasture lands; improvements in forest management; and conservation;

- C Inventory and data availability to report these activities; and

- C Shortcomings and limitations of only counting these activities versus full and comprehensive accounting.

To assist in the task of developing potential interpretations, we have provided a compilation of definitions used in the United States and internationally for the terms deforestation, afforestation and reforestation (Lund, 1998; attached). The potential interpretations of the other key forest and land use terms and implied in the Kyoto Protocol are characterized in Section B (1) of FCCC/SBSTA/1998/INF.1. These terms include: direct human-induced; activities; carbon stocks, and forests.

The IPCC should use a set of objective questions as part of the evaluation of alternative interpretations of key terms. For each potential interpretation, the IPCC should address:

- C Can inventory methods and reporting guidelines be developed and made available (or are they already available)?

- C What are the data requirements and uncertainties for the inventory methods and reporting guidelines?

- C What structural problems and accounting gaps exist?

- C What are the greenhouse gas mitigation options that are included and excluded?

- C What uncertainties exist in our scientific understanding of the effect of LUCF on the carbon cycle?

- C Can discounting systems be developed to adjust estimates for uncertainty and risk?

The process of developing this Special Report should provide for close coordination with the SBSTA and allow the SBSTA to provide interim feedback and direction during its development. Mechanisms to facilitate this include: comments provided by the Parties to the Secretariat by 15 August, 1998; additional comments by the Parties in their October 30, 1998 submissions to the FCCC Secretariat; the September workshop; and the workshop on Article 3.4 scheduled for January or February of 1999. A discussion of progress and the need for

interim feedback on the IPCC special report should be placed on the agenda of upcoming SBSTA meetings.

3) Guidance on the Article 3.3 workshop, September, 1998

We appreciate the efforts of the FCCC Secretariat and the IPCC in preparing for the workshop scheduled for September 23-25, 1998. The primary outcome of this workshop should be a draft of a detailed outline for the IPCC Special Report (to be forwarded to the IPCC Plenary); agreement on the process for completing and reviewing the special report; and an initial discussion of the specific terms and implications of alternative interpretations between Parties. It should be noted that there will be links between issues raised at the September 1998 workshop, issues that will be raised at the 1999 workshop and the IPCC special report. Workshop preparations should take into account such linkages.

Key items that would be useful as input to the September workshop include:

C A compilation of the August 15, 1998, submissions of Parties by the FCCC Secretariat. The Secretariat should make a presentation of the compilation at the September workshop. This presentation should include, if appropriate, a summary of potential interpretations of key terms offered by the Parties and additional activities proposed under Article 3.4. This presentation should also include a compilation of the views from the Parties on the scope and nature of the IPCC Special Report.

C A presentation by the IPCC on the proposed outline under development for the Special Report on Forests and Land Use Change and the Kyoto Protocol.

C Presentations by 3-5 Parties on the implications of various interpretations of key terms outlined in FCCC/SBSTA/1998/INF.1.

4) Recommendation for a Workshop to focus on Article 3.4. Issues:

The U.S. strongly supports holding a discussion at the September SBSTA workshop to plan the second workshop on LUCF activities, focusing on activities that could be added under Article 3.4. The U.S. has offered to support and host such a workshop in February or March, 1999 and would be pleased to provide additional logistical information at the September workshop about the 1999 workshop. A discussion in September could facilitate ensuring appropriate balance in the Special Report, in particular recognizing that there will be links between issues raised at the Article 3.4 workshop and issues raised at the September 1998 workshop.

5) A timetable for moving forward on Articles 3.3 and 3.4 of the Kyoto Protocol:

To maintain forward movement on LUCF activities, the US has identified a timetable and actions to be taken toward making operational the relevant LUCF articles in the Kyoto Protocol.

August 30, 1998:	Secretariat compiles submissions on Article 3.3. This MISC. document will be available to the Parties at the September Workshop and delivered to SBSTA and COP4.
September 23, 1998:	Workshop on Article 3.3 – discuss alternative interpretations of LUCF activities, identify data needs and gaps; provide guidance for the IPCC Special Report; scope workshop on 3.4.
September 25, 1998	IPCC Plenary , Vienna, Austria. Continue to scope Special Report with input from workshop and submissions by Parties. Approve draft IPCC workplan for special report on Land Use and Forestry under the Kyoto Protocol, noting emendations likely to emerge from Article 3.4 workshop and related submissions.
October 1, 1998	Deadline for submission by Parties on modalities, rules and guidelines for Article 3.4, which may include information on additional categories.
October 30, 1998	Secretariat compiles submissions on Article 3.4. This MISC. document will be available for the Parties at the February/March Workshop and delivered to SBSTA and COP4.
November, 1998:	COP 4—Approve plan of work regarding IPCC Special Report. Deliver MISC. document from September Workshop.
February or March, 1999:	Workshop on Article 3.4. Continue process of identifying additional LUCF activities.
November, 1999:	COP 5—IPCC provides progress report on Special Report or delivers Special Report on LUCF activities. If delivered, Parties should be prepared to agree on 3.3 interpretations and additional activities under Article 3.4 that would be included in the first commitment period (2008-12)
June, 2000:	SBSTA—IPCC delivers Special Report on LUCF activities. Parties should be prepared to agree on operationalizing Article 3.3 and additional activities under Article 3.4 that would be included in the first commitment period.
November, 2000	COP 6 – Partie agree on operationalizing Article 3.3 and additional activities under Article 3.4 that would be included in the first commitment period.

DEFINITIONS OF DEFORESTATION, AFFORESTATION, AND REFORESTATION
A report prepared for the USDA Forest Service and IUFRO 6.03.02

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Abstract: The Third Conference of the Parties to the United Nations Framework Convention on Climate Change (FCCC) held 1-11 December 1997 in Kyoto, Japan calls for, among other things, the tracking emission sinks resulting "from direct human-induced land use change and forestry activities, limited to afforestation, reforestation and deforestation since 1990." The FCCC Secretariat called for clarification of the use of these terms as they are used in various parts of the world [see: http://www.unfccc.de, Official Documents, Subsidiary Body for Scientific and Technological Advice (SBSTA) Document FCCC/SBSTA/1998/INF.1].

We initially developed this paper at the request of Dr. H. Fred Kaiser, USDA Forest Service. It has since been updated to incorporate input from the IUFRO Working Unite 6.03.02 Discussion Group on Reforestation, Afforestation, and Deforestation (RAD). This paper lists various definitions that have been used or are in use for deforestation, afforestation, and reforestation. To have a clear understanding of these terms we also need to definitions of tree, forest, degradation and other terms. The definitions we present were derived from a search via the Internet and from individual input. We list the sources used and additional contacts at the end of this paper. We also present a short discussion and comparison at the end of each set of definitions. See also http://home.att.net/~gklund/RADQA.html

Our thanks to all those that responded to our emails and provided the most valuable input.

Keywords: Climate change, forest, tree, afforestation, deforestation, reforestation, plantations.

GENERAL DISCUSSION

Deforestation, afforestation, and reforestation are actions or acts. There are probably fewer disagreements over these terms than on what to call the lands (deforested, afforested, and reforested) once the action is completed and how long the lands remain in those historical categories.

The decision on which terms and definitions presented here must be considered in light with the end point in mind. Most importantly, we need a clear understanding of what it is that we

are interested in and how we wish to use the information. It may turn out that none of the terms listed below are what is needed.

There are several issues one must consider. The Kyoto protocol speaks of changes in *human-induced land use changes* Are natural tree invasions, in the case of afforestation, and natural regeneration, in the case of reforestation, acknowledged or accepted? Do the terms reforestation and afforestation imply that there will be timber crops produced or just tree cover increased? Did the authors really mean **land use** or did they mean **land cover**?

Land Cover

4. **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. [Source: Interim Resource Inventory Glossary. U.S. Dept. of Agriculture, Forest Service. 14 June 1989]**
2. **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 [Source: Di Gregorio and Jansen 1997, 1998, Jansen and Di Gregorio 1998].**

Land Use

1. **The predominant purpose for which an area is employed. [Source: Interim Resource Inventory Glossary. U.S. Dept. of Agriculture, Forest Service. 14 June 1989]**
2. **The arrangements, activities and inputs people undertake in a certain land cover type to produce, change or maintain it. [Source: 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."**

If one is speaking of carbon sequestration, the fact that some lands with trees are considered forests and others are considered agricultural lands is unimportant. Rather than getting embroiled with definitions of forests, etc., we may prefer to speak of vegetated, revegetated, and devegetated lands where woody vegetation is the primary interest. Thus, one would include all lands with trees on them (forests, agricultural lands, urban areas, etc) and the changes in that cover.

What is important is the kind, amount (extent and size), and relative permanence of the woody vegetation. The kind and amount can be determined from remote sensing. The relative permanency depends, in part, on the landowners' management objectives.

To determine if an area has been afforested, deforested, or degraded, or vegetated (*having established vegetation in or on* – WWWebster), *revegetated (having provided barren or denuded lands with a new vegetative cover* – WWWebster) or devegetated (*having removed the vegetation from an area*), one must have some indication of what was the prior land and vegetation condition. The location and degree of change is determined by **monitoring** changes in land and vegetation cover. The interpretation depends on the **time interval** between observing or reporting periods. For example if an area was clearcut in 1996 and planted in 1997 – one could say the area was deforested in 1997 and reforested in 1998. If the same area were observed again in 1999, is the area now considered forested, reforested, or both? The fact that such estimates are estimates of change and with the estimates of change, the time factor is of importance is often overlooked.

The area of forested land may be easily determined from national inventories or remote sensing projects. If the inventories involve permanent sample sites or if periodic remote sensing coverage is obtained, one can determine which areas have changes in vegetation cover. Again, monitoring is an essential if one is to determine areas of forest degradation, deforestation, reforestation, and afforestation. The results from national forest inventory program which do not have monitoring components should be questioned.

Note from Christoph Kleinn: I think, the only easy thing is to copy the numbers from the results volume. Technically, as you know, there are various uncertainties around those data. Lastly, most forest inventories, do not look at lands where there are no trees. Consequently statistics on areas suitable for reforestation and afforestation will probably be missing nationally and globally.

TREE

1. A woody perennial with a single main stem or, in the case of coppice, with several stems, having a more or less definite crown. Includes: Bamboos, palms another woody plants meeting the above criterion. [Source: UN-ECE/FAO Temperate and Boreal Forest Resource Assessment 2000 – Terms and Definitions. GE.97-22231. 1997. 13 p.]
2. Woody plants that generally have a single main stem and have more or less definite crowns. In instances where life form cannot be determined, woody plants equal to or greater than 5 m in height will be considered trees. [Source: http://biology.usgs.gov/fgdc.veg/standards/appendix3.htm]
3. A woody plant usually having one or more perennial stem at least 3 inches d.b.h. at maturity, a more or less definitely formed crown of foliage, and a height of at least 16 feet at maturity. [Source: USDA Forest Service. 1989. **INTERIM RESOURCE INVENTORY GLOSSARY**. Document dated June 14, 1989. File 1900.Washington, DC: U.S. Department of Agriculture, Forest Service. 96 p]
4. A woody perennial plant having a single usually elongate main stem generally with few or no branches on its lower part [Source: WWWebster]

Discussion: Definitions two and three have a built-in height threshold.

FORESTRY

The science of developing, caring for, or cultivating forests b : the management of growing timber (WWWebster)FORESTS

1. Ecological systems with a minimum of 10% crown coverage of trees and/or bamboos, generally associated with wild flora, fauna and natural soil conditions, and not subject to agricultural practices. [Source: from http://faov02.fao.org:70/0gopher_root%3a[fao.fra]def_uk.txt (concepts, definitions and methodology of the FAO Forest Resources Assessment 1990) via Bernhard Schlamadinger]
2. A land area with a minimum 10 % tree crown coverage (or equivalent stocking level), or formerly having such tree cover and that is being naturally or artificially regenerated or that is being afforested. [Source: Päivinen et al. Via Brita Pajari]

3 Forest and other wooded land **.** Land under natural or planted stands of trees, whether productive or not and exceeding 0.5 ha in extent. It includes areas occupied by roads, small cleared tracts and other small open areas within the forest which constitute an integral part of the forest. [Source: Päivinen et al. Via Brita Pajari]

4 (UN-ECE/FAO) Land with tree crown cover (or equivalent stocking level) of more than 10 percent and area of more than 0.5 ha. The trees should be able to reach a minimum height of 5 m at maturity in situ. May consist either of closed forest formations where trees of various storeys and undergrowth cover a high portion of the ground; or of open forest formations with a continuous vegetation cover in which tree cover exceeds 10 percent. Young natural stands and all plantations established for forestry purposes which have yet to reach a crown density of 10 percent or tree height of 5 m are included under forest, as are temporarily unstocked as a result of human intervention or natural causes but which are expected to revert to forest. Includes: Forest nurseries and seed orchards that constitute an integral part of the forest; forest roads, cleared tracts, firebreaks, and other small open areas within the forest; forest in national parks, nature reserves and other protected areas such as those of special environmental, scientific, historical, cultural, or spiritual interest; windbreaks and shetlterbelts of trees with an area of more than 0.5 ha and a width of more than 20 m. Rubberwood plantations and cork oak stands are included. Excludes: Land predominantly used for agricultural practices. [Source: UN-ECE/FAO 1997]

5. Canada - BC) Crown land or private land that is predominantly maintained in one or more successive stands of trees, successive crops of forage, or wilderness. [Source: Glossary of Forestry Terms, Province of British Columbia, Ministry of Forests, http://www.for.gov.bc.ca/pab/publctns/glossary/glossary.htm via Igor A. Yakovlev]
6. (Ukraine) Combination of land, vegetation dominated by trees and shrubs, animals, microorganisms and other natural components interconnected in their development and influencing each other and the environment." [From: ``The Forest Code of Ukraine" Kiev, 1994, 56p. "Maksym Polyakov" mpoliak@pcomp.usau.kiev.ua Date: Thu, 11 Jun 1998 12:06:37 +0300 (MSD)]
7. (developed countries) Land with tree crown cover (stand density) of more than about 20 per cent of the area. Continuous forest with trees usually growing to more than about 7 m in height and able to produce wood. This includes both closed forest formations where trees of various storeys and undergrowth cover a high proportion of

the ground, and open forest formations with a continuous grass layer in which tree synusia cover at least 10 per cent of the ground. [Sources: "State of the World's Forests", FAO, 1997, pp. 173-174; Schuck, A., Parviainen, J. and Bücking, W. 1994. A review of approaches to forestry research on structure, succession and biodiversity of undisturbed and semi-natural forests and woodlands in Europe. EFI Working paper 3. Draft 15.8.1994. 62 pp.; Silviculture Terminology - Introduction, Silviculture Terminology - September 1993. SAF Silviculture Working Group Newsletter (D-2). October 1993. Society of American Foresters. Definitions used in the Helsinki Process - http://www.mmm.fi/english/minkonf/criteria.htm]

7. Land under natural or planted stand of trees, whether productive or not. Included are shrub land, savannah etc., land from which forests have been cleared but that will be reforested in the foreseeable future, area occupied by forest roads, small cleared tracts and other small open areas within the forest and which constitute an integral part of the forest. [Sources: FAO yearbook Production. 1992. Vol. 46. FAO Statistics Series No. 112. 281 pp. ; Schuck, A., Parviainen, J. and Bücking, W. 1994. A review of approaches to forestry research on structure, succession and biodiversity of undisturbed and semi-natural forests and woodlands in Europe. EFI Working paper 3. Draft 15.8.1994. 62 pp.; Silviculture Terminology - Introduction, Silviculture Terminology - September 1993. SAF Silviculture Working Group Newsletter (D-2). October 1993. Society of American Foresters. Definitions used in the Helsinki Process - http://www.mmm.fi/english/minkonf/criteria.htm]

9. (USA - Massachusets) Land that is at least sixteen and seven-tenths per cent stocked, that contains at least seven and five-tenths square feet of basal area per acre by forest trees of any size; or that formerly had such tree cover and is not currently developed for non-forest use; or that is a plantation containing at least five hundred trees per acre. [Source Chapter 61 Massachusets Taxation Law - http://www.forestmeister.com/laws/ch61.html]

10. (Sweden) Land which is suitable for wood production, and not used to a significant extent for other purposes; and land where tree cover is desirable in order to protect against sand or soil erosion, or to prevent a lowering of the tree line. [Source: Swedish Forest Act - http://www.svo.se/eng/englaw.htm]

11. (Russia) One of main types of vegetation consist of an aggregate of trees, shrub, grassy etc. plants (mosses, lichens), including animals and microorganisms biologically interconnected in the development and influencing against each other and an environment. [From: " Russian Forest Encyclopedia" "Igor Yakovlev" yakovlev@mari-el.ru Date: Sat, 6 Jun 1998 21:16:59 +0400]

12. (Russia) A population of forest plants changed in the exterior form and an internal structure under influence of effect against each other, on occupied soil and atmosphere. (G.F. Morozov- archfounder of scientific forestry in Russia). In practice of forestry forest consider as tree stands with a polnota more than 0,3. If polnota less than 0,3 - stand calls as light forest or open woodland. Main difference of a forest from "not forests " - the existence of mutual influence between all elementary component of a forest. [From: " Russian Forest Encyclopedia" "Igor Yakovlev" yakovlev@mari-el.ru Date: Sat, 6 Jun 1998 21:16:59 +0400]

13. (Slovenia) A plot of land overgrown with forest trees in the form of stands or other forest growths which provide any of the functions of a forest. Forests according to this

law also include overgrown plots of land defined as forest in the spatial element of the forest management plan. The following are not forest within the meaning of this law: individual forest trees, groups of forest trees up to an area of five hectares, non-autochthonous riverine and windbelt trees, avenues, parks, plantations of forest trees, pens for rearing game, and pastures overgrown with forest trees if used for pasturing, irrespective of how they are described in the land register. [From: Slovenian LAW ON FORESTS - Milan SINKO milan.sinko@UNI-LJ.SI via "Maksym Polyakov" <mpoliak@pcomp.usau.kiev.ua Date: Fri, 12 Jun 1998 16:11:17 +0300 (MSD)]

13. (Czech Republic) Forest stands with its environment and land designated for the fulfillment of forest functions. Forest functions shall mean benefits towards the general well-being of the society conditional on the existence of forests, which consist of wood-producing and non-wood-producing functions. Forest stands shall mean trees and shrubs of forest tree species which, in their particular environment, fulfil forest functions. [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)]

15. (Norway) Land which produces forest or which on an overall farming- and forestry assessment is considered to be most suitable for forest production and is not being used for any other purpose. [Source: The Norwegian Forest and Forest Protection Act of May 21, 1965 with amendments, latest by the Act no. 96 of June 11, 1993. http://www.nijos.no/panorama/!skog.htm From: "Maksym Polyakov" <mpoliak@pcomp.usau.kiev.ua Date: Mon, 15 Jun 1998 19:27:19 +0300 (MSD)]

16. (USA) Land at least 10 percent occupied by forest trees of any size or formerly having had such tree cover and not currently developed for non-forest use. Lands developed for non-forest use include areas for crops, improved pasture, residential, or administrative areas, improved roads of any width, and adjoining road clearing and powerline clearing of any width. [Source: Code of Federal Regulations. Title 36, Volume 2, Parts 200 to 299. [Revised as of July 1, 1997. CHAPTER II--FOREST SERVICE, DEPARTMENT OF AGRICULTURE. PART 219--PLANNING. Subpart A--National Forest System Land and Resource Management Planning. Sec. 219.3 Definitions and terminology. http://www.fs.fed.us/outdoors/wildlife/wfrp/plans/cfr219.txt From: "Maksym Polyakov" <mpoliak@pcomp.usau.kiev.ua Date: Sat, 27 Jun 1998 16:14:46 +0300 (MSD)] The land must be a minimum of one acre in area. Roadside, streamside, and shelterbelt strips of timber must have a crown width of at least 120 feet to qualify as forest land; and unimproved roads, trails, streams, and clearings within forest areas are classified as forest land if they are less than 120 feet wide. [Source: FSH 4809.11 Forest Survey Handbook, 1972. USDA Forest Service, Washington, DC]

17. (and Woodland). Land under natural or planted stands of trees, whether productive or not. This category included land from which trees have been cleared but will be reforested in the foreseeable future, but it excludes woodland or forest used only for recreation purposes. Stands of permanent crops such as rubber, fruit trees, nut trees, are classed as permanent crops under agricultural lands. [Source: FAO Production Yearbook. 10.10.97. http://www.fao.org/waicent/faosat/agricult/landuse-e.htm]

18. Assemblages of ecosystems comprised of trees, other vegetation, litter and soils, each having its own temporal dynamics, carbon storage patterns, and carbon release rates to the atmosphere. [Source: FCCC/SBSTA/1998/INF.1, 18 May 1998]
19. (developing countries). Ecosystem with a minimum of 10 per cent crown cover of trees and/or bamboos, generally associated with wild flora, fauna and natural soil conditions, and not subject to agricultural practices. [Source: "State of the World's Forests", FAO, 1997, pp. 173-174].
20. An area of tree-covered land typically consisting of hundreds or thousands (or more) of individual stands comprising trees of similar species composition, age-structure and management regime. [Source: Glossary in M.J. Apps and D.T. Price (eds.) (1996). *Forest Ecosystems, Forest Management and the Global Carbon Cycle.* NATO ASI Series I (Global Environmental Change), vol. I 40, Springer-Verlag Academic publishers, Heidelberg.]
21. A dense growth of trees and underbrush covering a large tract [Source: WWWebster Dictionary]
22. (India) Any land recorded as forest in any of the land records is legally a forest land. This legal connotation provides a working definition of forest land to the forest managers in India for all the practical purposes. This definition disregards whether there is any vegetation on that land or not. [Source: Forest Conservation Act, 1980, From: "Vivek K. Varma" <v.varma@landfood.unimelb.edu.au Date: Fri, 17 Jul 1998 02:28:29 -0400 (EDT)]
23. (Kyoto forest) That part of forests in industrialized countries whose changes in carbon stocks during the commitment period are used to meet emission reduction commitments. Under Article 3 para 3 of the Kyoto Protocol, these are such forests that are affected by afforestation, reforestation and deforestation that has taken place since 1990, and for which verifiable changes in carbon stocks attributable to these activities are measurable in the first commitment period (2008-2012).

Discussion: The definitions of "forest" and "forest land" vary considerably from being an administrative unit (Def. 14 and 22. See also Forest Fund below), a function of land use (Def. 2, 8, 9, 14, 15, 16), and one of tree cover (Def. 1, 3, 4, 7, 11, 12, 13, 20, 21) or combinations thereof (Def. 4). Definition one is an old FAO one used for the tropics in the 1990 Global Forest Resources Assessment. The definition for the developed world used a 20% crown cover threshold. Definition 4 is now the "official" FAO definition for the 2000 Global Forest Resources Assessment. As you will note it is based upon a combination of tree cover, land potential, and land use with land use or potential dominating. Definition 23 restricts "forests" to industrialized countries.

FORESTATION

1. (North Amer.) (Afforestation, Reforestation) The establishment of forest, naturally or artificially, on an area, whether previously carrying forest or not. [Source: Ford-Robertson via Tim Mullen]
2. (Chile) La acción de poblar con especies arbóreas o arbustivas terrenos que carezcan de ellas o que estando cubiertos de vegetación, ésta no sea susceptible de explotación económica, ni mejoramiento mediante manejo. [Source: Chile Forest Law 701 via Juan Pablo Cerda]

AFFORESTATION

1. The act or process of establishing a forest especially on land not previously forested. [Source: WWWebster Dictionary]
2. (USA) Establishment of forest crops by artificial methods, such as planting or sowing on land where trees have never grown. [Source: Timber Harvesting and Engineering Glossary, USFS]
3. The artificial establishment of forest corps by planting or sowing on land that has not previously, or recently, grown trees. [Source: Water Words Dictionary]
4. The establishment of a tree crop on an area from which it has always or very long been absent. NOTE: Where such establishment fails and is repeated, the latter may properly be termed reafforestation. [Source: Ford-Robertson via Christian Matter, Edward F. Loewenstein, and Tim Mullen and Silvicultural Terms in Canada - Second Edition 1995 From: Mark Johnston <johnston@larix.derm.gov.sk.ca Date: Tue, 16 Jun 1998 17:44:48 -0600]
5. (Australia and New Zealand) The establishment of a species of forest on an area where it does not occur naturally (British Commonwealth Terminology). [Source: Ford-Robertson via Christian Matter, Edward F. Loewenstein, and Tim Mullen]
6. The establishment of a forest or stand of trees by sowing, planting, or natural regeneration on an area not previously forested, or in areas where forests were cleared long ago and other land-use patterns have dominated the landscape for many generations (e.g., the moorlands of Great Britain). [Source: J. Dunster and K Dunster via Eric Boa, Phil Loseth and Renate Prüller]
7. [The establishment of plantations] to produce a forest product "crop" on lands that previously have not supported forests for more than 50 years. [Source: From IPCC Guidelines, Reference Manual, p. 5.13 (Brown et al., 1986: Brown S., A.E. Lugo and J. Chapman (1986), Biomass of tropical tree plantations and its implications for the global carbon budget", Canadian Journal of Forest Research 16: 390-394). via Bernhard Schlamadinger]
8. The establishment of a tree crop on an area from which it has always or very long been absent. Where such establishment fails and is repeated, the latter may properly be termed reafforestation. [Source: "State of the World's Forests", FAO, 1997, pp. 173 – 174 via Bernhard Schlamadinger].
9. (Canada - BC) The establishment of trees on an area that has lacked forest cover for a very long time or has never been forested. [Source: Glossary of Forestry Terms, Province of British Columbia, Ministry of Forests, http://www.for.gov.bc.ca/pab/publctns/glossary/glossary.htm via Igor A. Yakovlev]
9. The establishment of forest on a previously non-forested site. [Source: Definition prepared for a still unpublished work on forest management via Renate Prüller]
11. Artificial establishment by planting or seeding of forest on a non-forest area (e.g. agricultural or other land). [Source: UN/ECE 1990, via Brita Pajari]
12. Planting of new forests on lands which, historically, have not contained forests. These newly created forests are included in the category Changes in Forest and Other Woody Biomass Stocks in the Land Use Change and Forestry module of the emissions inventory calculations. [Source: IPC Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Reporting Instructions (vol. I), Glossary, pp. 1-18]

13. (Ukraine) Creation of forest plantation on the lands which previously were not covered by forest. Note that ``forest plantations" defined as ``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. Establishing new forests on lands which have not contained forests before. [From: "Igor Yakovlev" yakovlev@mari-el.ru Date: Wed, 10 Jun 1998 02:51:19 -0400 (EDT)]
15. Establishing new forests on lands which, historically, have not contained forests. [From: Schlamadinger Bernhard uvu@ornl.gov Date: Tue, 9 Jun 1998 18:02:09 -0400 (EDT)]
16. (Czech Republic) Creation of forest plantation on the lands which previously were not covered by forest. The establishment 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)]
17. (India) Defined as bringing any land under forest cover, which was not previously under forest cover. [Source: Glossary of Technical Terms, Forest Research Institute, India. From: "Vivek K. Varma" <v.varma@landfood.unimelb.edu.au Date: Fri, 17 Jul 1998 02:28:29 -0400 (EDT)]

Discussion: Definitions 2, 4, 7, and 8 use the term "crop" in the definition. If taken literally, this implies that the trees are planted for commercial uses. Shelterbelts, plantations for carbon sequestration may not be included. Definition 5 approaches an issue of planting exotic species. Definitions 2, 3, 11, 12,13 and 16 allow only artificial establishment. The rest permit natural establishment such as Pinyon-Juniper invading lands that previously did not have tree cover. Definition 12 does not mention sowing. Definition 16 does not specify if the land was not previously forested. See definition of ***plantation*** below.

REFORESTATION

1. The act of renewing forest cover by planting seeds or young trees. [Source: WWWebster Dictionary]
2. Restocking an area with forest trees. [Source: Timber Harvesting and Engineering Glossary, USFS]
3. The planting of trees on land from which the forest has been removed. [Source: Water Words Dictionary]
4. (Reforestation is a preferred synonym) forestation, revegetation (meaning the key term is narrower in sense than the one following). [Source: Ford-Robertson via Christian Matter, Edward F. Loewenstein, and Tim Mullen]
5. Re-establishment of a tree crop on forest land (British Commonwealth Terminology). [Source: Ford-Robertson via Christian Matter, Edward F. Loewenstein, and Tim Mullen]
6. The natural or artificial restocking of an area with forest trees. Typically, refers to planting. [Source: J. Dunster and K Dunster via Eric Boa and Renate Prüller]

7. Establishment of a tree crop on forest land. [Source: "State of the World's Forests", FAO, 1997, pp. 173 – 174 via Bernhard Schlamadinger]
8. [The establishment of plantations] to produce a forest product "crop" on lands that have supported forests within the last 50 years and where the original crop has been replaced with a different one. [Source: From IPCC Guidelines, Reference Manual, p. 5.13. (Brown et al., 1986: Brown S., A.E. Lugo and J. Chapman (1986), Biomass of tropical tree plantations and its implications for the global carbon budget", Canadian Journal of Forest Research 16: 390-394). via Bernhard Schlamadinger]
9. (Canada - BC) The natural or artificial restocking (i.e., planting, seeding) of an area with forest trees. Also called forest regeneration. [Source: Glossary of Forestry Terms, Province of British Columbia, Ministry of Forests, http://www.for.gov.bc.ca/pab/publctns/glossary/glossary.htm via Igor A. Yakovlev]
10. The restocking of felled or otherwise cleared woodland. [Source: British Commonwealth Forest Terminology via Renate Prüller]
11. (Chile) La acción de poblar con especies arbóreas o arbustivas mediante plantación, regeneración manejada o siembra, un terreno que haya sido objeto de explotación extractiva. [Source: Chile Forest Law 701 via Juan Pablo Cerda]
12. Artificial (planting, seeding) or natural re-establishment of forest on previously forest or other wooded land. [Source: UN/ECE 1990, via Brita Pajari]
13. Planting of forests on lands which have, historically, previously contained forests but which have been converted to some other use. Replanted forests are included in the category "Changes in Forest and Other Woody Biomass Stocks" in the Land Use Change and Forestry module of the emissions inventory calculations. See also Afforestation. [Source: IPC 1995. Via Gregg Marland]

13. (Ukraine) (Artificial) reforestation -- creation of forest plantations on the lands which were not previously under forest (covered by forest)with the aim of formation economically valuable, high productive and biologically sustainable forest stands. Note that ``forest plantations" defined as ``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: Polyakov]

15. Establishing forests on lands which have, historically, previously contained forests but which have been converted to some other use. This "other use" must have prevailed for at least 20 (or other number to be chosen) years, or, alternatively, the "other use" can be shorter if the land has been counted as "deforested" within a commitment period under the Kyoto Protocol. [From: Schlamadinger Bernhard uvu@ornl.gov Date: Tue, 9 Jun 1998 18:02:09 -0400 (EDT)]
16. (Russia) Process of establishing of forest cultures on before forested areas. (Forest cultures (specific Russian term) - forest, which was created by seeding or planting). [From: "Igor Yakovlev" yakovlev@mari-el.ru Date: Wed, 10 Jun 1998 02:51:19 -0400 (EDT)]
17. (Canada - Sask.) The natural or artificial restocking of an area with trees. [Source: Chapter F-19.1: An Act Respecting the Management of Forest Resources... new provincial legislation on forest management From: Mark Johnston <johnston@larix.derm.gov.sk.ca Date: Tue, 16 Jun 1998 17:44:48 -0600]
18. (Canada - Sask.) [reboisement (n.m.)] syn. reafforestation - Successful renewal of a forest crop by planting or direct seeding. [Source: Silvicultural Terms in Canada -

Second Edition 1995 From: Mark Johnston <johnston@larix.derm.gov.sk.ca Date: Tue, 16 Jun 1998 17:44:48 -0600]

19. (IPCC) Planting of forests on lands which have, historically, previously contained forests but which have been converted to some other use. Replanted forests are included in the category, Changes in Forest and Other Woody Biomass Stocks, in the LUCF module of the emissions inventory calculations. [Source: IPCC. Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Reporting Instructions (vol. I), Glossary, pp. 1-18]
20. (India) Bringing any deforested land under forest cover. [Source: Glossary of Technical Terms, Forest Research Institute, India. From: "Vivek K. Varma" <v.varma@landfood.unimelb.edu.au Date: Fri, 17 Jul 1998 02:28:29 -0400 (EDT)]

Discussion: Definitions 1, 2, 6, 8, 9 and 14 call for the planting of "forest" trees. Definitions 5, 7, 8 and 18 imply the trees will be used as a crop. Thus at some point in time, they will be removed for commercial purposes. Definitions 1, 2, 13, 14 and 19 imply only artificial regeneration and only through planting. Definition 13 implies that the land being replanted is not currently being used as "forest." Definitions 5,7 8, and 14 imply trees are planted for economic return. Definition 14 also sounds more like afforestation than reforestation. Definitions 17 and 20 allow for any means of establishing tree cover on areas previously forested. See definition of ***plantation*** below.

NATURAL FOREST

1. Growing without human care; also : not cultivated <natural prairie unbroken by the plow. Existing in or produced by nature. Not artificial. [Source WWWebster 11 June 1998]
2. A forest which has evolved as a sequence of natural succession but is still showing anthropogenic influences. Also, forests that have developed from unmanaged pastures or from fallow land. Often natural parks are included in this category. [Source: Dudley, N. 1992. Forests in trouble. A Review of the status of temperate forests worldwide. WWF. 260 pp. . Definitions used in the Helsinki Process - http://www.mmm.fi/english/minkonf/criteria.htm]

Discussion: Definition one does not allow human care where definition two allows some influence.

DEGRADATION

1. 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. [Source: from http://faov02.fao.org:70/0gopher_root%3a[fao.fra]def_uk.txt (concepts, definitions and methodology of the FAO Forest Resources Assessment 1990) via Bernhard Schlamadinger]
2. (Canada - BC) The diminution of biological productivity or diversity. [Source: Glossary of Forestry Terms, Province of British Columbia, Ministry of Forests, http://www.for.gov.bc.ca/pab/publctns/glossary/glossary.htm via Igor A. Yakovlev]
2. (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. [From: Slovenian LAW ON FORESTS - Milan SINKO milan.sinko@UNI-LJ.SI via "Maksym Polyakov" <mpoliak@pcomp.usau.kiev.ua Date: Fri, 12 Jun 1998 16:11:17 +0300 (MSD)]

4. 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. [Source: "State of the World's Forests", FAO, 1997, pp. 173-174]
3. The act or process of degrading (lowering to an inferior level) [Source: WWWebster Dictionary].

Discussion: All five definitions imply a reduction in productivity. Question: If one reports on degraded forest land, shouldn't there be a reciprocal category of improved forest land where production has been increased?

DEFORESTATION

1. The action or process of clearing of forests. The state of having been cleared of forest. [Source: WWWebster Dictionary]
2. (Deforest) To clear an area, other than purely temporarily, of forest. 1) While man is the main deforester, natural agencies (e.g. volcanic eruption, landslides) may also contribute. (2) Clear cutting (even with stump removal), if shortly followed by reforestation is not deforesting. [Source: Ford-Robertson via Christian Matter, Edward F. Loewenstein, and Tim Mullen]
3. The long-term removal of trees from forested site to permit other site uses. Cutting of trees followed by regeneration is not deforestation. syn: forest clearing disturbance, conversion, or wasteful destruction of forest lands. (AGRO). [Source: J. Dunster and K Dunster via Eric Boa and Renate Prüller]
4. The change of land use from forest to other land-use or depletion of forest crown cover to less than 10%. [Source: from http://faov02.fao.org:70/0gopher_root%3a[fao.fra]def_uk.txt (concepts, definitions and methodology of the FAO Forest Resources Assessment 1990) via Bernhard Schlamadinger]
5. (Developed countries): Change of forest with depletion of tree crown cover to less than 20 percent. [Source: "State of the World's Forests", FAO, 1997, pp. 173 – 174 via Bernhard Schlamadinger]
6. (Developing countries): Change of forest with depletion of tree crown cover to less than 10 percent. [Source: "State of the World's Forests", FAO, 1997, pp. 173 – 174 via Bernhard Schlamadinger]
7. (Canada - BC) Clearing an area of forest on a non-temporary basis for another use. Clearcutting (even with stump removal), if shortly followed by reforestation for forestry purposes, is not deforesting. [Source: Glossary of Forestry Terms, Province of British Columbia, Ministry of Forests, http://www.for.gov.bc.ca/pab/publctns/glossary/glossary.htm via Igor A. Yakovlev]
8. The temporary or permanent clearance of forest for agriculture or other purposes (Grainger 1993). In contrast, most 'logging' in tropical rain forests is selective, removing relatively few trees per ha, and therefore does not permanently cause deforestation. However, poorly implemented logging does cause forest degradation.

Deforestation is more a land use problem than a forestry problem. Attempts to ban logging as though this would stop deforestation are misguided. [Source: via Finchley]

9. Clearing of forest from large tracts of land which consequently remains unforested either as barren land or as agricultural crop. [Source: Bruening via Renate Prüller].
10. Conversion of forest land to other land use. [From: Schlamadinger Bernhard uvu@ornl.gov Date: Tue, 9 Jun 1998 18:02:09 -0400 (EDT)]
11. (Canada - Sask.) [deboisement (n.m.)] Permanent removal of forest cover and withdrawal of land from forest use, whether deliberately or circumstantially. [Source: Silvicultural Terms in Canada - Second Edition 1995 From: Mark Johnston <johnston@larix.derm.gov.sk.ca Date: Tue, 16 Jun 1998 17:44:48 -0600]
12. (India) Removal of forest cover from a forest land. It excludes clearfelling. [Source: Glossary of Technical Terms, Forest Research Institute, India. From: "Vivek K. Varma" <v.varma@landfood.unimelb.edu.au Date: Fri, 17 Jul 1998 02:28:29 -0400 (EDT)]

Discussion: Definitions 2, 3, 4, 7, 8, 9 and 11 have time factors built in. Definitions 1,5 and 10 do not. Definitions 4, 5, 6, and 12 carry a reduction in canopy cover clause. Definition 10 does not say anything about reduction in tree cover - just a conversion of land use. See also the Comparative Study on Terminology related to Forest Resources Management, which was prepared last year within the IUFRO Secretariat, with in particular one chapter on deforestation'. [Source: Via Renate Prüller and Tobias Zorn].

PLANTATION (Forest Cultures)

1. (UN-ECE/FAO) 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. [Source: UN-ECE/FAO 1997]
2. (Artificial crop, artificial stand ~ man-made forest) - A stand raised artificially, either by planting or by direct sowing. [Source: David South]
3. (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)]
4. Usually large group of plants and especially trees under cultivation. A place that is planted or under cultivation [Source WWWebster 11 June 1998]
5. 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. [Source: http://www.fscoax.org/html/1-2.html From: David South <dsouth@sofserv.forestry.auburn.edu Date: Wed, 17 Jun 1998 16:45:07 -0500]

6. (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 From: David South <dsouth@sofserv.forestry.auburn.edu Date: Wed, 17 Jun 1998 16:45:07 -0500 and "Maksym Polyakov" <mpoliak@pcomp.usau.kiev.ua Date: Tue, 23 Jun 1998 21:04:18 +0300 (MSD)]
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 From: David South <dsouth@sofserv.forestry.auburn.edu Date: Wed, 17 Jun 1998 16:45:07 -0500]
8. (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.

   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]
9. 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)]
10. (U.S.A.) 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]
11. 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). [Source: S. Brown, A.E. Lugo and J. Chapman (1986), Biomass of tropical tree

plantations and its implications for the global carbon budget, *Canadian Journal of Forest Research*, vol. 16, pp. 390-394]

Discussion: If the first definition is taken literally, plantations can only occur on areas that have been either deforested or never forested. The question comes up about the calling of land that is recently clear cut and immediately replanted lands that were deforested and then reforested. See definitions and discussion of ***deforestation*** above. Also, South points out that the first definition does not allow a 3 species plantation. The remaining definitions appear to apply to any lands. Definitions 10 and 11 do not include sowing. Definition 11 has economic and harvest implications through the use of the term "crop."

REGENERATION

1. An act or the process of regenerating : the state of being regenerated [Source WWWebster 11 June 1998]
2. 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. [From: "Igor Yakovlev" yakovlev@mari-el.ru Date: Wed, 10 Jun 1998 02:51:19 -0400 (EDT)]
3. Process of formation of new generation of forest by natural way (in word-by-word translation) [From: "Igor Yakovlev" yakovlev@mari-el.ru Date: Wed, 10 Jun 1998 02:51:19 -0400 (EDT)]
4. (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)]
5. (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]
6. (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)]
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)]

Discussion: Definitions 2, 3 and 7 indicate that regeneration is a natural process. Def. 4 does not specify. Definition 5 and 6 allow any method.

SEMI-NATURAL FOREST

1. 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. [Source: David South]
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]

Discusssion: Both definitions exclude plantations and include only native trees and shrubs.

STOCKING

1. (Russia) - 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]
2. 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)]
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)]
4. (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)]
5. 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)]

6. 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.]

OTHER TERMS

Damaged forest - Forest which is prevented by negative influences from natural development of the ecosystem or prevented from providing the functions of a forest. Damaged forest is forest for reclamation and is a threat to the environment under the terms of regulations on the protection of the environment. [From: Slovenian LAW ON FORESTS - Milan SINKO milan.sinko@UNI-LJ.SI via "Maksym Polyakov" <mpoliak@pcomp.usau.kiev.ua Date: Fri, 12 Jun 1998 16:11:17 +0300 (MSD)]

Established forest stand – The reaching such a state of forest stand where intensive protection is no longer required after afforestation and the number of individual trees and their distribution throughout the forested area, as well as the composition of the forest tree species, create all the prerequisites required for the establishment of a site suitable 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)]

Forest cultures - Artificially created or planted forest stands. [From: "Maksym Polyakov" mpoliak@pcomp.usau.kiev.ua Date: Thu, 11 Jun 1998 12:06:37 +0300 (MSD)]
Forest fund - All the lands given to state forestry enterprises plus all the forests under responsibility of other bodies. Or, all the forest lands plus non-forest lands of state forestry enterprises.

- forest [lands]: covered by forest (tree and shrubs) vegetation; not covered by forest vegetation but required to be afforested (cuttings [places after fellings], burnings, [loose forests], [empty places] etc., forest roads, cuttings [narrow straight road dividing quarters in forest], fire breaks;
- non-forest [lands]: under buildings connected with forest management, power lines, pipelines, other underground communications, etc.; agricultural lands (arable lands, hayfields, pastures, given for the purposes of forestry [forest management]; wetlands and waters within the parcels of forest fund given for the purposes of forestry." [From: ``The Forest Code of Ukraine" Kiev, 1994, 56p. "Maksym Polyakov" mpoliak@pcomp.usau.kiev.ua Date: Thu, 11 Jun 1998 12:06:37 +0300 (MSD)]

Forest management – The regeneration, protection, tending and felling of forest stands and other activities securing the fulfillment of forest functions, [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)]

Other wooded land (including "non-productive forest land" and "wooded mire") - Areas with an annual yield capacity between 0.1 and 1 m3 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]

Non covered by forest forest lands - Lands designated for forest growing, i.e. felled places, loose forest, `not closed yet young forest cultures'', etc. All these land were potentially needed to be reforested/afforested/reconstructed. [From: ``The Forest Code of Ukraine'' Kiev, 1994, 56p. "Maksym Polyakov" mpoliak@pcomp.usau.kiev.ua Date: Thu, 11 Jun 1998 12:06:37 +0300 (MSD)]

Productive forest land - Land which has an annual yield capacity of at least 1 m3 wood including bark per hectare under favourable stand conditions. Classification should not be affected if the land is temporarily without trees. More critical factors are the yield capacity and that the land is not utilized for other purposes than wood production. [From: Stein Tomter stein.tomter@tor.nijos.no Date: Mon, 15 Jun 1998 14:50:20 +0200]

Renewal - The natural or artificial renewal of any forest product and includes reforestation" [Source: Chapter F-19.1: An Act respecting the management of Forest Resources...aka THE ACT From: Mark Johnston <johnston@larix.derm.gov.sk.ca Date: Tue, 16 Jun 1998 17:44:48 -0600])

Stand -The basic unit of spatial arrangement of the forest identifiable in the terrain and shown on a forestry map. [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)]

Virgin forest = untouched forest - An area that has never been disturbed by human intervention, and is showing natural development in structure and dynamics. The soil, climate, entire flora and fauna and the life processes have not been disturbed or changed by timber management, cattle grazing, or other direct or indirect anthropogenic influences. . [Source: Definitions used in the Helsinki Process - http://www.mmm.fi/english/minkonf/criteria.htm]

CONTACTS AND ADDITIONAL SOURCES:

British Commonwealth Forest Terminology. Part I. The Empire Forest Association, London, 1953.
Bruenig, E.F.: Conservation and Management of Tropical Rainforests. An Integrated Approach to Sustainability. CAB International. Appendix 1: Glossary.
Boa, Eric. CABI Bioscience, "Eric Boa (BMP-PDN)" <E.BOA@cabi.org
Cerda, Juan Pablo, Environmental Impact Assessment Unit, National Environmental Commission of Chile. Tel: + 56 2 240 56 00. Fax: + 56 2 244 12 62. Email: jpcerda@conama.cl

Di Gregorio, A. & L.J.M. Jansen (1997) A New Concept For A Land Cover Classification System. Proceedings of the 1st Earth Observation and Environment Information 1997 Conference (EOEI'97), 13-16 October 1997, Alexandria, Egypt.
Di Gregorio, A. & L.J.M. Jansen (1998) Land Cover Classification System: Classification Concepts and User Manual. FAO GCP/RAF/287/ITA Africover East Africa Project/AGLS/SDRN, Nairobi/ Rome.
Dunster, J.; Dunster, K.. 1996. Dictionary of Natural Resource Management. UBC Press, Vancouver. 363 pp. CAB International, email m.legg@cabi.org if you want to order www.cabi.org for details of books
Finchley <finchley@ids.org.my
Ford-Robertson, F.C. ed. 1971. Terminology of forest science, technology practice and products (English-language version). The Multilingual Forestry Terminology Series No. 1. Society of American Foresters, Washington D.C. Library of Congress No. 77-138 089. 349 p. None of these terms have been amended, nor recommended for changes by the SAF Silviculture Working Group, as of 1993.
Intergovernmental Panel on Climate Change, Greenhouse Gas Inventory Reporting Instructions, Volume I, Glossary, 1995. Since the Kyoto Protocol refers specifically to the IPCC Methodology, these definitions will likely be the point of departure for the Protocol.
L.J.M. Jansen & Di Gregorio, A. (1998) The Problems of Current Land Cover Classifications: Development of A New Approach. Proceedings of the Eurostat Seminar on Land Cover and Land Use Information Systems For European Union Policy Needs, 21-23 January 1998, Luxembourg, Luxembourg.
Kleinn, Christoph Dr., CATIE, Programa de Investigación, Turrialba 7170, Costa Rica. Tel. +506 556 6431 Extensión 254. Fax +506 556 0914. <longterm@computo.catie.ac.cr
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Mullin, Tim, PhD, RPF(NB), President, Genesis Forest Science Canada Inc., 203 - 115, Côte de la Montagne, C.P. 64, Succursale Haute-Ville, Québec, QC G1R 4M8 CANADA, Tel./fax: 1-418-694-0155 genesis@fox.nstn.ca
Päivinen, R., Lund, H.G., Poso, S. and Zawila-Niedzwiecki, T. (eds.).. IUFRO International Guidelines for Forest Monitoring. 1994 In print to IUFRO World Series. 34 p.
Pajari, Brita <pajari@sauna.efi.joensuu.fi
Polyakov, Maksym mpoliak@pcomp.usau.kiev.ua State Standard of Ukraine, DSTU 2980-95 ``Forest plantations. Terms and definitions", being in force since 01.01.96.
Prüller, Renate <Prueller@FORVIE.AC.AT
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Schlamadinger, Bernhard, Environmental Sciences Division, Oak Ridge National Laboratory, P.O. Box 2008, Oak Ridge, Tennessee 37831-6335, USA Phone: +1/423-241-4935 Fax: +1/423-574-2232 E-mail: uvu@ornl.gov. http://www.joanneum.ac.at/GORCAM.htm, http://www.joanneum.ac.at/IEA-Bioenergy-TaskXV
South, David. School of Forestry, Auburn University, AL 36849-5418 USA. Tel: +1-334-844-1022. Fax: 1-334-844-1084. Email: dsouth@forestry.auburn.edu
UN-ECE/FAO. 1992. The Forest Resources of The Temperate Zones. The UN-ECE/FAO 1990 Forest Resource Assessment. Volume 1. General Forest Resource Information. UN. New York 1992. 348 p.

UN-ECE/FAO. 1997. UN-ECE/FAO Temperate and Boreal Forest Resources Assessment 2000 - Terms and Definitions. GE. 97-22231. Geneva. 13 p.
Yakovlev, Igor A., Assistant Professor Department of Forest Tree Breeding Mari State Technical University, RUSSIA 424000 Ioshkar-Ola, ul. Komsomolskaya, d.155, kv.49. Tel: (8362)-55-21-30. Fax: (8362)-11-08-72, e-mail: yakovlev@mari-el.ru. http://members.wbs.net/homepages/p/g/c/pgclub/YAKOPAGE.HTM
Zorn, Tobias Dipl. – Fw, (M. Agr.) <tobi@for.agr.hokudai.ac.jp, Dipl.-Fw. Tobias Zorn (M.Agr.) Hokkaido University, Forest Policy.

See also: Lexicon silvestre / Förderverein "Lexicon silvestre" e.V. Band: 1,en Pars 1 English part with definitions. - 2. ed. - 1997. - X, 125 S.; (engl.) ISBN 3-931262-20-0. Also see http://www.fao.org/faoterm/default.htm via Gerhard Röhrig.

'Terms and Definitions for the follow-up of the Second Ministerial Conference on the Protection of Forests in Europe'. We put it together with Andreas Schuck in 1994. It is not referred to as EFI work, but I have seen it for instance in FAO Working Group on Forestry Statistics proceedings, Rome Italy 20-24 November 1995 by Pekka Patosaari, who 'ordered' the work from EFI in 1994. Via Brita Pajari.

On a related subject, Roger Leakey has published a new definition of agroforestry in 1996 - see Agroforestry Today, 8(1): 5-7 (via Roger Leakey).

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