UNEP

CBD

Distr.
GENERAL

UNEP/CBD/SBSTTA/16/INF/25
30 March 2012

ORIGINAL: ENGLISH

SUBSIDIARY BODY ON SCIENTIFIC,
TECHNICAL AND TECHNOLOGICAL ADVICE
Sixteenth meeting
Montreal, 30 April – 05 May 2012
Item 7.1 of the provisional agenda*

A BACKGROUND REPORT ON IMPROVING FOREST BIODIVERSITY MONITORING AND REPORTING

Note by the Executive Secretary

1. The Executive Secretary is circulating herewith, for the information of participants in the sixteenth meeting of the Subsidiary Body on Scientific, Technical and Technological Advice, a note presenting an analysis on improving forest biodiversity monitoring and reporting in the context of the Convention on Biological Diversity. This report has been produced for the Secretariat of the Convention on Biological Diversity, with funding from the Government of Japan, as part of the Secretariat activities in response to decisions IX/5 paragraph 3(g) and X/36 paragraph 5(iii).

2. This document has been prepared by a team of independent consultants, and it is circulated in the form and language in which it was received, with some editing by the Secretariat. Comments from the following members of the Collaborative Partnership on Forests have been incorporated, as appropriate: Food and Agriculture Organization of the United Nations, International Tropical Timber Organization, Secretariat of the United Nations Convention to Combat Desertification, and the Secretariat of the United Nations Forum on Forests.

3. The views expressed in this document do not necessarily reflect the views of the Secretariat.

* UNEP/CBD/SBSTTA/16/1.

/…

A Background report on improving forest biodiversity monitoring and reporting

Prepared for the
Secretariat of the Convention on Biological Diversity
by
Stephen H. Yamasaki & Tristan D. Tyrrell

7 March 2012

Stephen H. Yamasaki, Ph.D.
EcoTerra Solutions
Montreal, Canada
Email: syamasaki@ecoterrasolutions.com
Web: www.ecoterrasolutions.com

Tristan D. Tyrrell
Tentera
Montreal, Canada
Email: tristan@tentera.org
Web: www.tentera.org

Acknowledgements

The authors wish to recognize the contributions of the following people: Tim Christophersen and Johannes Stahl (CBD Secretariat), Ian Thompson (Government of Canada), Adrien Kakula Diasotuka and Mike Ipanga Mwaku (Government of the Democratic Republic of Congo), Michael Bucki (European Commission, DG CLIMA), Ken MacDicken (FAO), Steve Johnson (ITTO), Janis Alcorn (IUCN CEESP), Val Kapos (UNEP-WCMC), Alan Grainger (University of Leeds), Maria Sanz-Sanchez (UNFCCC Secretariat), and Jasmin Metzler (UNCCD Secretariat). Thanks also to Simon Bridge for comments. This work was funded through a grant awarded to the CBD Secretariat by the Government of Japan.

List of abbreviations and acronyms

AHTEG	*Ad Hoc* Technical Expert Group
CBD	Convention on Biological Diversity
CIFOR	Center for International Forestry Research
CITES	Convention on the International Trade of Endangered Species of Wild Fauna and Flora
CMS	Convention on Migratory Species
COP	Conference of the Parties
CPF	Collaborative Partnership on Forests
DRC	Democratic Republic of Congo
ECOSOC	Economic and Social Council of the United Nations
EUROSTAT	Statistical Office of the European Communities
FAO	Food and Agriculture Organization of the United Nations
FRA	Global Forest Resources Assessment
GEF	Global Environment Facility
GLC2000	Global Land Cover 2000
ICRAF	World Agroforestry Centre
ITTO	International Tropical Timber Organization
IUCN	International Union for the Conservation of Nature
IUFRO	International Union of Forest Research Organizations
MDG	Millennium Development Goal
MEA	Multilateral Environmental Agreement
NBSAP	National Biodiversity Strategy and Action Plan
PA	Protected Area
SBSTTA	Subsidiary Body for Scientific, Technical and Technological Advice
UN	United Nations
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNFF	United Nations Forum on Forests
WCMC	World Conservation Monitoring Centre

Executive summary

- Progress reports on implementation are expected of Parties to the Convention on Biological Diversity and other multilateral environmental agreements, as well as under the Non-Legally Binding Instrument on All Types of Forests, at regular intervals, and there is growing recognition that the reporting burden has increased. Efforts by the Collaborative Partnership on Forests to reduce the reporting burden, through the Task Force on Streamlining Forest-related Reporting, should be strengthened.
- Progress on forest biodiversity monitoring has been made in preparation for reporting on the 2010 biodiversity target, however, current monitoring and reporting efforts are not adequate to fully assess the forest-related Aichi Targets of the Strategic Plan for Biodiversity 2011-2020.
- A review of the definitions used within several processes shows that there is significant divergence for some definitions and there are gains to be made from nurturing of consistency and comparability through the FAO. The Global Forest Resources Assessment (FRA) remains the most important data provider for reporting on forest biodiversity under the Convention and other processes.
- In examining forest classification and mapping initiatives, the authors find that the UNEP-WCMC mapping effort, as developed for the identification of protected area gaps, holds the most promise for improving reporting on forest biodiversity under the CBD. While the GLC2000 data on which it was based will not be updated, the comparable GlobCover[1] project should be producing updates on a regular basis.
- The FAO's FRA data collection process can help to inform on the attainment of forest-related Aichi Biodiversity Targets, although it is not sufficient alone. Some further specifications and changes of FRA variables for the forthcoming assessments might be needed to provide data and analysis that is relevant to Aichi Targets 5, 7, 11, and 15.
- There is a need to enhance biodiversity reporting capacity in developing countries, which should be provided in the form of a set of tools to allow countries to more effectively coordinate among focal points to reporting initiatives and national and sub-national departments.

A number of intergovernmental agencies and most multilateral environmental agreements (MEAs) require states or Parties to report at regular intervals on the status of environmental issues and on the measures they have taken to strengthen or improve national implementation, including on forest biodiversity.

As governments accede to a greater number of MEAs, they are confronted with a multitude of reports to prepare. In addition, while many questions may be similar across reporting initiatives, the information expected may differ, and countries often have difficulties to comply with all reporting requests due to lack of funding, data availability and accessibility, and institutional capacity, as well as in some cases inconsistencies in the definitions in use and to varying systems of land classification. In the past, these combined challenges have contributed to low submission levels and poor information quality. Therefore, reporting presents significant challenges in terms of the management of national information, of institutional linkages and effective liaison among national focal points to different conventions and initiatives, and of the development of appropriate guidance materials and tools.

[1] GlobCover website: http://www.gofc-gold.uni-jena.de/sites/globcover.php, see also section 3.3 of this note.

Accurate reporting on forest biodiversity requires a considerable amount of resources to be expended on a global scale, and those for monitoring in developing countries are, in particular, very limited.

Countries report to various bodies on progress in implementation of actions agreed (for example United Nations Forum on Forests (UNFF), United Nations Commission on Sustainable Development (CSD), International Tropical Timber Organizations (ITTO) and Conferences of Parties of CBD, United Nations Convention on Combating Desertification (UNCCD) and United Nations Framework Convention on Climate Change (UNFCCC)). Different processes and conventions have diverse objectives leading to variable reporting requirements. For this reason, a single reporting format is hardly possible. However, opportunities may exist for reducing the reporting burden by synchronizing reporting, avoiding overlap in reporting to different bodies/instruments, and facilitating information storage and retrieval, which would help avoid duplication of work and would save resources. The key issues will be to improve information management and facilitate flows of information.[2]

To this end, at the ninth and tenth meetings of the COP to the CBD, Parties requested continued cooperation with the FAO and other relevant organizations on the monitoring of forest biodiversity, and on clarifying the definitions of forest and forest types that reflect forest biodiversity at the level appropriate for reporting and monitoring the status of forest biodiversity (decision IX/5). This call was reiterated in decision X/36. This report seeks to provide information to the CBD Parties and Secretariat on the coordination and streamlining of forest-related biological diversity monitoring efforts. More specifically, this report provides analysis of (i) the definitions adopted by forest-related reporting initiatives (ii) how current data collection can contribute to the tracking of forest biodiversity monitoring and (iii) how improved forest classification system could be integrated with current monitoring efforts.

In examining forest classification and mapping initiatives, we find that the UNEP-WCMC mapping effort, as developed for the identification of protected area gaps, holds the most promise for reporting to the CBD. The synthesis of vegetation cover, land use, and ecoregions appears to provide a wealth of information relevant to biodiversity monitoring. While the GLC2000 data on which it was based will not be updated, the comparable GlobCover project should be producing updates on a regular basis.

With regards to forest-related definitions, a review of the definitions used within several processes showed that, while there is general consistency among many definitions, there is significant divergence for definitions such as "degradation". There are gains to be made here through the nurturing of consistency and comparability through the FAO. For example by operationalizing sustainable forest management (SFM), which is defined by the United Nations General Assembly as a '*dynamic and evolving concept that aims to maintain and enhance the economic, social and environmental value of all types of forests, for the benefit of present and future generations*'.[3]

Of particular importance to supporting reporting to the CBD, we examine how the FAO's FRA data collection process can help to inform on the attainment of Aichi Biodiversity Targets. Our findings indicate that while the information that has been (and is expected to be) collected is, in some cases, closely related to the information required for reporting on Aichi targets, the FRA information alone is

[2] http://www.fao.org/forestry/4928-0cd1fb85ab40e07284a058081255f579f.pdf

[3] SFM is presently defined by the UN General Assembly as follows: "Sustainable forest management as a dynamic and evolving concept aims to maintain and enhance the economic, social and environmental value of all types of forests, for the benefit of present and future generations" (UNGA Resolution December 2007 resolution 62/98 on non-legally binding instrument on all types of forests)

not sufficient. We also identify many challenges to harmonization related to data availability, logistics and funding, and politics.

In order to overcome some of the challenges identified, we propose that, because of the political obstacles to the standardization of definitions, efforts to harmonize definitions should focus on improving the consistency and comparability of definitions, so that definitions are built from the same basic set of criteria, but are allowed to vary in terms of which ones are used. Parties to MEAs and relevant other agreements such as the UNFF should strive for consistency and comparability among definitions, without necessarily seeking standardization.

Finally, there is a need to enhance biodiversity reporting capacity in developing countries. We suggest that part of this capacity building be provided in the form of a set of tools to allow countries to more effectively coordinate among focal points to reporting initiatives and national and sub-national departments. An online tool could also be developed, for example by the CPF Task Force on Streamlining Forest-related Reporting, to automatically compare and possibly consolidate the figures that countries submit under different processes.

Table of contents

1. Introduction

This report has been produced, with funding from the Government of Japan, for the Secretariat of the Convention on Biological Diversity (CBD), as part of the Secretariat activities in response to decision IX/5 paragraph 3(g) and decision X/36 paragraph 5 (iii).

1.1 Background and COP mandate for this study

Several intergovernmental agencies and most multilateral environmental agreements (MEAs) require countries or Parties to report at regular intervals on the status of environmental issues and the measures they have taken to implement existing commitments, including on forests and forest biodiversity. National reporting not only informs such agencies or Convention bodies such as the Secretariat, the Conference of the Parties (COP) or subsidiary bodies, but serves a number of purposes:

- It demonstrates compliance with the provisions of an agreement. A range of users such as government bodies and the public can use this information.
- It allows for developing an overview of the status and the effectiveness of implementation, which is important for policy analysis by convention bodies or researchers.
- It supports stocktaking of implementation work done and the identification of future priorities, thus supporting national governments as well as convention bodies who are concerned with taking the implementation further.
- It informs on the status and trends of biodiversity (in the case of the biodiversity-related agreements), which is information of potentially great importance for researchers and decision-makers at the global and national levels.
- It enables the identification of interactions with other processes, for example by national agencies, and therefore enabling discussions at the global level about increased synergies between conventions and processes.

It is widely recognized that the national reporting burden has increased. As governments accede to a greater number of MEAs, they are confronted with a multitude of reports to prepare. In addition, while many questions may be similar across reporting initiatives, the information expected may differ – due to lack of financial and technical resources, data availability and accessibility and institutional capacity to carry out data requests, as well as in some cases inconsistencies in the definitions in use. In the past, these problems have contributed to low submission levels and poor information quality. Therefore, reporting presents significant challenges in terms of adequate resources, data availability, the management of the national information, of institutional linkages and effective liaison among national focal points to different conventions and initiatives, and of the development of appropriate guidance materials and tools.

To this end, the COP to the Convention on Biological Diversity (CBD), at its ninth meeting held in Bonn in May 2008, requested that the Executive Secretary '*continue the cooperation with the Food and Agriculture Organization of the United Nations and other relevant organizations on the monitoring of forest biodiversity, and on clarifying the definitions of forest and forest types that reflect forest biodiversity at the level appropriate for reporting and monitoring the status of forest biodiversity, building on the existing concepts and definitions provided by Parties and members of the Collaborative Partnership on Forests and other relevant organizations and regional criteria and indicator processes and*

report to the Subsidiary Body on Scientific, Technical and Technological Advice prior to the tenth meeting of the Conference of the Parties' (decision IX/5, para. 3 (g)).

Subsequently, at its tenth meeting held in Nagoya in October 2010, the COP requested the Executive Secretary, '*based on priorities identified in its decision IX/5 and taking into account recent developments, in particular resolution 8/1 of the United Nations Forum on Forests, to identify and implement, in consultation with the Director of the United Nations Forum on Forests, targeted joint activities between the secretariats of the Convention on Biological Diversity and the United Nations Forum on Forests to support Parties, in particular developing countries, in the implementation of the expanded programme of work on forest biological diversity and the non-legally binding instrument on all types of forests, including through: (iii) Streamlining forest-related reporting, based on the Collaborative Partnership on Forests (CPF) Task Force on Streamlining Forest-related Reporting, including by organizing, in collaboration with the Food and Agriculture Organization of the United Nations, a meeting of the Task Force, prior to the eleventh meeting of the Conference of the Parties, to investigate whether there are inadequacies in forest biodiversity reporting and monitoring, aware of the need to follow up decision IX/5, paragraph 3(g), with the objective of further improving the biodiversity component of the Global Forest Resources Assessment and other relevant processes and initiatives; and report on progress to the Subsidiary Body on Scientific, Technical and Technological Advice at a meeting prior to the eleventh meeting of the Conference of the Parties.*'

This report has been developed to support the Secretariat in fulfilling these requests.

1.2 Objectives and methodology

This report seeks to provide information to the Parties of the CBD and to the Secretariat on improving and streamlining of forest biodiversity monitoring efforts. More specifically, this report provides analysis of (i) the definitions adopted for forest-related reporting initiatives and (ii) how current data collection can contribute to the tracking of forest biodiversity monitoring. The report therefore covers the following elements:

- Summary of the status of work under the Collaborative Partnership on Forests (CPF) Task Force on Streamlining Forest-related Reporting.

- Analysis of forest biodiversity reporting under the Global Forest Resources Assessments (FRA) in relation to future reporting and monitoring requirements for forest related targets of the 2011-2020 Strategic Plan for Biodiversity, in particular targets 5, 7, 11, and 15. The analysis should include the identification of any major gaps in forest biodiversity monitoring in relation to the 2020 targets under the FRA.

- Analysis of the fourth National Reports of Parties to the CBD in terms of the adequacy and accuracy of forest biodiversity monitoring, and suggested improvements for the national reporting to the CBD, as well as to the Global Forest Resources Assessment, in particular in view of FRA 2015.

- Applicability and feasibility of suggested improvements for forest biodiversity monitoring, including by specifying which information will be needed, and at which level, to apply proposed improvements at national and global level. In particular, improvements in forest classification systems as part of global monitoring efforts are proposed.

In order to cover these elements, we have applied an analytical approach combining a review of literature (both from peer-reviewed literature and from reports by relevant international organizations) with informal interviews with practitioners in the field of forest-related reporting, both at the international and national levels.

2. Current state of forest biodiversity monitoring at international level

2.1 Overview of existing reporting frameworks and respective objectives

Forests play a very important role in the lives of all people around the globe, and many international processes have been established to track the state of forests and of the products and services they provide in an attempt to promote a better understanding of our relationship with forests, to develop more effective forest related policies, and to influence decision-making on the ground. Countries report to various bodies on progress in implementation of actions agreed (for example UNFF, United Nations Commission on Sustainable Development (CSD), International Tropical Timber Organizations (ITTO) and Conferences of Parties of CBD, United Nations Convention on Combating Desertification (UNCCD) and United Nations Framework Convention on Climate Change (UNFCCC)). Different processes and conventions have diverse objectives leading to variable reporting requirements. While the object of concern for all of these initiatives is, at least in part, the same, the principle reasons for collecting forest-related information diverge in very significant ways. For this reason, a single reporting format is hardly possible. However, opportunities may exist for reducing the reporting burden by synchronizing reporting, avoiding overlap in reporting to different bodies/instruments, and facilitating information storage and retrieval, which would help avoid duplication of work and would save resources. The key issues will be to improve information management and facilitate flows of information. Table 1 presents a range of data collection objectives and decision-making processes.

Table 1. *List of international initiatives that report on the state of forests, along with their goals, motivations for collecting forest related data, a description of those that use this data, and the process that regulates decision-making within the institution.*

International process	Overall goals and objectives of the initiative	Reason for collecting forest-related data	Main users of collected data	Decision-making process within initiative
CBD	The conservation of biological diversity, The sustainable use of the components of biological diversity, The fair and equitable sharing of the benefits arising out of the utilization of genetic resources	To document changes to habitat and related impacts on biodiversity, to inform better environmental management	Parties to the convention, international funding agencies, academia, international organizations, NGOs, media	All decisions made by consensus by the Parties to the Convention
FAO	Help "nations manage their forests in a sustainable way"	To document the state of forests at a global scale and over time, in order to inform better forest resource governance and	Other initiatives, researchers, academia, NGO, media, governments, private sector	Standards are established through a consultative process with contributing

International process	Overall goals and objectives of the initiative	Reason for collecting forest-related data	Main users of collected data	Decision-making process within initiative
		management		nations; contribution of data is made on a voluntary basis
UNFF	To promote "the management, conservation and sustainable development of all types of forests and to strengthen long-term political commitment to this end…"based on the Rio Declaration, the Forest Principles, Chapter 11 of Agenda 21 and the outcome of the IPF/IFF Processes and other key milestones of international forest policy" (UNFF website) There is also reporting on the non legally binding instrument on all types of forests; Para 8 of the instrument	To document progress on the management, conservation, and sustainable development of forests; and To monitor and assess progress towards achieving the purpose of the non legally binding instrument on all types of forests	UN General Assembly and member states	The United Nations Forum on Forests is a subsidiary body of the Economic and Social Council of the United Nations, with universal membership. As such, it is composed of all member states of the United Nations and Member States of specialized agencies, with full and equal participation, including voting rights
UNFCCC	To achieve … stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner (UNFCCC article 2)	To quantify current carbon stocks in forests, and to document trends in forest carbon; more specifically, data on carbon is required when implementing carbon offset projects	Parties to the convention	All decisions made by consensus by the Parties to the Convention
ITTO	To promote the expansion and diversification of international trade in tropical timber from sustainably managed and legally harvested forests and to promote the sustainable management of tropical timber producing forests (ITTA 2006)	To document progress on the implementation of sustainable forest management	Member states, academia, international organizations, NGOs, media	Voting rights are distributed among two "caucuses", producer and consumer member states

2.2 Current definitions used at international level

The definitions used by various international processes are detailed in Table 4 in the Appendix I. Definitions are agreed upon following each organization's decision-making process, which is highlighted in Table 1.

2.3 CBD experience with forest definitions and indicators

As seen in section 2.2 and its corresponding table in the Appendices, the CBD bases its definitions relating to forests largely on those established by the FAO. The CBD itself has not elaborated an officially agreed-upon definition of forest. These are presented to Parties as guidance through the CBD website[4], but there is no requirement for Parties to strictly adhere to such a system. In consultation with national representatives, the authors of this paper found that the FAO definitions are used largely as a result of national-level support provided through the FRA process.

A review of fourth national reports submitted to the CBD Secretariat by March 2011 suggests that some forest-related information, in particular relating to forestry, may have been underreported owing to a lack of recognition of its relevance at the national level (Bubb *et al.* 2011). However, 'extent of forests and forest types' was the second most common indicator used by reporting Parties (after 'coverage of protected areas'); although a greater number of national statistics may be available through the FRA process, and thus the Millennium Development Goals (MDGs). This contrasts with the findings of the authors of this report who were advised that the FAO approach of direct national capacity support, at least to some countries, would encourage greater use of FRA data in national reporting to the CBD.

2.4 Global Forest Resources Assessment (FRA) reporting, and the Aichi Biodiversity Targets

At the tenth meeting of the COP in October 2010, the Strategic Plan for Biodiversity 2011-2020 and the Aichi Biodiversity Targets was adopted with an overall vision of "Living in harmony with nature" where "By 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people" (decision X/2).

The Strategic Plan includes 20 headline targets for 2015 or 2020 – commonly known as the "Aichi Biodiversity Targets" (see Appendix II) – organized under five strategic goals. Of particular relevance to this analysis are the targets (5, 7, 11, and 15) highlighted in Table 2. Table 6 (see Appendix II) considers potential indicators, and the use of FRA 2015 and 2020, to track progress against these targets.

The goals and targets comprise both (i) aspirations for achievement at the global level and (ii) a flexible framework for the establishment of national or regional targets. Parties are invited to define nationally-appropriate targets based on the global Aichi Targets, and to revise their National Biodiversity Strategy and Action Plans (NBSAP) in light of the new approach. It has been encouraged that the setting of national targets is an inclusive process with a broad range of stakeholders at the country level, including those not traditionally associated with the Convention. At the international level, partnerships between

future generations" (UNGA Resolution December 2007 resolution 62/98 on non-legally binding instrument on all types of forests)

the Convention and other conventions, international organizations and processes, civil society and the private sector are to be strengthened with particular effort to, *inter alia*, ensure cooperation to achieve implementation of the Plan in different sectors; and promote synergy and coherence in the implementation of the MEAs.

The monitoring of progress will be carried out through a range of indicators to be developed at multiple scales. COP 10 called for an *Ad Hoc Technical Expert Group* (AHTEG) to consider appropriate indicators, and the final global framework is expected to be adopted at the eleventh meeting of the COP in 2012. At the fifteenth meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) discussion was held on the subject of national indicators, with mixed expectations on the level of prescriptiveness from the CBD Secretariat with regards to indicators for reporting. In general, while there were many requests for guidance on indicator development and use, there was a clear expression of desire from Parties to maintain control over reporting (IISD 2011). The potential of FRA 2015 and FRA 2020 to contribute to monitoring of the Aichi Targets 5, 7, 11 and 15 is outlined in Table 2 below, and in Table 6 in Appendix II.

2.5 NBSAPs and national reporting

The tracking of progress against national and international targets is becoming increasingly important in a range of processes under the CBD. Article 6 of the Convention creates an obligation for national biodiversity planning, with strategies that will reflect how the country intends to fulfil the objectives of the Convention with respect to its own circumstances. Target 17 of the Aichi Biodiversity Targets expects the implementation of effective, participatory and updated NBSAPs by 2015. Article 26 states that each Party shall submit national reports on measures which it has taken for the implementation of the Convention and their effectiveness in meeting the objectives. These national reports are expected every two years in advance of the COP, and are used in part to assess the overall success of the Convention.

Neither the guidelines for NBSAP revision (CBD 2011a), nor those for the fourth (CBD 2006) or fifth national reports (CBD 2011b) incorporate much additional support on the issue of forest definitions and their use in national-level monitoring. However, the supporting materials for the fifth national reports begin to promote the use of indicators more heavily, with consideration of national circumstances, as well as drawing on global indicators as appropriate. It has been recommended that Parties follow a Pressure-State-Response model, with clear reference to national targets elaborated in their revised NBSAPs. Indicators are to be utilised as appropriate and the CBD Secretariat suggests that Parties should refer to the recommendations of the AHTEG on Indicators for the Strategic Plan for Biodiversity 2011-2020 (UNEP/CBD/SBSTTA/15/2). The forest-related indicators proposed for Targets 5, 7, 11 and 15 are listed in Table 6 (Appendix II).

Table 2. List of forest-related Aichi targets, along with a description of how FAO's FRA can inform on the attainment of these targets. Cells in dark and light grey indicate that the indicator is either fully or partially supported by FRA data, respectively.

Goals and targets	Supported by FRA 2010	Need for improved / harmonized definitions	Suggested improvements of FRA 2015 and 2020
Strategic goal B. Reduce the direct pressures on biodiversity and promote sustainable use			
Target 5: By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.	Area of Primary forest reported over time will inform on the rate of loss of natural habitat and, by extension, degradation, but no data is available to inform on fragmentation.	Yes	Clear definition of forest fragmentation and forest degradation needed; Improvements in remote sensing in both areas are needed
Target 7: By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.	"Forest area under sustainable forest management" could inform on this target, but the definition used (ITTO 2005) is not, in and of itself, sufficient to ensure conservation of biodiversity in managed forests.	Yes	Additional indicators on forest biodiversity required to ensure adequate conservation in a context of forest management; Improvements in variable and in analysis of FRA to quantify areas under SFM, and to assess trends in implementation of SFM are needed
Strategic goal C: Improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity			
Target 11: By 2020, at least 17 per cent of terrestrial and inland water areas, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.	Area contained in the "protected areas" and "conservation of biodiversity" category and "forest area within protected areas" will inform on the area of forest that is conserved. However, this metric will not inform on equitable management, ecological representation, and overall connectivity; analysis of national or sub-national level conservation and protected area policy may help to inform on these.	Yes	Additional indicators on equitable management, ecological representation, and overall connectivity required; Continued collaboration with UNEP-WCMC and World Database on Protected Area needed
Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services			
Target 15: By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and	Afforestation and natural expansion of forest, can inform on trends of natural forest and carbon stocks. Carbon stocks are not tracked in sufficient detail	In part	Additional indicators on carbon stocks held in natural or planted forest, and considering the preferred removal of non-native species, required; indicators for restoration of degraded forest

Goals and targets	Supported by FRA 2010	Need for improved / harmonized definitions	Suggested improvements of FRA 2015 and 2020
restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.	to inform on linkage between carbon stocks, restoration, and biodiversity (i.e., no distinction is made between carbon pools in natural or planted forest); trends in the area of planted forest (where "planted forest of introduced species" may be removed from the total) may inform on restoration effort.		needed

3. Forest Classifications

3.1 Introduction

The CBD expanded programme of work on forest biodiversity (decision VI/22) includes an objective to '*Review and adopt a harmonized global to regional forest classification system, based on harmonized and accepted forest definitions and addressing key forest biological diversity elements*' (Element 3, Goal 1, Objective 1), to be achieved through the following activities:

a) Review and adopt a minimum forest classification for forest types, compatible with remote sensing technologies, that includes broad indicators of biodiversity that can be taken into account in all international and regional forest-related programmes, plans and activities.
b) Adapt frequency of forest resource inventory at regional and global scales, where resources permit, preferably at least to every ten years.
c) Review and contribute (from the biodiversity point of view) to standard forest definitions in cooperation with the United Nations Forum on Forests and the Collaborative Partnership on Forests to be used in global and regional reporting to the scale of forest types.

However, this objective has proved elusive, despite some progress under the activities.

Global forest classification, and the mapping of resultant classes, provides a rich resource for land managers and policy makers. From the point of view of biodiversity monitoring and management, they can:

- Provide an invaluable tool to inform on ecosystem diversity;
- Offer a basis for coarse filter species diversity monitoring;
- Allow inference with regards to the extent of species at risk habitat;
- In combination with PA maps, can help to monitor the representativeness of PA networks; and
- Over time, contribute to monitoring shifts among forest types (through deforestation, degradation, and restoration).

Global forest classification and mapping has also been used extensively to feed other processes, such as global circulation modelling and the estimation of terrestrial carbon stocks for climate change mitigation.

Currently, no classification system has generated universal acceptance (Groombridge & Jenkins 2002, Turner *et al.* 2003). There remains a lack of "agreement on the key features of the classification to be adopted" (Puustjärvi & Simula 2002a); that is, there is no consensus on what basis (forest characteristics, spatial scale, etc.) a forest classification system should be developed.

At this time, several forest and land classification systems are available, among which many rely on remotely sensed data. In this section we present various bases for land classification, how land classifications and their resultant maps can contribute to the monitoring of biodiversity, and detail the principal land classification methods and their associated data products. Because conventional forest inventory data is not available for the entire globe, and because forest classification systems within national forest inventories vary significantly, we focus on forest classification schemes based on

remotely sensed data. Also, because classifications become of greater interest when accompanied by geographical data, we discuss here classifications systems in the context of data mapping projects.

3.2 Basis for the ecological classification of land and its ecosystems

As alluded to earlier in this section, there exists a relatively broad range of characteristics on which forest classification systems may be built. The choice of characteristics to apply as the discriminators of a class depends, to a large extent, on the purpose of the classification system. We present here several common bases for the classification and mapping of land and its vegetation.

Current vegetation

Classification of the earth's vegetation can be developed on a range of bases, and the number of classes generated by the different systems can vary considerably. For example, classification has been carried out at the biome level, dividing vegetation into very broad classes. At the other end of the spectrum, tree species communities have been mapped, as part of detailed conventional forest inventories. This process is very precise with regards to ecological conditions, especially when combined with information on understory vegetation and soils. However this method is extremely time consuming, and therefore not practical at a global level, as it requires interpretation of very high resolution imagery (aerial photography or, more recently, LIDAR[5]). The globe has also been divided up into areas with homogeneous plant functional types (Bonan *et al.* 2002); this has been useful for climate modelling, due to increased precision on biogeochemical behaviour of vegetation. Finally, plant primary productivity has been used as a basis for classification. Since many have postulated a link between productivity and species richness, such an approach is relevant to biodiversity monitoring.

Historical vegetation

The World Wildlife Fund has produced "ecoregion" maps, dividing the world into 825 ecoregions (WWF 2011). The authors generated ecoregions with the idea of delineating areas of historically (pre-industrial) homogeneous vegetation.

Land use / land use history

Land has been classed and mapped based on land use and land use history. For example, the Center for Sustainability and the Global Environment (University of Wisconsin-Madison) has generated maps of "Potential natural vegetation" (SAGE 2011). This group has also produced maps of urban and non-urban areas (SAGE 2011). The World Resources Institute produced a map of pristine and degraded ecosystems (WRI 2011). Humanity's agricultural footprint over time has also been mapped (McGill 2011, ARVE 2011, SAGE 2011).

Climatic

Due to the tight association among climate, soils, and vegetation (Bailey 1996), climatic mapping is quite relevant to ecological monitoring. In its simplest form, one can simply map specific climatic measurements, like mean annual rainfall or mean temperature. A more complex approach, such as dividing the earth into climatic regions, was developed by Köppen (1936) and further developed by Trewartha (1968), and updated by Peel *et al.* (2007). Climatic classification has been used in forestry for some time (Thornthwaite & Hare 1955).

[5] With Light Detection and Ranging (LIDAR) technology, a laser system is used to produce very high-resolution topographic maps. Resolution is so fine that canopy height and shape can be obtained, and estimates of biomass, leaf area may be approximated.

3.3 Global land classification and mapping systems

Over recent decades, several projects have classified and mapped forests on a global or regional scale. We present here mapping projects that show the greatest relevance to reporting under the CBD, and provide details in Table 3. These classification and mapping efforts, organized by basis of classification are:

Based on current vegetation:
We present classification and mapping systems that are based on current vegetation in Table 3 below, along with some key characteristics of the datasets.

Table 3. Spatially-derived international forest classification systems.

Name	Agency	Coverage	Resolution	Image acquisition	Data source	Compatible with FAO LCCS	Reference
IGBP-DISCover	USGS	Entire globe	1 km	04-1992, 09-1996	NOAA-AVHRR	No	Loveland *et. al*. 1991, Brown *et al.* 1993, Loveland & Belward 1997, Eidenshink & Faundeen 1994
GlobCover	ESA	Entire globe	300 m	05-2005 to 04-2006, 2009	Envisat's Meris	Yes	Arino *et al.* 2007
Corine Land Cover	EU-EEA	Europe	5-25ha (polygons), 100 m (linear features)	1990, 2000 and 2006	LANDSAT and SPOT	No	http://www.eea.europa.eu/data-and-maps/data#c12=corine+land+cover+version+13
FRA 2000 Global Forest Cover Map	FAO	Entire globe	1 km	02-1995 to 01-1996	NOAA-AVHRR	Yes	FAO 2001, Zhu & Waller 2003
Global Land Cover 2000 (GLC2000)	EU Joint Research Centre's (JRC) Global Monitoring Unit	Entire globe	1 km	11-1999 to 12-2000	VEGETATION - SPOT 4	Yes	http://bioval.jrc.ec.europa.eu/products/glc2000/glc2000.php
Global Land Cover Facility	University of Maryland	Entire globe	1 km	1981 and 1994	NOAA-AVHRR	Yes	Hansen *et al.* 2000
Global Distribution of Vegetation	Goddard Institute for Space Studies (GISS) - NASA	Entire globe	1 km	1981	various sources	UNESCO system, predates LCCS	Matthews 1983 & 1984
TREES	EU Joint Research Centre's (JRC) Global Monitoring Unit	Tropical forests, except for Indian sub-continent, China, East Africa	1 km	1992 to 1994	NOAA-AVHRR	No	Eva *et al.* 1999, Mayaux *et al.* 1999
FIRS	EU Joint Research Centre's (JRC) Global Monitoring Unit	Europe	1 km	03-1993 to 10-1993	NOAA-AVHRR	No	Kennedy *et al.* 1994
Global Forest Map	UNEP-WCMC	Entire globe	500 m	2005	MODIS05 VCF and GLC2000	No	Schmitt *et al.* 2008

Based on land use and degradation:

- Global Map of Land Use/Land Cover Areas (GMLULCA), International Water Management Institute
- LADA Land Use systems map, FAO
- Global Distribution of Cultivation Intensity, Goddard Institute for Space Studies (GISS), NASA

Based on other characteristics:

- Terrestrial ecoregions (inferred historical vegetation), WWF
- Plant biodiversity, UC-San Diego / University of Bonn
- Bailey's Ecoregions of the World, Bailey (1983) (climatic)
- Biome classification, Running *et al.* (1995)
- Global Lakes and Wetlands Database (GLWD) (University of Kassel and World Wildlife Fund)
- Harmonized World Soils Database, International Institute for Applied Systems Analysis (IIASA) / FAO
- Global Distribution of Wetland Ecosystems at 1°×1° Resolution, Goddard Institute for Space Studies (GISS), NASA

3.4 Land classification and biodiversity monitoring

Biodiversity, or the diversity of species, ecosystems and genetic material, is conceptually complex; its monitoring in the real world therefore presents many challenges (Turner *et al.* 2003, Schmitt *et al.* 2009). Meanwhile, in order to move forward with policy development and resource allocation for land management at a global scale, better information on the state and trends of biodiversity is required. We examine here how forest classifications and related mapped data may contribute to the monitoring of achievement of the four Aichi targets most directly relevant to forests (5, 7, 11, and 15). Due to the relatively coarse resolution of work on forest classification and mapping to date (usually 1km resolution or greater), it is not currently possible to distinguish between small forest fragments and fragments that are too small to be counted as forest (less than 0.5 ha). As processing power increases and higher resolution imagery becomes more affordable, it will become possible to treat higher resolution imagery (such as SPOT and RapidEye, at 8m and 5 m respectively).

Target 5: *By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.*

While agricultural activity can be detected by remote sensing (due to the spectral signature of cultivated plants), more subtle management activity, such as selective logging or high-grading, is difficult to detect from remotely sensed imagery. However, by monitoring shifts among forest types or from forest to non-forest, it is possible to obtain some indication of the rate of habitat loss. There are currently a few classification and mapping projects that can identify such shifts, such as GLC2000 and GlobCover.

Target 7: *By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.*

It appears that pertinent information on sustainability generated through classification and mapping is not currently obtainable. Sustainability is as much about strategic forward-looking planning as it is about the footprint of past activities, and so retrospective approaches may never yield a complete picture. Meanwhile, certain classification systems, such as the hybrid system implemented by UNEP-WCMC and

the GLC2000 data, have the potential to document various types of management impacts over time, including the degradation of forests and the creation of forest-cropland complexes. Thus, it may be possible to track at least the land-conversion component of sustainability at a global scale.

Target 11: *By 2020, at least 17 per cent of terrestrial and inland water areas, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.*

The work of the UNEP-WCMC demonstrates how forest classification and mapping can be used to document progress towards the establishment of a representative global protected area network. The report of Schmitt *et al.* (2008) identifies gaps in protected area coverage at a global scale using remotely sensed data, and expresses results in terms of representativeness.

Target 15: *By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.*

As mentioned above, current technology allows inference with regards to shifts among types of forests and from forest to non-forest, and therefore some information on degradation and restoration is available. Inference with regards to the carbon content of forest is also possible (Andersson *et al.* 2009, Gibbs *et al.* 2007, Rosenqvist *et al.* 2003, Ruesch & Gibbs 2008, Saatchi *et al.* 2011). However, while global maps approximating terrestrial carbon have been produced, high precision is only currently possible when remote sensing is supplemented by ground truthing (Baral 2011).

It should be stressed here that, in order to effectively monitor change over time, the data generated by global biodiversity monitoring should be relatively consistent from one measurement period to the next. Grainger (2008) has suggested that inconsistent data sources over previous FRA reports have led to considerable uncertainty about trends in forest cover globally. However, we should also recognize that technologies as well as ecological knowledge are advancing quite rapidly, and that we should expect accuracy to evolve over time. The key will be to maintain, at a minimum, a consistent classification system that is sufficiently informative, even though detection and interpretation methods change.

Based on the findings shown above, it is our opinion that the approach developed by UNEP-WCMC (Schmitt *et al.* 2008) holds the most promise in terms of biodiversity monitoring in general, and to measure progress towards achievement of the Aichi Targets in particular. This approach draws on existing map products – the GLC 2000 (Table 3) and the WWF's ecoregions map (Olson *et al.* 2001) – as well as interpretation of the somewhat finer resolution vegetation data of MODIS. Also, the dataset was developed with the principal purpose of identifying gaps in protected areas at a global scale, and therefore is well suited to biodiversity monitoring.
Since it appears that the GLC2000 will not be updated, another source of land use data will be required for this approach. We believe that the ESA's GlobCover, with its higher resolution (300m), compatibility with both the FAO's LCCS and the GLC2000 systems, and relatively high detail of classification, will adequately replace the GLC2000 data. Indeed, it has been stated previously that "UNEP anticipates

being able to put the GLOBCOVER map to good use within its programme of assessment"[6]. Also, it appears to be ESA's plan that updates will be generated automatically, with more detailed regionalized classification and validation taking place in subsequent steps.

[6] Ron Witt (UNEP) quoted at www.esa.int/esaEO/SEMZ76V681F_index_0.html

4. Past experience with harmonization and streamlining

4.1 Efforts to harmonize definitions

Efforts to harmonize forest-related definitions have been deployed for some time (FFRI 1987, FFRI 1993, FFRI 1996, FAO 2002a, FAO 2002b, FAO 2005) and harmonization has been discussed by several authors (Pajari & Schuck 1994, Peterken 1996, COST-E4 2000, Lund 2001, Puustjärvi & Simula 2002a, Schoene *et al.* 2007). Much of this work has concluded that Parties to international conventions and other international bodies should coordinate the development of definitions (FAO 2002a) and adopt "widely used and accepted definitions" (FAO 2005) whenever possible. While the FAO definition of "forest" has generally been adopted by international bodies, with the exception of the UNFCCC that proposes a modified version of the FAO definition (see Table 4, Appendix I), there remain significant differences among definitions for other forest-related terminology, notably for the terms "degradation" (Schoene *et al.* 2007, Simula 2009). Indeed, Lund (2009) inventoried over 50 definitions of the term "degradation" as it applies to forests. Also, the term "fragmentation" does not appear to have received a widely accepted definition. There are gains to be made here through the nurturing of consistency and comparability through the FAO, for example by operationalizing sustainable forest management (SFM), which is defined by the United Nations General Assembly as a '*dynamic and evolving concept that aims to maintain and enhance the economic, social and environmental value of all types of forests, for the benefit of present and future generations*'.[7]

4.2 Efforts to streamline reporting among biodiversity-related conventions

The issue of streamlining reporting across international initiatives, including biodiversity-related MEAs, has been discussed for a considerable amount of time. For instance in 1998, UNEP, in collaboration with the Secretariats of the global biodiversity-related conventions (CBD, Convention on the International Trade of Endangered Species of Fauna and Flora (CITES), Convention on Migratory Species (CMS), Ramsar Convention on Wetlands, World Heritage Convention), commissioned the UNEP World Conservation Monitoring Centre (UNEP-WCMC) to prepare a Feasibility Study for a Harmonized Information Management Infrastructure for Biodiversity-related Treaties. The study considered approaches for the treaties within their existing mandates to improve the effectiveness and efficiency in gathering, handling, disseminating and sharing information. One area the study explored was how the conventions could work together to streamline national reporting in order to reduce the reporting burden for Parties.

Subsequently, UNEP and UNEP-WCMC organised a workshop on harmonization of national reporting on biodiversity, which resulted in four UNEP-conducted pilot studies in developing countries. The results of the pilot projects were discussed with MEA secretariats, interested governments and organisations and resulted in 2004 with a number of recommendations that have subsequently been made available to the governing bodies of the biodiversity-related conventions. The recommendations included improved coordination at the national and international levels, in particular on knowledge management of

[7] SFM is presently defined by the UN General Assembly as follows: "Sustainable forest management as a dynamic and evolving concept aims to maintain and enhance the economic, social and environmental value of all types of forests, for the benefit of present and future generations" (UNGA Resolution December 2007 resolution 62/98 on non-legally binding instrument on all types of forests)

biodiversity (UNEP-WCMC 2004). UNEP-WCMC is currently implementing a GEF-funded project[8] that is piloting nationally-driven integrated processes and approaches to reporting to the three Rio Conventions (CBD, UNCCD and UNFCCC). It aims to develop integrated approaches to data collection/analysis and information management; increase synergies in the process of reporting to the three Conventions without compromising COP decisions in this regard; and contribute to improved overall planning and decision-making processes at the country-level related to the implementation of these Conventions.

4.3 CPF Task Force on Streamlining Forest-related Reporting

The Collaborative Partnership on Forests (CPF) is a voluntary arrangement among 14 international organizations and secretariats[9] with substantial programmes on forests. The mission of the Collaborative Partnership on Forests is to promote sustainable management of all types of forests and to strengthen long-term political commitment to this end. It was established in April 2001, in response to an invitation issued in the resolution of the Economic and Social Council of the United Nations (ECOSOC), which established the United Nations Forum on Forests (UNFF) in October 2000.

Among its objectives, the CPF is expected to support the work of UNFF and its member countries and to enhance cooperation and coordination on forest issues. In response to the call for assistance by the UNFF at its first session, the Collaborative Partnership on Forests (CPF) agreed to support efforts to harmonize and streamline requirements for forest-related reporting for international and regional purposes. To this end, a Task Force on Streamlining Forest-related Reporting was established in 2002[10]. The objective of the Task Force is to propose ways to reduce the forest-related reporting burden, for example, through reducing and streamlining reporting requests, synchronizing reporting cycles, harmonizing data collection methods and increasing data comparability and compatibility, and facilitating the accessibility and flows of existing information. The purpose of this work is also to guide ongoing international processes by sharing experiences and lessons learned on different reporting frameworks and by seeking possibilities for common approaches for data and information collection, storage and reporting by international organizations.

The mandate of the Task Force is provided in the resolutions of UNFF, as follows:

- UNFF "*further requests the Collaborative Partnership on Forests and its member organizations to:… reduce duplication in the reports required from countries by its member organizations"* (paragraph 9c of UNFF resolution 1/3);
- UNFF "*invites Collaborative Partnership on Forests members to streamline reporting requests and, to the extent possible, to synchronize their reporting cycles so as to reduce reporting burden on countries"* (section E of UNFF resolution 2/2).

[8] http://rioconventionsreporting.net/

[9] Center for International Forestry Research (CIFOR), Food and Agriculture Organization of the United Nations (FAO), International Tropical Timber Organization (ITTO), International Union of Forest Research Organizations (IUFRO), Secretariat of the Convention on Biological Diversity (CBD), Secretariat of the Global Environment Facility (GEF), Secretariat of the United Nations Convention to Combat Desertification (UNCCD), Secretariat of the United Nations Forum on Forests (UNFF), Secretariat of the United Nations Framework Convention on Climate Change (UNFCCC), United Nations Development Programme (UNDP), United Nations Environment Programme (UNEP), World Agroforestry Centre (ICRAF), World Bank, and International Union for the Conservation of Nature (IUCN).

[10] The Terms of Reference of the Task Force are available on the CPF website: www.cpfweb.org

With FAO as focal agency within the CPF for issues related to monitoring, assessment and reporting, convening the group and providing secretariat, the Task Force is composed of FAO; ITTO; CBD Secretariat; UNCCD Secretariat; Secretariat of UNFCCC; the UNFF Secretariat, and UNEP through UNEP-WCMC. The objective of the CPF Task Force is to propose ways to reduce the forest-related reporting burden, for example, through reducing and streamlining reporting requests, synchronizing reporting cycles, harmonizing data collection methods and increasing data comparability and compatibility, and facilitating the accessibility and flows of existing information. The purpose of this work is also to guide ongoing international processes by sharing experiences and lessons learned on different reporting frameworks and by seeking possibilities for common approaches for data and information collection, storage and reporting by international organizations. On a longer term, the work aims at contributing to better information management system(s), whereby data and information are more easily accessible and widely available and whereby these could eventually be provided and updated by countries themselves.

In 2006, the Task Force concluded (CPF 2006) that reducing reporting burden and improving information sharing can be facilitated by:

- Improving information management for sharing and presenting data and information at all levels.
- Harmonizing forest-related definitions.
- Coordinating the information requests among the secretariats, including joint questionnaires.
- Improving the content of information requests by cross-referencing information, by simplifying questions and by better presentation of information in the secretariat analyses and websites.
- Using better existing information, to avoid duplication and burden to countries when they are requested to provide information and to secretariats when they process information for the use of their constituencies and public (reports, databases etc).
- Capacity building at the national level to improve data collection, processing, and reporting and to improve coordination among national agencies that provide pieces of information and within the countries.

However, it also acknowledged some obstacles for streamlining:

- Clarification is needed of the necessity for each secretariat/organization to individually collect data to be valid and useful for the processes.
- Difficulties for the convention secretariats to streamline on a short-term as decisions regarding reporting (content, periodicity and timing) for the next few years have already been taken by the governing bodies.
- Difficulty of synchronizing the reporting schedules, due to the need for information in different times and frequency.

The CPF Task Force proposed developing a joint information framework to further improve access to forest-related information submitted to several CPF members, with the objective of streamlining reporting and reducing reporting burden on countries (CPF 2006). As its first concrete product towards the joint information framework, the Task Force launched a web portal[11] in 2002 which helped users

[11] www.fao.org/forestry/cpf-mar

find national reports and reporting guidelines related to forests to CBD, UNFCCC, UNCCD and UNFF. Plans to organise information according to thematic elements were not taken forward.

The Task Force came to an unofficial halt in 2006 with some discussion on a proposed phase II of the CPF information framework which would take a more coordinated approach for working with countries on information requests, maintain the CPF Reporting Portal, increased coordinated approach for the information assembly (especially with regards the CBD 2010 Biodiversity Target), and increase capacity at the national level for forest information collection, analysis and reporting (CPF 2006).

In October 2010, and again in September 2011, informal meetings of the "revitalized" Task Force were held. While some concerns still exist over the ability to streamline reporting and harmonise definitions, there is sufficient interest and scope for the Task Force to continue with a practical and achievable set of objectives. The Task Force noted that efforts have been on-going, even bilaterally between CPF member organizations. For example, the UNFF Secretariat has been working closely with FAO, and criteria and indicators (C&I) processes of SFM, including ITTO, the Montreal Process and Forest Europe, on approaches to streamline reporting and to identify a set of indicators that are objective, reliable and feasible to report on the implementation of the non legally binding instrument on all types of forests (forest instrument) and the achievement of its four global objectives on forests. In response to the invitation by UNFF 9 to consider how to further incorporate the elements of the forest instrument and its global objectives on forests into its reporting programmes, FAO has been working on identifying the most appropriate indicators for its 2015 Forest Resources Assessment (UNFF9 Omnibus Resolution Item 3, para 3 and 6). Given that FRA is the only comprehensive global C&I process covering all Member States of the Forum and that the ITTO C&I counts with the participation of over 60 countries, the majority of which are developing countries, indicators from these two processes appear to be the most applicable for providing indicators for reporting on the forest instrument.

5. Scientific and NGO perspectives on definitions and monitoring of biodiversity

There is a considerable amount of scientific literature on forest biodiversity monitoring. Mostly, this body of literature addresses the selection of indicators and indicator frameworks (Noss 1990, Lindemeyer 1999, Noss 1999, Balmford *et al.* 2005, Dobson 2005, Walpole *et al.* 2009), and methods for the measurement of forest biodiversity (e.g., Innes 1998, Butchart *et al.* 2005, Pereira & Cooper 2006). The potential role of modelling is highlighted by Spangenberg (2007). Grainger (2008) has discussed inconsistencies in the estimation of forest cover in the tropics. Literature has also addressed the process of indicator development, its mechanisms and implications (Sheil 2001, Failing & Gregory 2003), and improvements to biodiversity monitoring schemes have been proposed by many, including Yoccoz *et al.* (2001) for developed countries and by Danielson *et al.* (2003) for developing countries.

Very little peer-reviewed literature has been dedicated to the topic of definitions of forestry related terms. A notable exception is the work of Sasaki & Putz (2009), who examine the definitions for "forest" and "forest degradation" under the UNFCCC and other processes. In their conclusions, they suggest that "forests" should be defined as having a minimum height of 5m and minimum cover should be set at 40% (which corresponds to the FAO "closed forest" definition), and that natural forests should be distinguished from planted forests (a distinction also made within the FRA). They, as well as Schoene *et al.* (2007), also note that there is no consensus on the definition of "degradation" among the FAO, UNFCCC, UNEP, and the ITTO.

In a non-peer reviewed articles, Moses (2010) as well as the WRI (2010) suggest that, in a context where so-called degraded land may be converted to non-forest land, too-broad a definition of "degraded" will promote the loss of biodiversity from forests that are somewhat degraded but still biodiversity rich.

The preoccupations identified in the literature have implications for certain forest-related Aichi Targets, namely 5 (loss of natural habitat) and 15 (conservation and restoration). That no clear definition of degradation has emerged from either the literature or forest reporting initiatives means that the tracking of degradation, under Aichi Target 5, and restoration effort in degraded forests, under Aichi Target 15, will be difficult or impossible to track.

However, forest degradation guidelines for assessing and monitoring are currently being developed under the Collaborative Partnership on Forests, led by the FAO. This process began in 2009 and has resulted in a FAO Forest Resources Assessment Working Paper 177: 'Assessing Forest Degradation' (FAO, 2011)[12]. The report uses a working definition of forest degradation as "the reduction in the capacity of a forest to provide goods and services"[13]. The Working Paper proposes a range of indicators to measure the biodiversity aspects of forest degradation. While this is an encouraging development, it is unclear how FAO will take this process forward, and if/how forest degradation indicators would be included in the data collection and analysis of FRA.

[12] Available at: http://www.fao.org/forestry/cpf/forestdegradation/64442/en/
[13] Final drafts of these documents are available at: http://www.fao.org/forestry/cpf/forestdegradation/en/

6. Challenges to streamlining reporting

6.1 Data availability

There is currently a significant lack of data for reporting on forest-related Aichi Targets (5, 7, 11, and 15) and other aspects of biodiversity. Also of significant concern is the fact that countries use forest-related definitions that quite often differ significantly from one another, and from those applied within MEAs, so that national level data is often not appropriate for reporting initiatives. Furthermore, while FRA data contributes significantly to our understanding of forests, the analysis above has demonstrated that FRA data (both 2005 and 2010) are not fully adequate for reporting on Aichi Targets, as highlighted in Section 2.3.2 above. Remote sensing offers an important source of information. However, as elaborated in section 6.3 below, reluctance to openly share data combined with the capacity requirements of compiling and analysing remotely sensed data means that the full potential of remotes sensing for forest biodiversity monitoring is currently far from being reached.

6.2 Logistics and funding

A number of obstacles to streamlining reporting have been identified, at both the international and national levels (UNEP-WCMC 2009). In addition to inconsistent definitions, these include at the global level:

- Should some countries not be Party to all MEAs, they may have little reason to agree to changes in the reporting process.
- The reporting cycles of MEAs differ considerably, varying between annual reporting and reporting on a six-year cycle.

At the national level, major obstacles include:

- The information needed for reporting might be difficult to access and assess, being widely scattered throughout different institutions and organizations, without a central mechanism (such as a national biodiversity database) to bring relevant data and information together.
- In many developing countries, there is a lack of human, financial and/or technical capacity to address issues of data and information management as well as coordination between various ministries, agencies and/or stakeholders.

6.3 Political

There is also a certain degree of hesitation with regards to streamlining on the part of both international and national agencies on forest monitoring, albeit for different reasons. Through the course of this analysis, it has become clear that the three principal concerns are (i) the level of consensus building required to establish acceptable definitions in the context of MEAs, (ii) the fragmented and sometimes conflicted nature of Parties' participation in MEAs, or both, and (iii) lack of capacity at national, regional and international level to move towards more harmonized forest-related reporting.

At an international level, MEAs are taken through a process of agreement, which includes the setting of definitions. However, to reach such a level of accord can be a resource intensive practice, both in terms of time and financial cost, with a need to bring together a broad range of stakeholders into a sometimes lengthy consultative process. Such agreement is often only reached when parties are satisfied with what

is generally considered the “lowest common denominator” (Kohl 2000). Even within the FRA, where definitions are developed as guidance by FAO – albeit established through a consultative process with contributing nations and not necessarily through the achievement of consensus – the voluntary nature of data contribution means that effective consensus is required for the process to function at its full potential. At a time when trend data are sought in monitoring against a range of biodiversity and other environmental targets – such as the MDGs and Aichi Targets – there may be reluctance to dramatically alter a process that has been largely accepted by nations participating in FRA and at the UN level. Nevertheless, there has been greater recognition of the need to build synergies and harmonise reporting. For example, at UNFF9, member states invited FAO to consider how it can further incorporate into its reporting on the state of the world’s forests, including through the global forest resources assessment programme (FRA), the elements of the non-legally binding instrument on all types of forests and its global objectives on forests.

For Parties to the CBD at a national level, concerns predominate over the loss of control over reporting and the cost of implementing new or amended requirements. It may also be possible for agencies across national governments to fail to agree with an endorsement made by one national representative at an international forum, such as the CBD COP, and commit to a contradictory position at an FAO or ITTO event. Therefore, there is a need for greater internal coordination within countries regarding MEAs and international agreements dealing with forests and environment. Through consultations with experts for this report, it seemed that Parties considered that the support currently provided through the FRA and other processes encourages the use of FRA data and indicators for reporting to other processes, including the CBD.

In the coming months, the FAO and three criteria and indicator (C&I) processes – Montreal Process, ITTO and Forests Europe – are expected to pursue efforts to streamline reporting requirements for the FRA 2015, and work to establish a forest indicators partnership for the purposes of finding efficiencies in forest reporting and reduce redundancies (MPCI 2011). The recommendations, which are expected to be endorsed by all four participating organisations by 2012, include meetings between the FAO and the Montreal Process to strengthen the links between C&I and the FRA to develop the data questionnaire for the FRA 2015 and to consider further synergies. Given the apparent strong links between the CBD and the FRA, and that the CBD is looking to the FRA to report on certain indicators, this new vigour for collaboration among the C&I processes and the FAO, and alignment of C&I reporting and FRA reporting, will hopefully support future reporting on the Aichi targets.

7. Recommendations for streamlining and improving reporting on biodiversity

7.1 Definitions

Due to the political obstacles to the standardization of definitions described above, the authors propose that efforts to harmonize definitions should focus on improving the consistency and comparability of definitions. Consistent definitions are those that possess an "internal agreement of various elements of definitions" (Puustjärvi & Simula 2002a, also Kohl 2000). Thus, if definitions can be construed as assemblages of criteria, then definitions are consistent with one another when they share a certain number of identical criteria. By using common criteria for definitions, it becomes possible to identify subsets of data that apply to all definitions, and subsets that only apply to certain definitions.

A good example of this concept of consistency is the definitions for "forest" under the FRA 2010 and the UNFCCC. Both definitions share the common criteria of a minimum height at maturity (FAO: 5m, UNFCCC: 2m[14]), a minimum area (FAO: 0.5ha, UNFCCC: 0.05ha), a minimum percentage cover (FAO: 10%, UNFCCC: 30%), and exclude agriculture. So, we know that both definitions bring us to count as "forest" those stands of trees that have a **minimum** height of 5m at maturity, cover a **minimum** of 0.05ha, and have a percentage cover of **at least** 30% (Quantity B, in Fig. 1). FAO also counts as forest those areas where forest cover ranges from 10 to 30% (Quantity A), and UNFCCC also counts as forest patches between 0.05 and 0.5 ha and stand with a height ranging from 2 to 5 m (Quantity C). Thus, the FAO total forest area is Quantity A + B, and the UNFCCC total forest area is Quantity B+C. An illustration is provided to illustrate this concept in Figure 1.

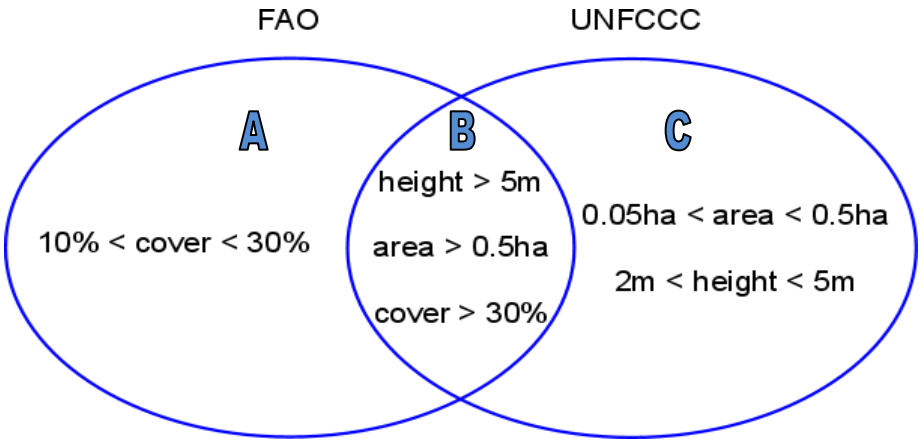

Figure 1. An illustration of consistency among definitions. Both UNFCCC and FAO consider forests greater than 5m, of an area greater than 0.5ha, and with cover greater than 30% as "forests", so this area of forest is relevant to both processes. For FAO, the area of forest with cover between 10 and 30% should be added to this amount; for UNFCCC, forest of an area between 0.05 and 0.5 as well as forest with a height between 2 and 5 m should be added to this amount.

To make definitions comparable, definitions should be "set so that their possible differences can be identified and data based on one definition can be converted to meet the needs of another, related

[14] For the sake of this illustration, the threshold values for UNFCCC are taken to be 2m for height, 0.05ha for area, and 30 per cent for forest cover; actual values for these thresholds depend on context.

definition" (Puustjärvi & Simula 2002a). That is, the wording of definitions should be established so as to clearly highlight similarities and differences through the use of standardized vocabulary.

The FAO forest inventory programs may be an appropriate context within which to implement harmonization, as described here, at the national level. At an international level, the UN and all of its agencies could consider establishing a common set of basic definitions, from which MEA parties could build context appropriate definitions.

7.2 Forest classification

It is the sense of the authors that the approach to land classification and mapping developed by UNEP-WCMC holds the most promise for biodiversity reporting. The mapping product was developed specifically to identify gaps in the global network of protected areas. The use of WWF ecoregions is very relevant to biodiversity monitoring. Also, several thresholds were applied to identify forests: 10-30% and greater than 30%; the authors considered that such thresholds could correctly distinguish degraded and non-degraded forests in the tropics, while correctly identifying more open forest in drier climates.

Over time, it will also be important to monitor the evolution of biodiversity science, as new methodologies are developed to refine the estimation of biodiversity from remote sensing and modelling. In order to remain current in both scientific understanding and capability to monitor forests and land cover change, and to support the timely development and implementation of appropriate policy responses, the CBD, other MEAs, and processes such as the FRA, should allow for regular input from the academic community. Equally important is the provision of support to countries in order that they too may remain as up-to-date as possible. The Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) should, once fully implemented, provide a suitable forum for such dialogue and capacity support.

7.3 Indicators

Any discussion on definitions, monitoring and reporting inevitably leads to the development and use of appropriate indicators. Such metrics need to be purpose specific, and should be geared towards decision making and policy development, not scientific hypothesis testing (Failing & Gregory 2003).

The incorporation of existing data is an inevitable part of such a process, owing to the resources required to begin a completely new monitoring process, and it is recognized that making greater use of existing information to fulfill the information needs of various international processes would also ease the reporting burden (UNFF 2004, BIP 2011), which would call for more harmonized and consistent use of forest-related definitions. The FRA, as well as the ITTO, Montreal Process and Pan-European Criteria and Indicators of Sustainable Forest Management sets that are already being used for reporting by countries (including to the FRA) and ITTO's guidelines for biodiversity conservation in production forests, are an excellent starting point from which to generate a forest-related indicator framework.

The authors therefore recommend that any discussion on definitions and monitoring also consider frameworks on appropriate cross-purpose indicators, including both ecological and policy contexts. While the recent 15th meeting of CBD SBSTTA involved discussion on the level of prescriptive guidance on indicators provided to Parties, and recognised that "parties are likely to use different metrics and methodologies depending on national targets and available data and methods", it also highlighted that

"countries with limited capacities and resources will require financial resources and technical support to develop and apply indicators, as well as to carry out priority monitoring activities required at the national level" (CBD 2011c).

In reviewing and aligning, where possible, the indicators used across the reporting requirement, the secretariats can support the following SBSTTA 15 recommendations (CBD 2011c):

- compile technical guidance materials for capacity building and provide support to parties for the further development of indicators and monitoring and reporting systems;
- propose a limited number of simple, easily applicable and cost-effective indicators that can potentially be implemented by all parties;
- assist parties, at their request, to initially establish and apply a few simple, cost-effective and easily applicable indicators for priority issues;
- include capacity building on the indicator framework in regional workshops to support its implementation; and
- explore options for the further harmonization of global indicators with other conventions, international and regional bodies, agreements and processes.

While such a process may seem be overly-prescriptive, and therefore potentially of concern to some CBD Parties, the nature of the reporting under the FRA may offer an option to achieve such harmonisation.

7.4 Capacity building and tools for streamlining reporting

There is a need to enhance biodiversity reporting capacity in developing countries. The authors suggest that part of this capacity building be provided in the form of a set of tools to allow countries to more effectively coordinate among focal points to reporting processes and national and sub-national departments. Such a tool-box could address:

- The relationships among forest definitions and how national data can be used for reporting to conventions, bodies, agreements and other processes;
- Reporting requirements and available data sources;
- The use of remote sensing data for reporting.

An online tool could be developed to automatically compare the figures that countries submit under different processes. Automated protocols could also be established to convert and feed data for one MEA into formats useable by other MEA. For instance, the CBD National Reports Analyzer[15] and the national reporting tool used by the Indian Ocean – South-East Asian Turtle Memorandum of Understanding under the Convention on Migratory Species[16] provide existing examples of single-MEA systems. However, they require sets of prescriptive questions with single, or otherwise simple, responses expected. Such a system may be feasible using the common criteria approach to definitions (see Section 7.1) with the initial questions focusing on the common traits of the definitions – in effect the lowest common denominator – with sub-questions allowing for finer resolution or detail if available. The authors note that strong collaboration between the secretariats of UNFCCC, CBD, FAO, ITTO, as well

[15] http://www.cbd.int/reports/analyzer.shtml
[16] http://www.ioseaturtles.org/report.php

as possibly others, would be required in order to start considering developing an online 'report analyzer', including standard data collation protocols and agreement on definitions to enhance querying the database. Such an approach has been proposed before, including by Parties to the biodiversity-related MEAs (UNEP-WCMC 2009), but has yet to be successfully implemented.

Coordination among national focal points, with the goal of developing synergies among the overlapping reporting processes on forests, should also be promoted. This solution circumvents the issue of political obstacles for the harmonization of definitions (Section 7.1) while contributing to the goal of alleviating the reporting burden of countries. In developing this set of tools, synergies should be developed among current initiatives, such as the WCMC-GEF project and the Eurostat/FAO/ITTO/UN-ECE Joint Forest Sector Questionnaire (Section 4.2).

References

Anderson, J.R., Hardy, E.E., Roach J.T. & Witmer R.E. 1976. *A land use and land cover classification system for use with remote sensor data*. U.S. Geological Survey Professional Paper 964.

Anderson, S.C., Kupfer, J.A., Wilson, R.R. & Cooper, R.J. (2000). Estimating forest crown area removed by selection cutting: a linked regression-GIS approach based on stump diameters. *Forest Ecology and Management* **137**(1-3): 171-177.

Arino, O., Gross, D., Ranera, F., Bourg, L., Leroy, M., Bicheron, P., Latham, J., Di Gregorio, A., Brockman, C., Witt, R., Defourny, P., Vancutsem, C., Herold, M., Sambale, J., Achard, F., Durieux, L., Plummer, S., Weber, J.-L., ESA-ESRIN & Frascati. 2007. *GlobCover: ESA service for global land cover from MERIS*. Geoscience and Remote Sensing Symposium, 2007. 23-28 July 2007. IEEE International.

Atmosphere Regolith VEgetation (ARVE). 2011. *Reconstructing Holocene vegetation*. http://arve.epfl.ch/research/landcover/pub_2009_recontructing_veg_poster2.pdf. Accessed on Dec 12th 2011. Video available at http://www.wired.co.uk/news/archive/2011-04/12/global-land-use-mapped

Bailey, R.G. 1983. Delineation of ecosystem regions. *Environmental Management* **7**(4): 365-373.

Bailey, R.G. 1996. *Ecosystem geography*. Springer, New York, USA.

Balmford, A., Crane, P., Dobson, A., Green, R.E. & Mace, G.M. 2005. The 2010 challenge: data availability, information needs, and extraterrestrial insights. *Phil. Trans. R. Soc. B*. **360**: 221-228.

Baral, S. 2011. *Mapping carbon stock using high resolution satellite images in sub-tropical forest of Nepal*. M.Sc. thesis. University of Twente, Enschede, The Netherlands. 60 pages.

Belward, A.S. (ed.) 1996. *The IGBP-DIS global 1 km land cover data set (DISCover)-proposal and implementation plans*. IGBP-DIS Working Paper No. 13. Toulouse, France.

BIP (Biodiversity Indicators Partnership). 2011. *Guidance for national biodiversity indicator development and use*. UNEP-WCMC, Cambridge, UK.

Bonan, G.B., Oleson, K.W., Vertenstein, M., Levis, S., Zeng, X., Dai, Y, Dickinson, R.E. & Yang, Z.-L. 2002. The Land Surface Climatology of the Community Land Model Coupled to the NCAR Community Climate Model. *Journal of Climate* **15**: 3123-3148.

Bubb, P., Chenery, A., Herkenrath, P., Kapos, V., Mapendembe, A., Stanwell-Smith, D. & Walpole, M. 2011. *National Indicators, Monitoring and Reporting for the Strategy for Biodiversity 2011-2020*. UNEP-WCMC, Cambridge, UK.

Butchart, S.H.M., Stattersfield, A.J., Baillie, J., Bennun, L.A., Stuart, S.N., Akçakaya, H.R., Hilton-Taylor, C. & Mace, G.M. 2005. Using red-list indices to measure progress towards the 2010 targets and beyond. *Phil. Trans. R. Soc. B* **360**: 255-268.

CBD. 2006. *Guidelines for the Fourth National report*. Convention on Biological Diversity, Montreal, Canada.

CBD. 2011a. *NBSAP training modules version 2.1 – Module 4 Setting National Biodiversity Targets in line with the Framework of the Strategic Plan for Biodiversity 2011-2020, including Aichi Biodiversity Targets*. Convention on Biological Diversity, Montreal, Canada.

CBD. 2011b. *Guidelines for the Fifth National report. Draft version, January 2011*. Convention on Biological Diversity, Montreal, Canada.

CBD. 2011c. *Recommendations adopted by the Subsidiary Body on Scientific, Technical and Technological Advice at its fifteenth meeting, Montreal, 7-11 November 2011*. Advance copy subject to clearance. Convention on Biological Diversity, Montreal, Canada.

COST-E4. 2000. *Forest Reserves Research Network in Europe. Mission, Goals, Outputs, Linkages, Recommendations and Partners*. COST Action E4, Final report. http://www.metla.fi/eu/cost/e4/coste4.pdf

CPF (Collaborative Partnership on Forests). 2006. *CPF effort to streamline forest-related reporting: Information note for the 16th meeting of the Collaborative Partnership on Forests on 12 February 2006*. Food and Agriculture Organization of the United Nations, Rome, Italy.

CPF (Collaborative Partnership on Forests). 2011. *CPF Task Force on Streamlining Forest-Related Reporting: 15 September 2011, Nastola, Finland*. Meeting report. Food and Agriculture Organization of the United Nations, Rome, Italy.

Danielson F., Mendoza, M.M., Alviola, P., Balete, D.S., Enghoff, M., Poulsen, M.K. & Jensen, A.E. 2003. Biodiversity monitoring in developing countries: what are we trying to achieve? *Oryx*. **37**(4): 407-409.

Di Gregorio, A. & Jansen, L.J.M. 2000. *Land cover classification system (LCCS)*. FAO, Rome, Italy. http://www.fao.org/docrep/003/X0596E/X0596e00.htm#P-1_0

Dickinson, R.E., Henderson-Sellers, A., Kennedy, P.J. & Wilson, M.F. 1986. *Biosphere-atmosphere transfer scheme (BATS) for the NCAR community climate model*. NCAR Technical Note NCAR/TN275+STR, Boulder, USA.

Dobson, A. 2005. Monitoring global rates of biodiversity change: challenges that arise in meeting the Convention on Biological Diversity (CBD) 2010 goals. *Phil. Trans. R. Soc. B* **360**: 229-241.

Eva, H.D., Glinni, A., Janvier, P. *et al.* 1999. *Vegetation Map of Tropical South America, Scale 1/5M*. TREES Publications Series D, No. 2, EUR EN 18658, European Commission, Luxembourg.

Failing, L. & Gregory, R. 2003. Ten common mistakes in designing biodiversity indicators for forest policy. *Journal of Environmental Management* **68**: 121-132.

FAO (Food and Agriculture Organization of the United Nations). 2001. *FRA 2000: Global Ecological Zoning for the Global Forest Resources Assessment 2000. Final Report*. Forest Resources Assessment Programme Working Paper 56. FAO, Rome Italy.

FAO (Food and Agriculture Organization of the United Nations). 2002a. *Proceedings: Expert Meeting on harmonizing forest-related definitions for use by various stakeholders* (Rome, 22-25 January 2002). http://www.fao.org/forestry/15533-0cb816e82c09c14873ce9226dd13910b9.pdf

FAO (Food and Agriculture Organization of the United Nations). 2002b. Proceedings: Second Expert Meeting on Harmonizing Forest-related Definitions for Use by Various Stakeholders (Rome, from 11 to 13 September 2002). http://www.fao.org/DOCREP/005/Y4171E/y4171e00.htm

FAO (Food and Agriculture Organization of the United Nations). 2005. *Proceedings: Third Expert Meeting on Harmonizing Forest-related Definitions for Use by Various Stakeholders* (Rome, from 17 to 19 January 2005). ftp://ftp.fao.org/docrep/fao/008/j4959e/j4959e.pdf

FFRI (Finnish Forest Research Institute). 1987. *Proceedings of* ad hoc *FAO/ECE/FINNIDA meeting of experts on forest resource assessment. Kotka, Finland, 26-30 October 1987*. Bulletin 284 of the Finnish Forest Research Institute. FINNIDA, Helsinki, Finland.

FFRI (Finnish Forest Research Institute). 1993. *Proceedings of FAO/ECE Meeting of Experts on Global Forest Resources Assessment in cooperation with UNEP and with the support of FINNIDA (Kotka II)*. Kotka, Finland, 3 -7 May 1993. Research Paper 469 of the Finnish Forest Research Institute. Helsinki, Finland. http://www.fao.org/forestry/fra/51858@6773/en/

FFRI (Finnish Forest Research Institute). 1996. *Proceedings of Ad Hoc FAO/ECE/FINNIDAMeeting of Experts Forest Resource Assessment 2000 in Cooperation with ECE and UNEPwith the Support of the Government of Finland (Kotka III)*. Kotka, Finland, 26-30 June 1996. Bulletins of the Finnish Forest Research Institute 284. http://www.fao.org/forestry/fra/51858@6773/en/

Gibbs, H. K. & Herold, M. 2007. Tropical deforestation and greenhouse gas emissions. *Environmental Research Letters* **2**(4).

Grainger, A. 2008. Difficulties in tracking the long-term global trend in tropical forest area. *PNAS* **105**: 818-823.

Groombridge, B. & Jenkins, M. 2002. *World Atlas of Biodiversity: Earth's Living Resources in the 21st Century*. University of California Press, Berkley, CA.

Hansen, M., DeFries, R., Townshend, J.R.G. & Sohlberg, R. 2000. Global land cover classification at 1km resolution using a decision tree classifier. *International Journal of Remote Sensing* **21**: 1331-1365.

IISD. 2011. Summary of the Fifteenth Meeting of the Subsidiary Body on Scientific, Technical and Technological Advice of the Convention on Biological Diversity. *IISD Earth Negotiations Bulletin* **09**(562). URL: http://www.iisd.ca/vol09/enb09562e.html. Accessed 16 November 2011.

Innes, J.L. 1998. Forest biodiversity and its assessment by remote sensing. *Glob. Ecol. Biogeo. Let*. **7**: 397-419.

International Tropical Timber Organization (ITTO). 2002. ITTO guidelines for the restoration, management and rehabilitation of degraded and secondary tropical forests. ITTO Policy Development Series No. 13. ITTO, Yokohama, Japan.

International Tropical Timber Organization (ITTO). 2005. Annual Review and Assessment of the World Timber Situation 2004. ITTO, Yokohama, Japan.

Kennedy, P., McCormick, N. & Folving, S. 1994. European forest ecosystems mapping and forest statistics: the FIRS project. In: *Proceedings of the International Workshop on Designing a System of Nomenclature for European Forest Mapping*. Joensuu, Finland , 13-15 June 1994. European Commission. Report EUR 16113 EN, pp. 34-48.

Kohl, M. 2000. Reliability and Comparability of TBFRA-2000 Results. In: UN-ECE/FAO 2000: Forest Resources of Europe, CIS, North America, Australia, Japan and New Zealand. *Main Report*. Geneva Timber and Forest Study Papers, No, 17. ftp://ftp.fao.org/docrep/fao/008/j4959e/j4959e.pdf

Koppen, W. 1936. Das geographisca System der Klimate. In: Handbuch der Klimatologie. W. Koppen & G. Geiger (eds). *Gebr, Borntraeger*. Quoted in Peel *et al.* (2007).

Lindemeyer, D.B. 1999. Future directions for biodiversity conservation in managed forests: indicator species, impact studies and monitoring programs. *For. Ecol. Manage*. **115**: 277-287. http://www.landsinfo.org/ecosystem_defense/science_documents/Lindenmayer_1999.pdf

Loveland, T., Merchant, J., Ohlen, D. & Brown, J. 1991. Development of a land-cover characteristics database for the contermious US. *Photogrammetric Engineering and Remote Sensing* **57**: 1453-1463

Lund, H.G. 2001. *Definitions of old growth, pristine, climax, ancient forests, and similar terms*. [Online publication], Manassas, VA, USA: Forest Information Services. White paper prepared for FAO. http://home.att.net/~gklund/pristine.html

Lund, H.G. 2009. *What is degraded forest?* http://home.comcast.net/~gyde/2009forestdegrade.doc

Matthews, E. 1983. Global vegetation and land use: New high-resolution data bases for climate studies. *J. Clim. Appl. Meteor*. **22**: 474-487.

Matthews, E. 1984. *Prescription of Land-surface Boundary Conditions in GISS GCM II: A Simple Method Based on High-resolution Vegetation Data Sets*. NASA TM-86096. National Aeronautics and Space Administration. Washington, D.C.

Mayaux, P., Janodet, E. & Blair-Myers, C. 1997. *Vegetation Map of Central Africa at 1.5M*. TREES Publications Series D1, EUR 17322. European Commission, Luxembourg.

MPCI (Montreal Process Working Group on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests). 2011. *22nd Montreal Process Working Group, Victoria, British Columbia, Canada – October 16-17, and 21, 2011*. http://www.rinya.maff.go.jp/mpci/meetings/22_e.html

Moses, K. 2010. *Lack of forest definition 'major obstacle' in fight to protect rainforests*. http://www.theecologist.org/News/news_analysis/640908/lack_of_forest_definition_major_obstacle_in_fight_to_protect_rain forests.html

Noss, R.F. 1990. Indicators for monitoring biodiversity: a hierarchical approach. *Conserv. Biol*. **4**: 355-364. http://maps.wildrockies.org/ecosystem_defense/Science_Documents/Noss_1990.pdf

Noss, R.F. 1999. Assessing and monitoring forest biodiversity – A suggested framework and indicators. *For. Ecol. Manage.* **115**: 135-146. http://flash.lakeheadu.ca/~rrempel/ecology/Biodiversity_Papers/PDF0259-Noss.pdf

Olson, J.S. 1994a. *Global ecosystem framework-definitions: USGS EROS Data Center Internal Report*. USGS, Sioux Falls, USA.

Olson, J.S. 1994b. *Global ecosystem framework-translation strategy: USGS EROS Data Center Internal Report*. USGS, Sioux Falls, USA.

Olson D.M., Dinerstein E., Wikramanayake E.D., Burgess N.D., Powell G.V.N., Underwood E.C., D'Amico J.A., Itoua I., Strand H.E., Morrison J.C., Loucks C.J., Allnutt T.F., Ricketts T.H., Kura Y., Lamoreux J.F., Wettengel W.W., Hedao P. and Kassem K.R. 2001. Terrestrial Ecoregions of the World: A New Map of Life on Earth. BioScience. **51**: 933-938.

Pajari, B.JK., & Schuck, A. 1994. *Terms and Definitions for the Follow-up of the Second Ministerial Conference on the Protection of Forests in Europe*. Working Paper 17.6.94.

Peel, M.C., Finlayson, B.L. & McMahon, T.A. 2007. Updated world map of the Koppen-Geiger climate classification. *Hydrol. Earth Syst. Sci*. **11**: 1633-1644.

Pereira, H.M. & Cooper, H.D. 2006. Towards the global monitoring of biodiversity change. *Trends in Ecology and Evolution*. **21**: 123-129

Peterken, G.F. 1996. *Natural woodland: Ecology and Conservation in Northern Temperate Regions*. Cambridge University Press.

Puustjärvi. E. & Simula, M. 2002a. *Development of Common Framework for Forest-Related Definitions*. http://www.fao.org/docrep/005/y4171e/Y4171E06.htm

Rosenqvist, Å., Milne, A., Lucas, R., Imhoff, M. & Dobson, C. (2003). A review of remote sensing technology in support of the Kyoto Protocol. *Environmental Science & Policy* **6**(5): 441-455.

Ruesch, A. & Gibbs, H.K. 2008. *New IPCC Tier-1 Global Biomass Carbon Map for the Year 2000*. Available online from the Carbon Dioxide Information Analysis Center [http://cdiac.ornl.go], Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Running, S.W., Loveland, T.R., Pierce, L.L., Nemani, R.R. & Hunt, E.R. 1995. A remote sensing based vegetation classification logic for global land cover analysis. *Remote Sensing of Environment* **51**: 948-952.

Saatchi, S., Harris, N.L., Brown, S., Lefsky, M., Mitchard. E.T.A., Salas, W., Zutta, B.R., Buermann, W., Lewis, S.L., Hagen, S., Petrova, S., White, L., Silman, M. & Morel, A. 2011. Benchmark map of forest carbon stocks in tropical regions across three continents. *PNAS*.

Sasaki, N. & Putz, F.E. 2009. Critical need for new definitions of "forest" and "forest degradation" in global climate change agreements. *Conserv. Let*. **2**: 226-232.

Schmitt, C.B., Belokurov, A., Besançon C., Boisrobert, L., Burgess, N.D., Campbell, A., Coad, L., Fish, L., Gliddon, D., Humphries, K., Kapos, V., Loucks C., Lysenko, I., Miles, L., Mills, C., Minnemeyer, S., Pistorius, T., Ravilious, C., Steininger, M. & Winkel, G. 2008. *Global Ecological Forest Classification and Forest Protected Area Gap Analysis. Analyses and recommendations in view of the 10% target for forest protection under the Convention on Biological Diversity (CBD)*. Freiburg University Press, Freiburg, Germany.

Schoene, D., Killmann, W., von Lüpke, H. & Loyche-Wilkie, M. 2007. Definitional issues related to reducing emissions from deforestation in developing countries. *Forest and Climate Change Working Paper* **5**.

Sellers, P.J., Mintz, Y., Sud, Y.C. & Dalcher A., 1986, A simple biosphere model (SiB) for use within general circulation models. *Journal of Atmospheric Science* **43**: 505-531.

Sellers, P.J., Randall, D.A., Collatz, G.J., Berry, J.A., Field, C.B., Dazlich, D.A., Zhang, C., Collelo, G.D. & Bounoua, L., 1996, A revised land surface parameterization (SiB2) for atmospheric GCMs - Part I-model formulation. *Journal of Climate* **9**: 676-705.

Sheil, D. 2001. Conservation and biodiversity monitoring in the tropics: realities, priorities, and distractions. *Conserv. Biol*. **15**: 1179-1182. http://www.cifor.cgiar.org/mla/download/publication/Conservation%20and%20Biodiversity.pdf

Simula, M. 2009. *Towards defining forest degradation: comparative analysis of existing definitions*. FAO discussion paper. http://www.ardot.fi/Documents_2/Degradationdefintions.pdf

Spangenberg, J.H. 2007. Integrated scenarios for assessing biodiversity risks. *Sust. Dev*. **15**: 343-356.

Sustainability and the Global Environment (SAGE). 2011. *Global land use database*. Accessed on Dec 12th 2011.

Thornthwaite, C.W. & Hare, F.K. 1955. Climatic classification in Forestry. *Unasylva* **9**(2). http://www.fao.org/docrep/x5375e/x5375e02.htm

Trewartha, G.T. 1968. *An Introduction to Climate, 4th edition*. New York, NY: McGraw Hill.

Turner, W., Spector, S. Gardiner, N., Fladeland, M., Sterling, E. & Steininger, M. 2003. Remote sensing for biodiversity science and conservation. *Trends in Ecology and Evolution* **18**(6): 306-314.

UNEP-WCMC. 2004. *Towards the harmonization of national reporting to biodiversity-related treaties: A workshop convened by UNEP-WCMC in cooperation with the governments of Belgium and the UK. Haasrode, Belgium, 22-23 September, 2004*. Workshop Report. UNEP World Conservation Monitoring Centre, Cambridge, UK.

UNEP-WCMC. 2009. *Preconditions for harmonization of reporting to biodiversity-related multilateral environmental agreements*. UNEP World Conservation Monitoring Centre, Cambridge, UK.

UNFF. 2004. *Report of the Secretary-General: Monitoring, assessment and reporting, concepts, terminology and definitions*. E/CN.18/2004/10. United Nations Forum on Forests, New York, USA.

Walpole, M., Almond, R.E.A., Besançon, C., Butchart, S.H.M., Campbell-Lendrum, D., Carr, G.M., Collen, B., Collette, L., Davidson, N.C., Dulloo, E., Fazel, A.M., Galloway, J.N., Gill, M., Goverse, T., Hockings, M., Leaman, D.J., Morgan, D.H.W., Revenga, C., Rickwood, C.J., Schutyser, F., Simons, S., Stattersfield, A.J., Tyrrell, T.D., Vié, J.C. & Zimsky, M. 2009. Tracking Progress Toward the 2010 Biodiversity Target and Beyond. *Science* **325**: 1503–1504.

WRI (World Resources Institute. 2011. *A World of Opportunity for Forest and Landscape Restoration*. http://www.wri.org/map/global-map-forest-landscape-restoration-opportunities. Accessed on December 11th 2011.

WWF (World Wildlife Fund). 2011. *Ecoregions*. http://www.worldwildlife.org/science/ecoregions/item1847.html. Accessed on December 12th 2011.

WRI (World Resources Institute). 2010. *Degraded Land, Sustainable Palm Oil, and Indonesia's Future*. http://www.wri.org/stories/2010/07/degraded-land-sustainable-palm-oil-and-indonesias-future. Accessed on December 12th 2011.

Yoccoz, N.G., Nichols, J.D. & Boulinier, T. 2001. Monitoring biodiversity in space and time. *Trends Ecol. Evol*. **16**: 446-453.

Zhu, Z. & Waller, E. 2003. Global Forest Cover Mapping for the United Nations Food and Agriculture Organization Forest Resources Assessment 2000 Program. *For. Sci*. **49**(3): 369-380.

Appendices

I. Definitions of forest-related terms

Table 4. Terms used by the various international processes, with their respective definitions.

Term	CBD	FAO FRA 2000	FAO FRA 2010	ITTO	UNFCCC
Forest	FRA 2000	Land with tree crown cover (or equivalent stocking level) of more than 10 percent and area of more than 0.5 hectares (ha). The trees should be able to reach a minimum height of 5 meters (m) at maturity *in situ*[17].	Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds *in situ*. It does not include land that is predominantly under agricultural or urban land use[18].	Land spanning more than 0.5 hectares with trees higher than five meters and a canopy cover of more than 10%, or trees able to reach those thresholds *in situ*. It does not include land that is predominantly under agricultural or urban use	Forest is a minimum area of land of 0.05 – 1.0 hectares with tree crown cover (or equivalent stocking level) of more than 10 – 30 per cent with trees with the potential to reach a minimum height of 2 – 5 meters at maturity *in situ*. A forest may consist either of closed forest formations where trees of various storeys and undergrowth cover a high portion of the ground or open forest. Young natural stands and all plantations which have yet to reach a crown density of 10 – 30 per cent or tree height of 2 – 5 meters are included under forest, as are areas normally forming part of the forest area which are temporarily unstocked as a

[17] May consist either of closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground; or open forest formations with a continuous vegetation cover in which tree crown 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 areas normally forming part of the forest area which 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; forest in national parks, nature reserves and other protected areas such as those of specific scientific, historical, cultural or spiritual interest; windbreaks and shelterbelts of trees with an area of more than 0.5 ha and width of more than 20 m; plantations primarily used for forestry purposes, including rubberwood plantations and cork oak stands. Excludes: Land predominantly used for agricultural practices

[18] 1. Forest is determined both by the presence of trees and the absence of other predominant land uses. The trees should be able to reach a minimum height of 5 meters *in situ*. 2. Includes areas with young trees that have not yet reached but which are expected to reach a canopy cover of 10 percent and tree height of 5 meters. It also includes areas that are temporarily unstocked due to clear-cutting as part of a forest management practice or natural disasters, and which are expected to be regenerated within 5 years. Local conditions may, in exceptional cases, justify that a longer time frame is used. 3. Includes forest roads, firebreaks and other small open areas; forest in national parks, nature reserves and other protected areas such as those of specific environmental, scientific, historical, cultural or spiritual interest. 4. Includes windbreaks, shelterbelts and corridors of trees with an area of more than 0.5 hectares and width of more than 20 meters. 5. Includes abandoned shifting cultivation land with a regeneration of trees that have, or is expected to reach, a canopy cover of 10 percent and tree height of 5 meters. 6. Includes areas with mangroves in tidal zones, regardless whether this area is classified as land area or not. 7. Includes rubber-wood, cork oak and Christmas tree plantations. 8. Includes areas with bamboo and palms provided that land use, height and canopy cover criteria are met. 9. Excludes tree stands in agricultural production systems, such as fruit tree plantations, oil palm plantations and agroforestry systems when crops are grown under tree cover. Note: Some agroforestry systems such as the "Taungya" system where crops are grown only during the first years of the forest rotation should be classified as forest.

Term	CBD	FAO FRA 2000	FAO FRA 2010	ITTO	UNFCCC
					result of human intervention such as harvesting or natural causes but which are expected to revert to forest.
Degradation	A degraded forest is a secondary forest that has lost, through human activities, the structure, function, species composition or productivity normally associated with a natural forest type expected on that site. Hence, a degraded forest delivers a reduced supply of goods and services from the given site and maintains only limited biological diversity. Biological diversity of degraded forests includes many non-tree components, which may dominate in the undercanopy vegetation.	Takes different forms, particularly in open forest formations, deriving mainly from human activities such as over-grazing, over-exploitation (for firewood or timber), repeated fires, or due to attacks by insects, diseases, plant parasites or other natural sources such as cyclones. In most cases, degradation does not show as a decrease in the area of woody vegetation but rather as a gradual reduction of biomass, changes in species composition and soil degradation. Unsustainable logging practices can contribute to degradation if the extraction of mature trees is not accompanied with their regeneration or if the use of heavy machinery causes soil compaction or loss of productive forest area.	The reduction of the capacity of a forest to provide goods and services.	The reduction of the capacity of a forest to produce goods and services. 'Capacity' includes the maintenance of ecosystem structure and functions.	(IPCC 2003) a direct human-induced long-term loss (persisting for X years or more) of at least Y % of forest carbon stocks (and forest values) since time T and not qualifying as deforestation or an elected activity under Article 3.4 of the Kyoto Protocol.
Fragmentation	Forest fragmentation refers to any process that results in the conversion of				

Term	CBD	FAO FRA 2000	FAO FRA 2010	ITTO	UNFCCC
	formerly continuous forest into patches of forest separated by non-forested lands.				
Deforestation		Refers to change of land cover with depletion of tree crown cover to less than 10 percent. Changes within the forest class (e.g. from closed to open forest) which negatively affect the stand or site and, in particular, lower the production capacity, are termed forest degradation.	The conversion of forest to other land use or the long-term reduction of the tree canopy cover below the minimum 10 percent threshold.[19]		The direct human-induced conversion of forested land to non-forested land.
Reforestation	FRA 2000	Artificial establishment of forest on lands which carried forest before.	Re-establishment of forest through planting and/or deliberate seeding on land classified as forest.[20]	The re-establishment of trees and understorey plants at a site immediately after the removal of natural forest cover (ITTO 2002)	Direct human-induced conversion of non-forested land to forested land through planting, seeding and/or the human-induced promotion of natural seed sources, on land that was forested but that has been converted to non-forested land. For the first commitment period, reforestation activities will be limited to reforestation occurring on those lands that did not contain forest on 31 December 1989.

[19] 1. Deforestation implies the long-term or permanent loss of forest cover and implies transformation into another land use. Such a loss can only be caused and maintained by a continued human-induced or natural perturbation. 2. Deforestation includes areas of forest converted to agriculture, pasture, water reservoirs and urban areas. 3. The term specifically excludes areas where the trees have been removed as a result of harvesting or logging, and where the forest is expected to regenerate naturally or with the aid of silvicultural measures. Unless logging is followed by the clearing of the remaining logged-over forest for the introduction of alternative land uses, or the maintenance of the clearings through continued disturbance, forests commonly regenerate, although often to a different, secondary condition. 4. In areas of shifting agriculture, forest, forest fallow and agricultural lands appear in a dynamic pattern where deforestation and the return of forest occur frequently in small patches. To simplify reporting of such areas, the net change over a larger area is typically used. 5. Deforestation also includes areas where, for example, the impact of disturbance, over utilization or changing environmental conditions affects the forest to an extent that it cannot sustain a tree cover above the 10 percent threshold.

[20] 1. Implies no change of land use. 2. Includes planting/seeding of temporarily unstocked forest areas as well as planting/seeding of areas with forest cover. 3. Includes coppice from trees that were originally planted or seeded. 4. Excludes natural regeneration of forest.

Term	CBD	FAO FRA 2000	FAO FRA 2010	ITTO	UNFCCC
Afforestation	FRA 2000	Artificial establishment of forest on lands which previously did not carry forest within living memory.	Establishment of forest through planting and/or deliberate seeding on land that, until then, was not classified as forest.[21]	The establishment of a planted forest on non-forested land (ITTO 2002)	The direct human-induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding and/or the human-induced promotion of natural seed sources.
Sustainable forest management	UN General Assembly definition (2007).[22]		National definition or if no national definition or criteria exist, countries may use the following (ITTO 2005).[23]	the process of managing permanent forest land to achieve one or more clearly specified objectives of management with regard to the production of a continuous flow of desired forest products and services without undue reduction in its inherent values and future productivity and without undue undesirable effects on the physical and social environment (ITTO 2005)	
Habitat loss	Habitat loss, used with reference to an individual species, is the permanent conversion of	Artificial establishment of forest on lands which previously did not carry forest within living memory.	Establishment of forest through planting and/or deliberate seeding on land that, until then, was not classified as forest.[24]		The direct human-induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding and/or the human-induced promotion of natural seed sources.

[21] Implies a transformation of land use from non-forest to forest.

[22] Sustainable forest management as a dynamic and evolving concept aims to maintain and enhance the economic, social and environmental value of all types of forests, for the benefit of present and future generations. It is characterized by seven elements, including: (i) extent of forest resources; (ii) forest biological diversity; (iii) forest health and vitality; (iv) productive functions of forest resources; (v) protective functions of forest resources; (vi) socio-economic functions of forests; and (vii) legal, policy and institutional framework.

[23] Forest areas that fulfil any of the following conditions: i. have been independently certified or in which progress towards certification is being made; ii. have fully developed, long-term (ten years or more) forest management plans with firm information that these plans are being implemented effectively; iii. are considered as model forest units in their country and information is available on the quality of management; iv. are community-based forest management units with secure tenure for which the quality of management is known to be of high standard; v. are protected areas with secure boundaries and a management plan that are generally considered in the country and by other observers to be well managed and that are not under significant threat from destructive agents.

[24] Implies a transformation of land use from non-forest to forest.

Term	CBD	FAO FRA 2000	FAO FRA 2010	ITTO	UNFCCC
	former (forest) habitat to an area where that species can no longer exist, be it still forested or not.				
Forest biological diversity	Forest biological diversity means the variability among forest living organisms and the ecological processes of which they are part; this includes diversity in forests within species, between species and of ecosystems and landscapes.		The variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, among species and of ecosystems.	(use CBD 1992 definition)	
Primary forest	A primary forest is a forest that has never been logged and has developed following natural disturbances and under natural processes, regardless of its age. It is referred to "direct human disturbance" as the intentional clearing of forest by any means (including fire) to manage or alter them for human use. Also included as primary, are forests that are used	Naturally regenerated forest of native species, where there are no clearly visible indications of human activities and the ecological processes are not significantly disturbed.	Naturally regenerated forest of native species, where there are no clearly visible indications of human activities and the ecological processes are not significantly disturbed.	Forest which has never been subject to human disturbance, or has been so little affected by hunting, gathering and tree-cutting that its natural structure, functions and dynamics have not undergone any changes that exceed the elastic capacity of the ecosystem (ITTO 2002)	

Term	CBD	FAO FRA 2000	FAO FRA 2010	ITTO	UNFCCC
	inconsequentially by indigenous and local communities living traditional lifestyles relevant for the conservation and sustainable use of biological diversity.[25]				
Secondary forest	A secondary forest is a forest that has been logged and has recovered naturally or artificially. Not all secondary forests provide the same value to sustaining biological diversity, or goods and services, as did primary forest in the same location. In Europe, secondary forest is forest land where there has been a period of complete clearance by humans with or without a period of conversion to another land use.		Woody vegetation regrowing on land that was largely cleared of its original forest cover (i.e., carried less than 10% of the original forest cover). Secondary forests commonly develop naturally on land abandoned after shifting cultivation, settled agriculture, pasture, or failed tree plantations.	Woody vegetation regrowing on land that was largely cleared of its original forest cover (i.e. carried less than 10% of the original forest cover). Secondary forests commonly develop naturally on land abandoned after shifting cultivation, settled agriculture, pasture, or failed tree plantations (ITTO 2002)	

[25] In much of Europe, primary forest has a different connotation and refers to an area of forest land which has probably been continuously wooded at least throughout historical times (e.g., the last thousand years). It has not been completely cleared or converted to another land use for any period of time. However traditional human disturbances such as patch felling for shifting cultivation, coppicing, burning and also, more recently, selective/partial logging may have occurred, as well as natural disturbances. The present cover is normally relatively close to the natural composition and has arisen (predominantly) through natural regeneration, but planted stands can also be found. However, the suggested definition above would include other forests, such as secondary forests.

Term	CBD	FAO FRA 2000	FAO FRA 2010	ITTO	UNFCCC
	Forest cover has regenerated naturally or artificially through planting.				
Managed forest				(definition exists for "managed primary forest", but not for "managed forest")	All forests subject to some kind of human interactions (notably commercial management, harvest of industrial round-wood (logs) and fuelwood, production and use of wood commodities, and forest managed for amenity value or environmental protection if specified by the country), with defined geographical boundaries.
Restoration				A management strategy applied in degraded primary forest areas. Forest restoration aims to restore the forest to its state before degradation (same function, structure and composition)	Direct human-induced conversion of non-forested land to forested land through planting, seeding and/or the human-induced promotion of natural seed sources, on land that was forested but that has been converted to non-forested land. For the first commitment period, reforestation activities will be limited to reforestation occurring on those lands that did not contain forest on 31 December 1989

i.2020 Aichi Biodiversity Targets

Table 5. The Aichi Biodiversity Targets.

Target	
Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society	
1	By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.
2	By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.
3	By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions.
4	By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.
Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use	
5	By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.
6	By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.
7	By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.
8	By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.
9	By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.
10	By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.
Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity	
11	By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.
12	By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.
13	By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.
Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services	
14	By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are

Target	
	restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.
15	By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.
16	By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation.
Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building	
17	By 2015 each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.
18	By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.
19	By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.
20	By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization, should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and reported by Parties.

Table 6. Suggested indicators to measure progress against the forest-related Aichi Biodiversity Targets, and the potential for support from FRA 2015 and 2020. The indicators are taken from the headline indicators proposed by the SBSTTA 15. These indicators mostly have a scope that goes beyond ecosystems/forest biodiversity. It can be expected that more refined sub-indicators will address forest-related ecosystems, and these are considered in the right-hand column, where FRA or the State of the World's Forest Genetic Resources Report (SOW-FGR) of FAO (to be published in 2013) might provide partial information on these indicators (i.e. only related to forests: for example, the information expected from FRA for 'Trends in extent of selected biomes, ecosystems and habitats' would be on the extent of forest area, including of primary forests).

Target		Relevant indicators for the Strategic Plan for Biodiversity 2011-2020 (in bold: indicators for possible inclusion into FRA 2015 and 2020, as sub-sets or disaggregations, with a focus on forests) [26]	Supported by FRA 2015 and 2020, and/or SOW-FGR
Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use			
5	By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced	Trends in extent of selected biomes, ecosystems and habitats	In part
		Trends in fragmentation of natural habitats	In part
		Trends in proportion of degraded/threatened habitats	In part
		Trends in condition and vulnerability of ecosystems	In part
		Trends in the proportion of natural habitats converted	In part
		Extinction risk trends of habitat dependent species in each major habitat type	No
		Trends in abundance of selected species	In part
		Trends in extinction risk of species	No
		Trends in distribution of selected species	No
		Trends in population and extinction risk of utilized species, including species in trade	In part
		Trends in primary productivity	No
		Trends in proportion of land affected by desertification	No
		Population trends of habitat dependent species in each major habitat type	No
		Trends in extent, and rate of shifts of boundaries, of vulnerable ecosystems	In part
		Trends in climatic impacts on community composition	No
		Population trends and extinction risk trends of species that provide ecosystem services	No
		Status and trends in extent and condition of habitats that provide carbon storage	In part
		Trends in resources mobilized from the removal, reform, or phase out of incentives, including subsidies, harmful to biodiversity, which could be used for the promotion of positive incentives, including but not limited to innovative mechanisms that are consistent and in harmony with the Convention and other international obligations taking into account, national, social and economic conditions	In part

[26] As suggested in UNEP/CBD/SBSTTA/15/2.

Target		Relevant indicators for the Strategic Plan for Biodiversity 2011-2020 (in bold: indicators for possible inclusion into FRA 2015 and 2020, as sub-sets or disaggregations, with a focus on forests) [26]	Supported by FRA 2015 and 2020, and/or SOW-FGR
		Trends in area of forest, agricultural and aquaculture ecosystems under sustainable management	In part
		Trends in land-use change and land tenure in the traditional territories of indigenous and local communities	In part
		Trends in the practice of traditional occupations	No
		Trends in protected area condition and/or management effectiveness including more equitable management	In part
		Trends in representative coverage of protected areas and other area based approaches, including sites of particular importance for biodiversity, and of terrestrial, marine and inland water systems	In part
		Trends in the connectivity of protected and other area based approaches integrated into land and sea scapes	In part
		Trends in area of degraded ecosystems restored or being restored	In part
		Trends in the delivery of ecosystem services and equitable benefits from protected areas	In part
		Population trends of forest-dependent species in forests under restoration	No
7	By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity	Trends in condition and vulnerability of ecosystems	In part
		Trends in the proportion of natural habitats converted	In part
		Extinction risk trends of habitat dependent species in each major habitat type	No
		Trends in abundance of selected species	In part
		Trends in extinction risk of species	In part
		Trends in genetic diversity of selected species	In part (through SOW-FGR)
		Trends in Ecological Footprint and/or related concepts	No
		Trends in population and extinction risk of utilized species, including species in trade	In part
		Trends in population of forest and agriculture dependent species in production systems	In part
		Trends in area of forest, agricultural and aquaculture ecosystems under sustainable management	In part
		Trends in production per input	No

Target		Relevant indicators for the Strategic Plan for Biodiversity 2011-2020 (in bold: indicators for possible inclusion into FRA 2015 and 2020, as sub-sets or disaggregations, with a focus on forests) [26]	Supported by FRA 2015 and 2020, and/or SOW-FGR
		Ecological limits assessed in terms of sustainable production and consumption	No
		Trends in proportion of products derived from sustainable sources	In part
		Population trends of habitat dependent species in each major habitat type	No
		Status and trends in extent and condition of habitats that provide carbon storage	In part
		Trends in nutritional contribution of biodiversity: Food consumption	No
		Trends in resources mobilized from the removal, reform, or phase out of incentives, including subsidies, harmful to biodiversity, which could be used for the promotion of positive incentives, including but not limited to innovative mechanisms that are consistent and in harmony with the Convention and other international obligations taking into account, national, social and economic conditions	In part
		Trends in area of forest, agricultural and aquaculture ecosystems under sustainable management	In part
		Trends in the delivery of ecosystem services and equitable benefits from protected areas	No
Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity			
11	By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes	Trends in condition and vulnerability of ecosystems	In part
		Trends in the proportion of natural habitats converted	In part
		Extinction risk trends of habitat dependent species in each major habitat type	No
		Trends in abundance of selected species	No
		Trends in extinction risk of species	No
		Trends in distribution of selected species	No
		Trends in genetic diversity of selected species	In part (through SOW-FGR)
		Trends in proportion of products derived from sustainable sources	In part
		Population trends of habitat dependent species in each major habitat type	No
		Trends in protected area condition and/or management effectiveness including more equitable management	In part
		Trends in representative coverage of protected areas and other area based approaches, including sites of particular importance for biodiversity, and of terrestrial, marine and inland water systems	In part

Target		Relevant indicators for the Strategic Plan for Biodiversity 2011-2020 (in bold: indicators for possible inclusion into FRA 2015 and 2020, as sub-sets or disaggregations, with a focus on forests) [26]	Supported by FRA 2015 and 2020, and/or SOW-FGR
		Trends in the connectivity of protected and other area based approaches integrated into land and sea scapes	In part
		Trends in the delivery of ecosystem services and equitable benefits from protected areas	No
Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services			
15	By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification	Trends in fragmentation of natural habitats	In part
		Trends in proportion of degraded/threatened habitats	In part
		Trends in extinction risk of species	No
		Trends in distribution of selected species	No
		Trends in population and extinction risk of utilized species, including species in trade	In part
		Trends in primary productivity	No
		Trends in proportion of land affected by desertification	No
		Population trends of habitat dependent species in each major habitat type	No
		Trends in benefits that humans derive from selected ecosystem services	In part
		Population trends and extinction risk trends of species that provide ecosystem services	No
		Status and trends in extent and condition of habitats that provide carbon storage	In part
		Trends in economic and non-economic values of selected ecosystem services	In part
		Trends in number of countries that have assessed values of biodiversity, in accordance with the Convention	No
		Trends in the connectivity of protected and other area based approaches integrated into land and sea scapes	In part
		Trends in the delivery of ecosystem services and equitable benefits from protected areas	In part
		Trends in mobilization of financial resources	No
