

**PROCESS TO UPDATE THE PAN-EUROPEAN SET OF INDICATORS
FOR SUSTAINABLE FOREST MANAGEMENT**

**BACKGROUND INFORMATION
FOR THE UPDATED PAN-EUROPEAN INDICATORS
FOR SUSTAINABLE FOREST MANAGEMENT**

3 June 2015

NOTE:

This is a “clean version” of the document BACKGROUND INFORMATION FOR UPDATED PAN-EUROPEAN INDICATORS FOR SUSTAINABLE FOREST MANAGEMENT.

A document showing all changes in relation to the original formulation (Vienna 2003) is available on the following link:

https://www.dropbox.com/sh/2vjwmz82yc236k2/AAD_JdDfDdH2pZk6v8YA6cY6a?dl=0

Folder: FOREST_EUROPE_UPI / 4_UPI_Final_Report

File: *3AG_UPI_Updated_Backgr_Info_Changes.docx*

PAN-EUROPEAN INDICATORS FOR SFM

INTRODUCTION

This document presents the background information of the concrete proposals of updating the pan-European indicators for SFM.

Since the first set of Pan-European Indicators for Sustainable Forest Management in 1998 and its improvement in 2003, experience has shown that criteria and indicators are a very important tool for European forest policy. Based in the improvement of knowledge and data collection systems as well as the current and upcoming information needs an update of the indicators is needed. Thus, the Expert Level Meeting (ELM) on January 2015 decided to update the existing set of Pan-European Indicators for SFM.

An Advisory Group, representing countries and relevant organizations expertise in Europe, was set up to facilitate the updating process, a participatory process to consult with countries and stakeholders was established (through two online consultations and a workshop) and a wide range of experts have been consulted. The first online consultation was conducted from mid-December to end of January, the second online consultation on March and the FOREST EUROPE Workshop on Updating the Pan-European Indicators for SFM was held on April 2015 in Madrid.

This document comprises detailed information on rationales, international data providers, measurement units, current periodicity of data availability, possible reporting figures and related terms and definitions of the updated list of indicators, presented in the framework of the existing Criteria and structured following a linkage between the qualitative and the quantitative indicators' proposal.

The document build upon the background information of Vienna 2003, consolidated with the information as contained in the reporting questionnaires for the "Joint FOREST EUROPE/UNECE/FAO Questionnaire on Pan-European Indicators (quantitative) for Sustainable Forest Management. November 2013" and the questionnaire for Reporting on the pan-European Qualitative Indicators for Sustainable Forest Management SoEF 2015 and with the recommendations on modifications of the Advisory Group and the ones collected from experts.

Regarding the background information for the Qualitative indicators, as there was no original formulation from Vienna 2003 all the related information has been developed based on the considerations of the reporting questionnaires for SoEF 2015 and the approach suggested by the Advisory Group.

STRUCTURE OF THE DOCUMENT

The document presents the related information of the updated quantitative and qualitative indicators for SFM. The qualitative and quantitative indicators are presented together in a sequential approach.

The list is structured following the proposal to link the quantitative and qualitative indicators, with qualitative overarching information on the policy framework of the set, and then each of the thematic Criterion with a first qualitative indicator on the policy dialog/information under each Criterion (numbered as C.x) and then the related quantitative indicators.

Each indicator is structured according to the following headings which are shortly described below:

- Qualitative indicators: indicator; rationale; descriptive questions and related definitions.
- Quantitative indicators: indicator; rationale; international data source; measurement units; current periodicity of data availability; reporting notes; and related definitions.

Indicator

The name of the indicator represents the brief reference to the full text of the indicator as agreed.

Note: The full text of the recommended updated indicators does not make reference to "change". However, change which is derived from the comparison of data from two different points in time should always be taken into account. Change is usually to be understood as "average change per year" and in some cases as "average change per decade".

PAN-EUROPEAN INDICATORS FOR SFM

Rationale

This paragraph explains the rationale behind the indicator, its scope and limitations. In some cases it also includes the explanation of the desired direction of change, the utility of the information provided through the indicator, the range of views expressed, possible threshold issues and pitfalls in interpretation and limitations in force of expression, as well as major links to other indicators or criteria.

International data sources

In this paragraph the relevant main international data sources and providers are listed. The ultimate source of data is the national level (national statistics, national inventories and other national data providers). The references to the national level are not explicitly given for each indicator.

Measurement units

This paragraph provides the measurement units of the indicator for the status as well as for changes. If possible an error estimate should be included under each indicator.

Current periodicity of data availability

This paragraph is included to show the current periodicity of data availability. However the information provided under this heading must be understood in a general approach since the description of the periodicity should take into account various situations.

The periodicity of data source may differ between countries and / or between different figures or parameters within an indicator. Some of the information is usually associated with periodic cycles of the national forest inventories (NFI), the classical periodicity of 10 years, however countries with continuous NFI are capable of providing annual estimates.

Reporting notes

The reporting notes refer to classification categories as well as to instructions on how to collect the respective data which are not obvious from the wording of the full text of the indicator.

Related definitions

The underlying terms and definitions related to the indicator are listed. A glossary of the concepts, definitions and explanations is given in the supplementary document "Relevant Definitions Used for the Updated Pan-European Indicators for Sustainable Forest Management".

PAN-EUROPEAN INDICATORS FOR SFM

Acronyms and Abbreviations

C carbon

CO₂ carbon dioxide

CBD Convention on Biological Diversity

CITES Convention in International Trade in Endangered Species of Wild Fauna and Flora

C/N ratio carbon-to-nitrogen concentration

COST European Cooperation in Science and Technology

EC European Commission

ECE Economic Commission for Europe

EEA European Environmental Agency

EFIS European Forest Fire Information System

EFI European Forest Institute

EFSOS European Forest Sector Outlook Study

EFTA European Free Trade Association

EMEP International Cooperative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe

EQ Wood equivalents

EU European Union

EUFGIS European Information System on Forest Genetic Resources

EUFORGEN European Forest Genetic Resources Programme

EUR euro

EUROSTAT Statistical Office of the European Communities

FAO Food and Agriculture Organization of the United Nations

FAOSTAT Food and Agriculture Organization of the United Nations Statistics Department

FAWS Forest available for wood supply

FLEGT Forest Law Enforcement, Governance and Trade

FMU Forest management unit

FOWL Forest and other wooded land

FRA FAO Forest Resource Assessment

FRA/CFRQ global Forest Resources Assessment/Collaborative Forest Resources Questionnaire

FSC Forest Stewardship Council

FSCC/ICP International Cooperative Programme Forests Soil Coordinating Centre

FTE Full-time equivalent

GDP Gross Domestic Product

GHG greenhouse gas

GMES Global Monitoring for Environment & Security

ha hectare

ICP Forests International Cooperative Programme on Assessment and Monitoring of Air Pollution Effects on Forests

IDP International data provider

IEA International Energy Agency

PAN-EUROPEAN INDICATORS FOR SFM

ILO International Labour Organization

IPCC Intergovernmental Panel on Climate Change

ISIC International Standard Industrial Classification of all Economic Activities

IUCN International Union for Conservation of Nature

JRC European Commission – Joint Research Centre

JWEE Joint Wood Energy Enquiry

LULUCF Land Use, Land Use Change and Forestry

MCPFE Former brandname of Ministerial Conference on the Protection of Forests in Europe, now FOREST EUROPE

m³ cubic metre

NACE General industrial classification of economic activities within the European communities (Nomenclature générale des activités économiques dans les communautés Européennes)

NAI Net annual increment

NATURA 2000 Natura 2000 Networking Programme

NFI National forest inventory

NFP National forest programme

NWFP Non-wood forest product

NWGs Non-wood goods

NWGS Non-wood goods and services

NUTS The Nomenclature of Territorial Units for Statistics (Nomenclature des unités territoriales statistiques)

OC organic carbon

OWL Other wooded land

PEFC Programme for the Endorsement of Forest Certification

R&D Research and Development

REFORGEN FAO global information system on forest genetic resources

SFM Sustainable forest management

SoEF State of Europe's Forests

TBFRA Temperate and Boreal Forest Resources Assessment

UNCBD UN Convention on Biological Diversity

UNCCD UN Convention to Combat Desertification

UNCED United Nations Conference on Environment and Development

UNECE United Nations Economic Commission for Europe

UNEP United Nations Environmental Programme

UNESCO United Nations Educational, Scientific and Cultural Organization

UNF United Nations Forum on Forests

UNFCCC United Nations Framework Convention on Climate Change

UNIDO United Nations Industrial Development Organization

WRB World Reference Base

yr year

FOREST POLICY AND GOVERNANCE

Indicator 1. National forest programmes or equivalent

Rationale:

An effective forest policy is the base to implement and achieve the sustainable management of the forests and the forest sector. The forest governance/policy framework includes the existence of a National Forest Programme (NFP) process, or equivalent process, and existence, quality and implementation of related policies instruments/documents¹, which contributes to govern and guide the sustainable forest management.

A NFP or equivalent constitutes a participatory, holistic, inter-sectoral and iterative process of policy planning, implementation, monitoring and evaluation at national and/or subnational level in order to proceed towards the further implementation of SFM and to contribute to sustainable development. It addresses national needs and contributes to the implementation of forest-related global commitments and internationally agreed actions. It is a tool to identify and address cross-sectoral issues of relevance to forests and sustainable forest management; and assess gaps and inconsistencies in forest-relevant policies, programmes, strategies and legislation and in overall national sustainable development strategies and other relevant processes and strategies in order to take action to minimise them.

Within the NFP process, or equivalent process, policy issues are addressed at the national and/or sub-national level in accordance with the principles of the process. These issues are derived from various levels, from local to global, and include the national and/or subnational implementation of relevant forest related commitments, such as the outcomes of the UNFF, UNCBD, UNFCCC and UNCCD, coordinating across sectors to support the sustainable management of forests.

Descriptive questions:

Existence of forest policy framework to support implementation of sustainable forest management.

a. In relation to National Forest Programmes process or equivalent process for forest dialogue, policy development and implementation:

- Existence and possible changes on NFP or equivalent process, with considerations, among others, on the participatory process, the main formal decision making body of the process, key lessons learned, as appropriate.

b. In relation to forest policy instruments/documents (National forest programme or equivalent document, forest policy statement, forest strategy or other/s):

- Existence, effectiveness and efficiency and possible changes of the main policy instruments/documents (including as appropriate forest policy document development process, endorsing/enacting institution, evaluation of policy implementation, etc.)
- Other overall policy instruments/documents from the sector or from other sectors that explicitly encourage sustainable forest management or address key forest policy issues.

Related definitions:

Forest governance; National Forest Programme, Forest policy, National forest policy/strategy document or statement, Sub-national forest policy/strategy documents or statements; Forest Institutional Framework; Law (or Act or code), Institutional framework.

¹ The main forest policy document can be a national forest programme document, a forest policy statement, a forest strategy or other.

FOREST POLICY AND GOVERNANCE

Indicator 2. Institutional frameworks

Rationale:

The existence, resources, capacity and effectiveness of an institutional framework provide an enabling environment for the implementation of forest policies and the sustainable management of forests and the forest sector.

Government and private framework capacity to deliver programmes and services, to maintain and develop infrastructure and to access the financial and human resources is crucial for the support to the sustainable forest management.

The organizational and administrative set-up of forest policy determines responsibilities and competence of different bodies, public and private, at different levels. It provides the structure for national, sub-national, and local politics and for developing forest-related public policies and their implementation. The prevailing institutional framework indicates how countries organize the protection and sustainable use of forests and it changes shows modifications in political goals and social culture.

Moreover, the institutional framework and capacity to develop and incorporate new science, knowledge, research and technologies into forest management, and continuously improve in depth and extent its application through training, education and capacity building, among others, helps to ensure the implementation and advance in Sustainable Forest Management.

Descriptive questions:

- Existence, type, resources and capacity of forest-related institutional framework and related changes (including quantitative information as appropriate):
 - Government bodies and public organizations: administering forest policy, supervising legislation enforcement, managing public forests, supporting private forest management, shaping forest research, education and training, etc.
- Policies, objectives and measures/actions taken in forest-related research, training, education and capacity building.

Related definitions:

Forest institutional framework; Forest policy; Education; Institutional framework; Publicly owned forests; Public ownership

FOREST POLICY AND GOVERNANCE

Indicator 3. Legal/regulatory framework: National (and/or sub-national) and International commitments

Rationale:

The existence, implementation, effectiveness and enforcement of a legal/regulatory framework for forests, the forest sector and the sustainable forest management, provide an enabling environment for achieving good forest governance and the implementation of forest policies for the sustainable management of forests and the forest sector.

The forest-related legal/regulatory framework of a country includes the forest law or act and its complementary regulations that cover the augmented social, economic and political aspects of sustainable forest management, nature or forest protection regulations, hunting and wildlife management legislation as well as land use and related planning laws and, in some cases, the constitution.

International conventions and multilateral agreements, forestry-related international legal instruments together with regional conventions and agreements affecting forests and sub-regional considerations (EU regulations and directives), directly influence and/or determine national and sub-national forest-related legislation and regulations.

Descriptive questions:

a. In relation to legal/regulatory framework at national (or sub-national) level:

- Existence, characteristics and possible changes of the main forest and SFM related legal/regulatory instrument at national (or sub-national) level that provide a framework for the implementation of sustainable management of forests: forest law, act or code and complementary regulations.
- Existence, types, characteristics and possible changes of any other legal/regulatory instruments, from forests or other sectors, that provide a policy framework for the support of the implementation of sustainable management of forests.

b. In relation to legal/regulatory framework international commitments:

- Main international commitments related to forests signed by the country as: UN conventions, international, regional and sub-regional commitments/obligations, including EU regulations and directives if applicable.
- Initiatives in the implementation of international commitments related to forests.

Related definitions:

Forest Institutional Framework, Forest policy, Institutional framework, Law (or Act or code), National forest policy/strategy document or statement, Subnational forest policy/strategy documents or statements

FOREST POLICY AND GOVERNANCE

Indicator 4. Financial and economic instruments

Rationale:

The existence, effectiveness and efficiency of financial and economic instruments related to forests and the forest sector provide an enabling environment for achieving the implementation of forest policies for sustainable forest management.

Economic instruments consider the economic dimension of sustainable forest management under a broader perspective.

Financial instruments are essential to pursue a variety of public goals, which can both pursue financial incentives or disincentives.

It has to be highlighted that the flow of capital in and out the forests and the forest sector is a respond, among others, to markets, public policy decisions, forest management and society considerations, that provides the forest policy framework for sustainable forest management.

Descriptive questions:

Existence, characteristics and possible changes of forest-related economic and financial instruments (including quantitative information as appropriate):

- Main objectives, measures and actions taken on economic policies related to forests in public and private owned forests.
- Government expenditures and financial instruments related to state-owned and private forests and their management.
- Public expenditure on forest related activities: operational expenditure on public institutions solely engaged in the forest sector, and transfer payments on direct financial incentives paid to non-government and private-sector to implement forest related activities (as reforestation, afforestation, forest inventory, monitoring and/or planning, conservation of forest biodiversity; protection of soil and water, forest stand improvements, establishment or maintenance of protected areas, other).
- Where appropriate include types of markets and Payment for Ecosystem Services (PES) schemes both at public and private² level (Types of markets for example: Public payment schemes for private land owners; Formal markets with open trading between buyers and sellers; Self-organized private deals).

Take note that quantitative information on public expenditure on forest related activities is also included in the “Indicator 6.4. Investment in forests and forestry”. Quantitative information provided on both indicators should be consistent.

Related definitions:

Public expenditure; Operational expenditure; Transfer payments, Payment for Ecosystem Services (PES)

² Private approaches to PES as e.g. water market, recreation, carbon payments.

FOREST POLICY AND GOVERNANCE

Indicator 5. Information and communication

Rationale:

The existence, effectiveness and efficiency of informational and communication means to politicians, the forest sector, other sectors, stakeholders, the society and the public in general, provide an enabling environment for achieving the sustainable management of forests and the forest sector.

Information and communication means are essential to inform the public and establishing a dialogue on forests related issues and priorities, to inform on the state of the forests and the effectiveness and efficiency of sustainable forest management practices. They also contribute to increasing the transparency of forest policy and to holding forest policy makers accountable. Is crucial the existence and use of policies and frameworks to raising public awareness and procedures to participation so a broad range of stakeholders can provide opinions, suggestions, analysis, recommendations and other input into the development of forest policy.

Descriptive questions:

Existence of informational and communication means to implement the policy framework (including quantitative information as appropriate) as:

- Existence of a forest-related outreach and/or communication instrument (strategies, action plans, etc.).
- Public access to forest information, including forest inventory data.
- Existence and quality of monitoring and reporting framework/system on forest extent and characteristics, and measure/monitor of progress towards SFM at national level
- Measures, means and actions taken on communication related to forests.
- Existence of a national platform or any other mean to promoting stakeholder participation/involvement in forest policy development and/or decision making.

CRITERION 1: MAINTENANCE AND APPROPRIATE ENHANCEMENT OF FOREST RESOURCES AND THEIR CONTRIBUTION TO GLOBAL CARBON CYCLES

Indicator C.1. Policies, institutions and instruments to maintain and appropriately enhance forest resources and their contribution to global carbon cycles

Rationale:

The policy dialog related to the maintenance and appropriate enhancement of forest resources and their contribution to global carbon cycles, is basic to implement and achieve the sustainable management of the forests and the forest sector.

Information on policies, objectives, actions and measures taken related to forest resources, to their extent, structure and age distribution, which also represent a substantial carbon pool crucial in the global carbon cycle, is key for establishing a dialogue on forests, analyse the efficiency and effectiveness of the current policies and identifying gaps and updating needs.

Policy framework, legislation/regulations, institutional capacity, economic and financial instruments and informative means, with associated policy objective, actions and measures on forest area, growing stock, forest structure, forest carbon stocks, land use changes and management, climate change mitigation and adaptation, energy issues (renewable energy, energy efficiency), etc., at both national and sub-national levels, create an enabling environment for the sustainable management of the forests and the forest sector.

The existence of a forest management plan or equivalent indicates approaches of forest management towards sustainable goals. These management plans, of horizontal nature, maintain, conserve, enhance and encourage the multifunctionality of the forest ecosystems at ecological, social and economic aspects, being considered at a global level of high importance.

Information on forest certification schemes, voluntary instrument for market actors, serves as an adjunct to the implementation of sustainable forest management as ensures the commitment by actors to forestry instructions and standards.

Descriptive questions:

Information, where appropriate, on main policy objectives, relevant institutions, main policy instruments (legal/regulatory, financial/economic, informational) and significant changes related to the maintenance and appropriate enhancement of forest resources and their contribution to global carbon cycles.

Questions to be considered:

a. Forest policies on maintenance and appropriate enhancement of forest resources and their contribution to global carbon cycles, as appropriate:

- Existence of policy policies and instruments, including specific policy objectives, related to maintain and enhance forest resources, land use changes and management, climate change (mitigation and adaptation), mobilization of wood, enhance the sustainable production of forest products, including for energy (renewable energy, energy efficiency), etc.
- Existence and capacity of an institutional framework to carry out forest planning and management and integration with land-use planning; undertake and develop monitor, report and assessment of forest resources; develop programmes for enhancing the use of forest products for energy, to enhance the research, technologies, education, training and capacity building, etc.
- Existence of a legal/regulatory framework to maintain forest resources and prevents forest degradation; supports sustainable management while increasing the growing stock; enhance the sustainable use of forest products for energy; etc.
- Existence of economic and financial instruments to support and maintain forest resources; mechanisms promoting integration between land-use planning and forest management planning; to provide appropriate incentives to support forest policy, the use of wood for energy, etc.

CRITERION 1: MAINTENANCE AND APPROPRIATE ENHANCEMENT OF FOREST RESOURCES AND THEIR CONTRIBUTION TO GLOBAL CARBON CYCLES

- Existence of communication and informational means to implement the policy framework.
- Related actions and measures taken to maintain and enhance forest resources and their contribution to global carbon cycles.

b. Forests under management plan or equivalent: Proportion of forest and other wooded land under a management plan or equivalent instrument.

To quantify the operational level progress toward sustainable forest management, which means the forest area, for which a planning process has been carried out and documented in written form. The management document can be operational (management plan) or less specific (equivalent). It is often registered or approved by public authorities, but this is not a pre-condition.

- Area and percentage of forest land and other wooded land with management plans and/or equivalents.
- Area and percentage of forests land and other wooded land under other forest-related types of management documents/instruments at operational level.

Note that for the quantitative information:

Measurement units are: ha and % of total forest and other wooded land, and per year

International data sources: FRA/CFRQ; FOREST EUROPE/UNECE/FAO

c. Forest under third party certification schemes:

- Area and percentage of forest land and other wooded land certified under the Forest Stewardship Council certification (FSC) scheme.
- Area and percentage of forest land and other wooded land certified under the Programme for the Endorsement of Forest Certification (PEFC) scheme.
- Area and percentage of forest land and other wooded land certified both under the FSC and the (PEFC) schemes.
- Area and percentage of forest land and other wooded land certified under other international forest management certification.
- Area and percentage of forest land and other wooded land certified under domestic forest management certification.

Note that for the quantitative information:

Measurement units are: ha and % of total forest and other wooded land, and per year

International data sources: FSC, PEFC, FOREST EUROPE/UNECE/FAO

Related definitions:

Institutional framework; Forest management plan; Equivalent of forest management plan; International forest management certification; FSC certification; PFEC certification

CRITERION 1: MAINTENANCE AND APPROPRIATE ENHANCEMENT OF FOREST RESOURCES AND THEIR CONTRIBUTION TO GLOBAL CARBON CYCLES

Indicator 1.1: Forest area

Full text: Area of forest and other wooded land, classified by forest type and by availability for wood supply, and share of forest and other wooded land in total land area

Rationale:

Forest and other wooded land (FOWL) area contribute to various aspects of sustainable development. They enrich the landscape and are habitats for wild flora and fauna. They are places for leisure and recreation and are the economic basis for timber production as well as contributing to rural development, tourism and regeneration.

Changes in forest area are caused by afforestation, reforestation and deforestation and are a substantial indicator for sustainable forest management and the role of forests in the global carbon cycle.

Area of forest and other wooded land are key attributes in any forest survey, as many attributes describing forest ecosystems and sustainable forest management are presented as figures on a per hectare reference or in area related proportions.

This indicator is mainly linked to indicators 1.2, 1.4, 2.4, 3.5, 4.1, 4.2, 4.3, 4.4, 4.6, 4.9, 5.1 and 5.2.

International data sources:

- FRA/CFRQ
- FOREST EUROPE/UNECE/FAO

Measurement units:

Status: ha

Changes: ha yr⁻¹

Status: % of total land area

Changes: % of total land area/decade

Current periodicity of data availability: Usually associated with NFI, typically 10 years, but note that many countries with a continuous NFI are capable of providing annual estimates.

Reporting notes:

Separate figures to be reported on:

- Area of forest, of other wooded land and total:
- Area of forest available for wood supply (FAWS)
- Area of other land with tree cover
- Area of forest, classified by forest type: coniferous, broadleaved and mixed forests
- Share of forests and other wooded land in total land area

Forest type should be understood as “coniferous, broadleaved and mixed forests”.

Related definitions:

Forest, Other wooded land, Forest available for wood supply, Other land, Forest type.

CRITERION 1: MAINTENANCE AND APPROPRIATE ENHANCEMENT OF FOREST RESOURCES AND THEIR CONTRIBUTION TO GLOBAL CARBON CYCLES

Indicator 1.2: Growing stock

Full text: Growing stock on forest and other wooded land, classified by forest type and by availability for wood supply

Rationale:

This indicator is one of the basic figures of any forest inventory and useful for various purposes.

The growing stock is closely related to the above ground woody biomass and provides data for calculating carbon budgets (linked to indicator 1.4 carbon stock).

This indicator is mainly linked to indicators 1.3, 1.4, 2.3, 2.4, 3.5, 4.3 y 4.5.

International data sources:

- FRA/CFRQ
- FOREST EUROPE/UNECE/FAO

Measurement units:

Status: m^3

Changes: $m^3 yr^{-1}$

Status: $m^3 ha^{-1}$

Changes: $m^3 ha^{-1} yr^{-1}$

Current periodicity of data availability: Usually associated with NFI, typically 10 years, but note that many countries with a continuous NFI are capable of providing annual estimates.

Reporting notes:

Separate figures to be reported on:

- Growing stock on forest land, classified by availability for wood supply and by tree species: coniferous and broadleaved.
- Growing stock on other wooded land, classified by tree species: coniferous and broadleaved.
- Growing stock by forest type: coniferous, broadleaved and mixed forests.
- Growing stock composition, classified by main species.

The categories “Coniferous” and “Broadleaved” are determined by tree species and do not represent “Forest types”.

Forest type should be understood as “coniferous, broadleaved and mixed forests”

Related definitions:

Forest, Other wooded land, Forest available for wood supply, Growing stock, Broadleaved, Coniferous, Forest type.

CRITERION 1: MAINTENANCE AND APPROPRIATE ENHANCEMENT OF FOREST RESOURCES AND THEIR CONTRIBUTION TO GLOBAL CARBON CYCLES

Indicator 1.3: Age structure and/or diameter distribution

Full text: Age structure and/or diameter distribution of forest and other wooded land, classified by availability for wood supply

Rationale:

Diameter and age class distributions provide insight in the future development of forests and are a prerequisite for SFM. On a national level for uneven-aged stands the diameter distribution should be given, while for even-aged stands the age class distribution is more appropriate. As forest management is changing towards more uneven-aged stands, the data on diameter distribution might gain importance in future.

This indicator is mainly linked to other indicators describing forest resources, health and vitality, productive and protective functions as well as biodiversity. Age class and diameter distributions support especially the interpretation of indicator 1.2 (growing stock) and also indicate the stability of forests (e.g. over-mature forests might collapse). In combination with figures on current state and changes of growing stock the indicator enables the evaluation of future potential growth and sustainable timber supply.

There are also links with indicators 3.5, 4.2, 4.3, y 4.5.

International data sources:

FOREST EUROPE/UNECE/FAO

Measurement units:

Age-class distribution (area of even-aged stands):

Status: area (ha) per development phases (regeneration phase, intermediate phase, mature phase, unspecified), total

Status: volume (m³) per development phases (regeneration phase, intermediate phase, mature phase, unspecified) in forest available for wood supply.

Diameter distribution and total area (uneven-aged stands)

Total area: ha

Total volume: m³

Volume by diameter class (\leq 20 cm; 21-40 cm; >41-60 cm; >60; unspecified)

Current periodicity of data availability: Usually associated with NFI, typically 10 years, but note that many countries with a continuous NFI are capable of providing annual estimates.

Reporting notes:

It has to be considered that data on age structure and on diameter distribution are reported on the national level and not on stand levels.

Diameter classes refer to diameter at 1.3 m height above ground (d.b.h., $d_{1.3}$). The upper limits of classes are inclusive, i.e. in the diameter class \leq 20 - the 20 cm diameter is included, in the diameter class 21-40cm – the 40 cm diameter is included in this class, etc. The following diameter classes should be reported:

- 0-20 cm
- 21-40 cm

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- 41-60 cm
- > 60 cm
- Unspecified

Separate figures to be reported on:

- For even-aged stands by forest types and by availability for wood supply
- For uneven-aged stands by forest types and by availability for wood supply

Additional information could be provided on data by main species.

Related definitions:

Forest, Forest available for wood supply, Stand, Even-aged stand, Uneven-aged stands, Development phase, Regeneration phase, Intermediate phase, Mature phase, Forest type.

CRITERION 1: MAINTENANCE AND APPROPRIATE ENHANCEMENT OF FOREST RESOURCES AND THEIR CONTRIBUTION TO GLOBAL CARBON CYCLES

Indicator 1.4: Forest-related carbon stocks

Full text: Carbon stock and carbon stock changes in forest biomass, forest soils and in harvested wood products.

Rationale:

Although the main goal of the UNFCCC and its Kyoto Protocol is to secure the reducing of emissions of greenhouse gases, it also recognises that carbon sequestration in forest ecosystems may contribute to climate change mitigation by removing CO₂ from the atmosphere.

In the global carbon cycle, forests represent an important pool of carbon. Carbon accumulates in forest ecosystems through absorption of CO₂ from the atmosphere (“removals”) and its allocation into biomass and soils. Outside the forests, carbon may also accumulate in harvested wood products (HWPs).

The net difference over time of the carbon stored in biomass, soil and HWPs is called “carbon stock change” and equals the net amount of CO₂ emitted to or removed from the atmosphere. The carbon stock change is always a balance between inflow and outflow from a given pool, e.g. photosynthesis minus respiration and other losses (e.g. by harvest, mortality and natural disturbances) equals the carbon stock change in the forest biomass pool. The amount of carbon entering the HWP pool minus the HWP transferred to landfills or destroyed equals the carbon stock change of HWP.

Soil organic carbon represents also an important carbon pool, and conservation of soil C is crucial to prevent potential positive feedbacks to climate change. Furthermore, soil organic carbon is also an important indicator of several soil functions and related processes.

Both carbon stocks and carbon stock changes of the various pools (biomass, soil, HWP) are of relevance for this indicator.

This indicator is mainly linked to indicators 1.1, 1.2, 1.3, 2.1, 2.2, 2.3, 2.4, 3.1, 4.5, 6.7, 6.9.

International data sources:

- FRA/CFRQ for carbon stock in woody biomass and soils
- ICP Forests for carbon stock in soils (Level I)
- IPCC LULUCF/AFOLU databases of “emission factors”
- Reports of GHG inventories from Countries to UNFCCC/Kyoto Protocol (carbon stocks changes in biomass and soils; recently, also carbon stock and stock changes from HWP)

Measurement units for carbon stock of woody biomass and of soils:

Status (stock): tonnes of C ha⁻¹

Changes: tonnes of C ha⁻¹ yr⁻¹

Current periodicity of data availability:

- 5 to 10 years (report to FRA/FAO/) for carbon stock in biomass and soils
- Annually through reports of countries to UNFCCC/Kyoto Protocol for carbon stock change in biomass and soils and for carbon stock and stock changes in HWP. Note that countries may select if report annually or at the end of the Commitment period. In the latter case, Countries will report anyhow annually but only the report at the end of the Commitment period will be considered as binding. Note also that, theoretically, annual reports of stock change in biomass and soils could be used to update annually the data on carbon stock.

CRITERION 1: MAINTENANCE AND APPROPRIATE ENHANCEMENT OF FOREST RESOURCES AND THEIR CONTRIBUTION TO GLOBAL CARBON CYCLES

Reporting notes:

Separate figures to be reported on:

- Carbon stock in above-ground living biomass on forest, other wooded land and total
- Carbon stock in below-ground living biomass on forest, other wooded land and total
- Carbon stock in deadwood on forest, other wooded land and total
- Carbon stock in litter on forest, other wooded land and total
- Carbon stock in soils on forest, other wooded land and total
- Carbon stock changes in biomass and soil
- Carbon stock and stock change in harvested wood products

The separation of forest and other wooded land is sometimes not done in reporting to UNFCCC/KP, although the countries have adopted a forest definition also there, that it is usually coherent with the FAO definition.

Information reported for the carbon stock changes in biomass and soil can be obtained by (i) difference of subsequent estimates of stocks (FRA/FAO) and (ii) those obtained according to UNFCCC/KP. As a matter of fact, the two estimation methods may provide different results in terms of absolute figures, and the reason for such a difference (e.g. definitions used; explanation why one method was adopted and considered more reliable than the other) should be commented by data providers by e.g. providing some basic qualitative explanation. In general, however, the trends detected by the two methods should be consistent (e.g. decreasing or increasing over time).

Note: Under the UNFCCC/KP countries must follow the methodological guidance by the IPCC, which allows two different methods to estimate the CO₂ emissions/removals from forests:

- stock-difference: difference of stock in two points in time.
- gain/loss: essentially, growth - losses (harvest, mortality, etc.).

No one method is *a priori* better than the other. The choice of using gain-loss or stock-difference method is a matter of expert judgment, taking into account the national inventory systems, availability of data and information from ecological surveys, forest ownership patterns, activity data, conversion and expansion factors as well as cost benefit analysis.

Regarding the harvested wood products, countries report to UNFCCC/KP on stock and changes in three "pools": paper, wood panels, sawnwood.

Related definitions:

Forest, Other wooded land, Carbon in above ground biomass, Carbon in below-ground biomass, Carbon in deadwood, Carbon in litter, Soil carbon, Harvested wood products

Indicator C.2. Policies, institutions and instruments to maintain forest ecosystem health and vitality

Rationale:

The policy dialog related to the maintenance of forest ecosystem health and vitality is basic to implement and achieve the sustainable management of the forests and the forest sector.

Policies related to forest health and vitality, including those aimed at promoting forest health and vitality and monitoring, controlling and managing the detrimental effects of pests and diseases, forest fires, storms, drought and flooding, and air pollution provide an important framework for management actions, analyse the efficiency and effectiveness of the current policies, identifying gaps and updating needs, and also provide support for forest managers.

Policy framework, legislation/regulations, institutional capacity, economic and financial instruments and informative means, with associated policy actions/measures on forest health and vitality (air pollution, soil condition, forest fires, storms, floods, damages, land degradation/desertification, etc.), including considerations on risk management or contingency plans and strategies, and policies, actions and measures taken both at national and sub-national levels, create an enabling environment for the sustainable management of the forests and the forest sector.

Policies to combat land degradation / desertification integrates aspects not only related to the maintenance of forest ecosystem health and vitality, but also the maintenance of regulating and provisioning services of the forest ecosystems, i.e. both protective and productive services. In particular, it should be noted the close link between the policies, actions and measures taken against land degradation / desertification, and policies related to protective functions of forests (notably soil and water conservation) addressed on the criterion 5.

Descriptive questions:

Information, where appropriate, on main policy objectives, relevant institutions, main policy instruments (legal/regulatory, financial/economic, informational) and significant changes related to the maintenance of forest ecosystem health and vitality.

Questions to be considered (as appropriate):

- Existence of forest policies and instruments, including specific policy objectives, related to maintaining forest health and vitality.
- Existence and capacity of an institutional framework to develop mechanisms for preventing, managing and controlling the occurrence of serious damages / damage agents, and the related necessary knowledge and capacities.
- Existence of a legal/regulatory framework that enforces laws and policies related to maintaining forest health and vitality.
- Existence of economic and financial instruments, to support, monitor, control and appropriate incentives to prevent and manage the health and vitality of our forests.
- Existence of informational means to implement the policy framework, and the capacity to strengthen regular monitoring and inventories.
- Related actions and measures taken to preserve, control, and manage forest ecosystem health and vitality.

It is up to the countries if they consider better inform on policies taken against land degradation / desertification here or under criterion 5 (or on both sites by pertinent references).

Related definitions:

Damage to forest, Combat desertification, Desertification, Land degradation, Forest policy, Policy supporting sustainable forest management, Institutional framework

CRITERION 2: MAINTENANCE OF FOREST HEALTH AND VITALITY

Indicator 2.1: Deposition and concentration of air pollutants

Full text: Deposition and concentration of air pollutant on forest and other wooded land

Rationale:

Deposition and concentration of air pollutants, such as nitrogen and sulphur, and ground-level ozone, represent a stress factor that has been demonstrated to affect forest ecosystem stability, health and productivity. Direct or indirect adverse effects of deposition have been demonstrated on soil condition, forest tree health and growth, and ground vegetation composition. Effects of ozone have been demonstrated on tree growth and health. Air pollution may also predispose trees to the effects of drought and attack by fungi or insects.

This indicator is mainly linked to indicators 1.4, 2.2, 2.3, 2.4, 3.1, 4.5, 4.8, 5.1 and 5.2.

International data sources:

- ICP Forests (Level II) (International data provider)
- EC JRC Ispra (International data provider)
- EMEP (Co-operative programme for monitoring and evaluation of the long range transmission of air pollutants in Europe)

Measurement units:

For deposition of Nitrogen, Sulphur, and base cations:

Status: $\text{kg ha}^{-1} \text{ yr}^{-1}$

Changes: $\text{kg ha}^{-1} \text{ yr}^{-1}$

For concentration of ozone:

Status: AOT40 (ozone Accumulated Over Threshold of 40 ppb), ppb h

Changes: AOT40 (ozone Accumulated Over Threshold of 40 ppb), ppb h per year

Current periodicity of data availability: annual

Reporting notes:

Separate figures to be reported on:

- Deposition of N, S and base cations, each on forest land
- Deposition of N, S and base cations, each on other wooded land
- Concentration of ozone in forest land
- Concentration of ozone in other wooded land
- Area where Critical Loads for S and N deposition are exceeded for forests
- Area where Critical Loads for S and N deposition are exceeded for other wooded land
- Area where Critical Levels for ozone are exceeded for forests
- Area where Critical Levels for ozone are exceeded for other wooded land

Related definitions:

Total atmospheric deposition to the forest; Critical load; Critical level; AOT40

CRITERION 2: MAINTENANCE OF FOREST HEALTH AND VITALITY

Indicator 2.2: Soil condition

Full text: Chemical soil properties (pH, CEC, C/N, organic C, base saturation) on forest and other wooded land related to soil acidity and eutrophication, classified by main soil types.

Rationale:

Soil condition is the basic source of ecosystem stability, soil productivity, water protection and for the contribution that forested systems make to the global carbon cycle. It is therefore critical for sustainable forest management. Changes in soil condition may occur because of acidification and changes in chemical soil properties, and this can directly or indirectly affect decomposition rates, tree condition, growth and species composition, tree resistance to insect attacks and diseases. In addition ecosystem stability is closely related to nutrient cycling. The existing tendency to acidification and eutrophication of soils and the associated changes in foliar chemistry of many parts in Europe is therefore a potential area of concern. Changes in soil condition are also caused by forest management that may affect long-term carbon sequestration in soil and soil C and N content.

The base saturation indicates the reserves left in the soil to buffer against further additions of e.g. acidifying substances. The C/N ration, the Cation Exchange Capacity (CEC) as well as the pH and organic C are important key indicators to describe soil fertility, acidity and eutrophication.

Depending on the respective soil property, the recommended soil depths are the organic layer and the top 20 cm.

This indicator is mainly linked to indicators 1.4, 2.1, 2.3, 3.4, 5.1 and 5.2.

International data provider:

- ICP Forests (Level I, Level II)
- EC JRC Ispra

Measurement units:

Status pH: pH scale; units

Changes pH: Changes in pH units between two subsequent surveys

Status CEC: cmol/kg

Changes CEC: cmol/kg between two subsequent surveys

Status C/N: C/N ratio

Changes C/N: Changes in C/N ratio between two subsequent surveys

Status organic C: g/kg, t/ha

Changes organic C: g/kg between two subsequent surveys

Status base saturation: % (sum base cations/CEC)*100

Changes base saturation: changes between two subsequent surveys in %

Current periodicity of data availability: ICP Forest Soil Expert Panel (FSEP) is planning to develop a new EU-wide forest soil survey in 2020. On the solid phase of soils, a periodicity of 10-15 years between surveys is a good approach. For soil solution the data availability can be every 5 years.

Reporting notes:

CRITERION 2: MAINTENANCE OF FOREST HEALTH AND VITALITY

Main soil types according to EC/UNECE:

- Podzols
- Cambisols
- Leptosols
- Arenosols
- Regosols
- Luvisols
- Histosols
- Gleysols
- Other soils

Separate figures to be reported on:

- pH, CEC, C/N, organic C, base saturation, each on forest land for each soil type mentioned above
- pH, CEC, C/N, organic C, base saturation, each on other wooded land for each soil type mentioned above

Related definitions:

Soil nitrification and acidity

CRITERION 2: MAINTENANCE OF FOREST HEALTH AND VITALITY

Indicator 2.3: Defoliation

Full text: Defoliation of one or more main tree species on forest and other wooded land in each of the defoliation classes

Rationale:

Crown defoliation is an indicator giving an estimate of tree condition. Defoliation depends on many stress factors and is therefore a valuable measure to describe the overall forest condition, although the causes of observed defoliation might be non-specific and not quantifiable.

This indicator is mainly linked to indicator 1.2, 1.4, 2.1, 2.2, 2.4 and 3.1.

International data sources:

- ICP Forests (Level I) (International data provider)
- EC JRC Ispra (International data provider)

Measurement units:

Status: % of total population

Changes: % of total population/yr.

Status: % of main tree species

Changes: % of main tree species/yr.

Current periodicity of data availability: annual

Reporting notes:

Separate figures to be reported on:

- Mean defoliation of all tree species
- Mean defoliation by species (individual main tree species)
- Annual rate of change of mean defoliation for all tree species over the reporting period
- Annual rate of change of mean defoliation for individual tree species over the reporting period.

Defoliation classes. To obtain the frequency of trees per each defoliation class, the degree of defoliation should be reported separately for single tree species on forest and single tree species on other wooded land, according to the following classification:

<i>Class / Degree of defoliation</i>	<i>Needle/Leaf loss</i>
2 / moderate	> 25% to < 60%
3 / severe	> 60% to <100 %
4 / dead	100%

Mean defoliation. To obtain the mean defoliation for the tree population (all trees, individual species), the mean defoliation value should be reported separately for single tree species on forest and single tree species on other wooded land.

Related definitions:

Defoliation; Mean defoliation

Indicator 2.4: Forest damage

Full text: Forest and other wooded land with damage, classified by primary damaging agent (abiotic, biotic and human induced)

Rationale:

Biotic agents include e.g. insects and diseases, wildlife and cattle grazing in woodland. Abiotic agents include e.g. fire, storm, wind, snow, drought, mudflow and avalanche. Direct human induced damage factors include harvesting damages and damages by forest operations which cause severe economical losses and decrease of the ecosystems health and vitality (decrease in timber quality, rot, decay, destruction of natural regeneration, soil degradation). The effects are long lasting. A decrease of harvesting damage indicates gentle harvesting and logging methods and an increased ecological sense of responsibility. Also damages caused by wrong forest management should be indicated here.

Heavy attacks of insects and phytopathogens (bacteria, viruses, fungi) may cause major impacts to forests resulting in a risk for forest ecosystem health, functionality and an economic loss. Insect populations are also likely to react to long term change processes such as climate change. Furthermore, biotic damages may result in deterioration of tree condition not only in the year of occurrence but also in later years.

Forest fires are a major threat notably to Mediterranean forests with an average area burnt of several thousand hectares. While controlled burning might increase species diversity under controlled conditions, uncontrolled forest fires might have major negative consequences for the ecosystem, such as desertification, erosion, loss of water supply or economic loss.

Storm, drought, mudflow and avalanche damage are also serious threats to forest and other wooded land because they might also result in a loss of timber yield, landscape quality and wildlife habitat. However, impacts in the case of non-site adapted forest stands may be evaluated less serious than in the case of natural, semi-natural or site adapted ones since necessary reforestations may lead to side adapted forests in the future.

Pressure to forests and other wooded land is also caused by society in form of intensive tourist and recreational activities with negative side effects such as forest fire, contamination and vandalism.

Human induced damages by unidentifiable causes comprise e.g. damages of air pollution, traffic or cattle breeding.

Several countries have forest lands damaged by point-source contamination (e.g. radioactive contamination), areas in which the multifunctionality of forests has been affected in a long term and forest management is a challenge. (Diffuse contamination is addressed under indicators 2.1 and 2.2).

This indicator is mainly linked to indicators 1.1, 1.2, 2.1, 2.3, 3.1, 5.1 and 5.2

International data sources:

- ICP Forests (Level I)
- FOREST EUROPE/UNECE/FAO
- EC - DG Environment

Measurement unit:

Status: ha

Changes: ha yr⁻¹.

Current periodicity of data availability: variable

CRITERION 2: MAINTENANCE OF FOREST HEALTH AND VITALITY

Reporting notes:

Categories of biotic agents could include:

- Insects and diseases
- Wildlife and grazing
- Other identifiable biotic agent

Categories of abiotic agents could include:

- Fire
- Weather related events: storm, wind, snow, drought, mudflow, avalanche
- Other identifiable abiotic agent

Categories of human induced damages comprise e.g.:

- Damage by forest operations
- Damage by human induced fire
- Damage by contamination (mainly point-source contamination)
- Other identifiable human induced damage

Separate figures to be reported on:

- Total area with damage on forest land, on other wooded land and total
- Area primarily damaged by biotic agents (insects and disease, wildlife and grazing, other) on forest land, on other wooded land and total
- Area primarily damaged by abiotic agents (weather related events, other) on forest land, on other wooded land and total
- Area damaged primarily by human induced damage (forest operations, contamination, other) on forest land, on other wooded land and total
- Primarily damaged by fire (total, of which human induced) on forest land, on other wooded land and total
- Area damaged by unspecified / mixed damage on forest land, on other wooded land and total

It is up to the countries to define the threshold level for the minimum size of damaged forest and other wooded land to be reported. It is recommended that the minimum size be >1 ha.

It is up to the countries to define and measure other identifiable damages, relevant to their forest areas, whatever their origin.

The area damaged by various agents (no matter which kind of agent and how many subsequent agents) has to be counted just once!. "Unspecified / Mixed damage": should include areas where damaging agent is unknown or areas damaged by many agents, where determination of the major agent is impossible.

Related definitions

Forest, Other wooded land, Damage to forest, Primarily damaged by insects and disease, Primarily damaged by wildlife and grazing, Primarily damaged by storm, wind, snow or other identifiable abiotic factors, Primarily human induced, Primarily damaged by fire

Indicator 2.5 Forest land degradation

Full text: Trends in forest land degradation

Rationale:

Land degradation and desertification on forests and other wooded lands, understood as a persistent reduction or loss of land biological and economic productivity, adversely affect the multiple provision of forests ecosystem goods and services. Causes and consequences of land degradation have multiple characteristics and vary within space, scale and context; hence measuring land degradation is a very complex multifaceted problem that needs to address biophysical and societal processes.

As a consequence of climate change, extreme meteorological events (e.g. drought, intense rains, wind-storms) are likely to increase in frequency and intensity. Vegetation productivity and soil stability and health are directly affected by these extremes, thus magnifying, accelerating and even driving land degradation.

Therefore an indicator related with forest areas affected by land degradation/desertification is of broad interest, not only for the countries affected by desertification, for which it is of utmost importance, but for other countries outside the climate scope defined by the UNCCD, which may also be affected by land degradation caused by whatever the cause or combination thereof.

In fact, to increase the efforts to prevent forest degradation is part of one of the Global Objectives on Forests, but having objective information on forest degradation remains a challenge, as there are major problems on definition and measurement.

Moreover, whilst there is no agreed definition of what constitutes “degraded forest land”, the concept of “land degradation” is agreed and well established within the United Nations Convention to Combat Desertification (UNCCD) to be applied at all levels. This definition is fully applicable to forest land and may be extended out of the scope of the UNCCD (arid, semi-arid and dry sub-humid areas)³.

Thus, in accordance with the definition of land degradation as established in the text (article 1) of the UNCCD, “forest land degradation” can be understood as reduction or loss of the biological or economic productivity and complexity of forest and other wooded lands resulting from land use or from a process or combination of processes, including processes arising from human activities and habitation patterns such as:

- (1) soil erosion caused by wind and/or water;
- (2) deterioration of the physical, chemical and biological or economic properties of soil and
- (3) long term loss of natural vegetation.

While highlighting the role of forests in recovering degraded land, this indicator would also emphasize that sustainable forestry activities can make a difference in recovering degraded land.

This indicator is mainly linked with the indicators: 1.1, 2.1, 2.2, 2.3, 5.1 and 5.2

This indicator needs to be further elaborated before implementation and measurement methods should be the subject of an in-depth review and discussion at the implementation stage, on the one hand considering the possibility of aligning with the reporting approach of UNCCD (under development) and, on the other hand, considering other possible parameters/proxies/measurement methods to include the widest range of causes of forest land degradation and of ways to approach the issue.

³ The definition of “desertification” established in the text (article 1) of the United Nations Convention to Combat Desertification (UNCCD) contains geographical restrictions, limiting areas under consideration to ‘drylands’, namely those of climate yielding an aridity index ≤ 0.65 (UNEP, P/ETP). Therefore, according to the UNCCD definition, only a few countries within Europe are affected by desertification. This indicator considers land degradation regardless of whether fall into the climate scope defined by the UNCCD, but with the aim to align itself with the ongoing work of the UNCCD to measure trends in land degradation in the world.

CRITERION 2: MAINTENANCE OF FOREST HEALTH AND VITALITY

International data sources:

- Joint Research Centre (JRC)
- UNCCD

Measurement units:

To be established (see Reporting notes)

Current periodicity of data availability:

To be established (see Reporting notes)

Reporting notes:

At the global level, one of the more increasingly widespread approaches to assess land degradation is the utilization of vegetation indexes obtained from satellite images. The UNCCD is proposing the use of metrics heavily based on analysis of remote-sensed variables, like Normalized Difference Vegetation Index (NDVI), that are proxy of the evolution of Net Primary Productivity (NPP). In particular, this type of method is quite appropriate for forest areas where intended fertilization inputs are quite low or non-existent.

With the aim to align this indicator on the trends in forest land degradation with the ongoing work of the UNCCD to measure land degradation in the world, the methodology of the New World Atlas of Desertification that the Joint Research Centre is developing (known as “*land productivity dynamics*”), could be considered as a possible metric.

To estimate the “*land productivity dynamics*”, vegetation condition and its dynamics (i.e. declining, stable or increasing of the land productivity) provide a good proxy for ecosystem structure and functioning. For example, responding to variations in soil quality, climate influence or human induced land use and land use changes. For each satellite-based observation point, the standing biomass, being the total biomass of a given area at a moment in time, is calculated per year, over the entire 1982 to 2010 observation period. Long-term changes and fluctuations in the standing biomass are then calculated. These changes and fluctuations are subsequently combined with measures of deviations from current locally defined maximum productivity levels derived from a higher spatial resolution (1x1km) data set from the ‘Vegetation’ sensors on Europe’s SPOT satellites, spanning the period 2006 to 2010. This combination is the basis to determine land-productivity dynamics. For each 5 x 5 km square we can measure if stable, declining or improving standing biomass dynamics have led to land-productivity conditions at or below the current local potential. The latter is either a natural potential, a human land use determined potential or a combination of both. Whilst not an absolute measure of land-productivity, this robust approach does provide a consistent, uniform and repeatable index with which to flag areas of concern, as well as identifying areas of improvement.

The periodicity of data availability would be linked to the update of the World Atlas of Desertification (foreseen every five years).

An adequate interpretation of this indicator in combination with National Forests Inventories or other available (both at regional and national level) information related to different degradation processes, and with the information obtained from the other indicators of criterion 2, can help to monitor and assess the health and vitality state of forests in Europe.

Other available approaches based on analysis of remote-sensed variables at regional or national level to assess and monitoring forests land degradation and other wooded land could be considered.

Other available parameters/proxies/measurement methods at regional or national level to assess and monitoring the different types and / or causes of forest land degradation, whatever its nature, should be considered.

Related definitions:

CRITERION 2: MAINTENANCE OF FOREST HEALTH AND VITALITY

Land, desertification, land degradation, forest land degradation

CRITERION 3: MAINTENANCE AND ENCOURAGEMENT OF PRODUCTIVE FUNCTIONS OF FORESTS (WOOD AND NON-WOOD)

Indicator C.3. Policies, institutions and instruments to maintain and encourage the productive functions of forests

Rationale:

The policy dialog related to the maintenance and encouragement of the productive functions of forests is basic to implement and achieve the sustainable management of the forests and the forest sector.

Nowadays, productive functions of forests include a variety of wood and non-wood products and services. Policy objectives, actions and measures on the production/provision and use of forest products and services reflect current and future policy goals, recognizing the value and contribution of wood, non-wood goods and other forest ecosystem services to economic viability. Policies also influence and are influenced by the availability of timber, by the demand for wood as a renewable and environmentally-friendly raw material, by the demand of energy sources, and by the availability and demand of non-wood products and other forest ecosystem services.

It might be included in this indicator the promotion of incorporation of forest ecosystems and their services (all of them) into the socio-economic system, while recognizing that it is a horizontal issue, not only related to the maintenance and encouragement of the productive functions. One of the elementary conditions for such incorporation is to estimate the full value of forest ecosystem services across Europe, with possible subsequent economic valuation. The assessment based on a valuation of forest ecosystem services can be considered as a convincing method for the assessment of the significance of forest services to the society.

Policy framework, legislation/regulations, institutional capacity, economic and financial instruments and informative means, with associated policy actions/measures on value, production/provision and use of wood products, non-wood products, and forest ecosystem services, including the ones taken against illegal logging and harvesting, to value forest ecosystem services, to encourage green procurements policies, etc., both at national and sub-national levels, create an enabling environment for the sustainable management of the forests and the forest sector.

Descriptive questions:

Information, where appropriate, on main policy objectives, relevant institutions, main policy instruments (legal/regulatory, financial/economic, informational) and significant changes related to the maintenance and encouragement of the productive functions of forests.

Questions to be considered (as appropriate):

- Existence of forest policies and instruments, including specific policy objectives, related to the maintenance and enhancement of productive functions of forests.
- Existence and capacity of an institutional framework to develop institutions, mechanisms and infrastructures to facilitate production and use of wood, other forest products and other services; to support appropriate organizations for extension services on non-wood benefits, the capacity to improve research and technologies, etc.
- Existence of a legal/regulatory framework, that encourages practice of environmentally sound forestry based on a forest management plan or equivalent, provides legal instruments to regulate forest management practices for wood production and use, the harvesting of important non-wood forest products, legal basis against illegal logging and harvesting, the consideration of other forest ecosystem services, etc.
- Existence of economic and financial instruments related to the maintenance and enhancement of productive functions of forest.
- Existence of informational means to implement the policy framework.

CRITERION 3: MAINTENANCE AND ENCOURAGEMENT OF PRODUCTIVE FUNCTIONS OF FORESTS (WOOD AND NON-WOOD)

- Related actions and measures taken to maintain and encourage the productive functions of forests, including measures taken against illegal logging and harvesting of forest products and to estimate the value of forest ecosystem services and subsequent economic valuation (*including quantitative information if feasible*).

Related definitions:

Forest policy, Forest services, Non wood-products, Policies supporting sustainable forest management

CRITERION 3: MAINTENANCE AND ENCOURAGEMENT OF PRODUCTIVE FUNCTIONS OF FORESTS (WOOD AND NON-WOOD)

Indicator 3.1: Increment and fellings

Full text: Balance between net annual increment and annual fellings of wood on forest available for wood supply

Rationale:

This indicator highlights the sustainability of timber production over time as well as the current availability and the potential for future availability of timber. For a long run sustainability the annual fellings must not exceed the net annual increment. It is also considered of interest having the consideration about increment and fellings in total forest area.

The net annual increment is defined according to FRA 2015 as “average annual volume of gross increment over the given reference period less that of natural losses on all trees, measured to minimum diameters as defined for “Growing stock”. Gross increment ~~is~~ includes the volume growth of survivor trees and the increment on trees which have been felled or die during the reference period.

This indicator is mainly linked to indicators 2.1, 2.3 and 2.4.

International data sources:

- FOREST EUROPE/UNECE/FAO (for fellings)
- Eurostat: JQ annual data (for removals)

Measurement units:

Status: m³

Changes: m³ yr⁻¹

Current periodicity of data availability: Usually associated with NFI, typically 10 years, but note that many countries with a continuous NFI are capable of providing annual estimates.

Reporting notes:

Separate figures to be reported on:

- Net annual increment of wood on forest available for wood supply
- Annual fellings of wood on forest available for wood supply
- Net annual increment of wood on total forest area
- Annual fellings of wood on total forest area

Related definitions:

Forest, Forest available for wood supply, Growing stock, Gross annual increment, Net annual increment, Natural losses, Fellings.

CRITERION 3: MAINTENANCE AND ENCOURAGEMENT OF PRODUCTIVE FUNCTIONS OF FORESTS (WOOD AND NON-WOOD)

Indicator 3.2: Roundwood

Full text: Quantity and market value of roundwood

Rationale:

Roundwood includes all wood removed from the forest with or without bark, including wood removed in its round form, or split, roughly squared or in other form, includes woodfuel and roundwood directly chipped in the forest, and sold by the forest owner. Value added processing steps are not included.

Marketed roundwood is a direct contribution to the income of the forest owner.

Value and quantity of all the wood, both marketed and non-marketed, might be also considered, since an estimate of the value of total wood (although has not been placed on the market) may be of interest for policy and communication reasons.

This indicator is mainly linked to indicators 3.3 and 3.4.

International data sources:

- FRA/CFRQ
- FOREST EUROPE/UNECE/FAO
- Eurostat: JQ annual data

Measurement units:

Status: National currency/ha

Changes: National currency/ha/yr.

Status: $\text{m}^3 \text{ha}^{-1}$

Changes: $\text{m}^3 \text{ha}^{-1} \text{yr}^{-1}$

Current periodicity of data availability: annual

Reporting notes:

Separate figures to be reported on:

- Quantity of total removed roundwood
- Quantity of marketed roundwood
- Value of marketed roundwood
- Quantity of non-marketed wood
- Estimated market value of non-marketed wood (*optional information*)

Estimated market value of non-marketed wood could be based on the best information about the related revenue and value of non-marketed wood based on the volume of removed wood (if known) and the price that would be obtained if this wood were marketed.

Related definitions

Total wood removals, Roundwood, Industrial roundwood, Woodfuel, Marketed roundwood.

CRITERION 3: MAINTENANCE AND ENCOURAGEMENT OF PRODUCTIVE FUNCTIONS OF FORESTS (WOOD AND NON-WOOD)

Indicator 3.3: Non-wood goods

Full text: Quantity and market value of non-wood goods from forest and other wooded land

Rationale:

Non-wood goods (NWGs) are e.g. game meat, pelts, fruits and berries, mushrooms and truffles, cork, medicinal plants, Christmas trees, honey or nuts.

Non-wood goods have an important economic value with regard to SFM. However, it has to be considered that depending on national laws the income of e.g. berry picking might belong to the berry picker and not necessarily to the forest owner.

Value and quantity of all the non-wood goods, both marketed and non-marketed, might be also considered, since an estimate of the value of total wood (although has not been placed on the market) may be of interest for policy and communication reasons.

This indicator is mainly linked to indicators 3.2, 3.4 and 6.10.

International data sources:

- FRA/CFRQ
- FOEST EUROPE/UNECE/FAO
- Eurostat: IEEAF

Measurement units:

Status: kg

Changes: kg yr⁻¹

Status: National currency · kg⁻¹

Changes: National currency · kg⁻¹ yr⁻¹

Current periodicity of data availability: Variable.

Reporting notes:

Separate figures to be reported on:

- Quantity of total NWGs derived from forests and from other wooded land
- Quantity of marketed NWGs from forest land and from other wooded land
- Value of marketed NWGs from forest land and from other wooded land
- Quantity of non-marketed NWGs from forest land and from other wooded land
- Estimated value of non-marketed NWGs from forest land and from other wooded land (*optional information*)

Estimated market value of non-marketed NWGs could be based on the best information about the related revenue and value of non-marketed NWGs based on the volume of removed wood (if known) and the price that would be obtained if this wood were marketed.

Related definitions:

Non-wood goods, Marketed non-wood goods

CRITERION 3: MAINTENANCE AND ENCOURAGEMENT OF PRODUCTIVE FUNCTIONS OF FORESTS (WOOD AND NON-WOOD)

Indicator 3.4: Services

Full text: Value of marketed-services on forest and other wooded land

Rationale:

Marketed services include, for instance, hunting licences, fishing licences, managed outdoor recreation areas or trails for mountain biking, horse riding, skiing and other recreational activities. Also environmental services like private contracts for conservation should be indicated here. Depending on national laws these marketed services of the forest contribute in general directly to increase the income of the forest owner.

This indicator is mainly linked to indicators 3.2, 3.3, 4.6, 4.9, 5.1, 5.2, and 6.10.

International data sources:

FOREST EUROPE/UNECE/FAO

Measurement units:

Status: National currency · ha⁻¹

Changes: National currency · ha⁻¹ yr⁻¹

Current periodicity of data availability: Variable.

Reporting notes:

Separate figures to be reported on:

- Value of marketed services on forest land and other wooded land

Related definitions

Marketed forest services

CRITERION 4: MAINTENANCE, CONSERVATION AND APPROPRIATE ENHANCEMENT OF BIOLOGICAL DIVERSITY IN FOREST ECOSYSTEMS

Indicator C.4. Policies, institutions and instruments to maintain, conserve and appropriate enhance the biological diversity in forest ecosystem

Rationale:

The policy dialog related to the maintenance, conservation and appropriate enhancement of the biological diversity in forest ecosystem, is basic to implement and achieve the sustainable management of the forests and the forest sector.

Forest management policies and practices in Europe promote biodiversity, notably through the use of natural regeneration and mixed-species stands, encouraging higher proportion of deadwood in forests, enhancing biological diversity in forest ecosystems, managing genetic resources, single stands and the landscape, etc. Information on policies, objectives, actions and measures taken related to forest biodiversity, is key for establishing a dialogue on forests, analyse the efficiency and effectiveness of the current policies and identifying gaps and updating needs to substantially contribute to forest biodiversity conservation and management at pan European level.

Policy framework, legislation/regulations, institutional capacity, economic and financial instruments and informative means, with associated policy actions/measures on biological diversity, trees species, regeneration, naturalness, introduced tree species, deadwood, genetic resources, threatened forest species, protected forests, including as appropriate considerations on policies and measures/actions taken on forest fragmentation/landscape pattern, etc., both at national and sub-national levels, create an enabling environment for the sustainable management of the forests and the forest sector.

Descriptive questions:

Information, where appropriate, on main policy objectives, relevant institutions, main policy instruments (legal/regulatory, financial/economic, informational) and significant changes related to the maintenance, conservation and appropriate enhancement of the biological diversity in forest ecosystem.

Questions to be considered:

- Existence of forest policies and instruments, including specific policy objectives, related to the maintenance, conservation and appropriate enhancement of the biological diversity in forest ecosystem.
- Existence and capacity of an institutional framework to maintain, conserve and appropriately enhance biological diversity at the forest ecosystems, manage species and genetic levels; have responsibilities related to protected areas, protect threatened species, ensure regeneration of managed forests, etc.
- Existence of a legal/regulatory framework for the management, conservation and sustainable development of forest; that provides national adherence to international legal instruments; provides legal instruments to protect representative, rare or vulnerable forest ecosystems, to protect threatened species; to ensure regeneration of managed forests, etc.
- Existence of economic and financial instruments to maintain, conserve and appropriately enhance biological diversity at the forest ecosystems.
- Existence of informational means to implement the policy framework.
- Related actions and measures taken to maintain, conserve and appropriate enhance the biological diversity in forest ecosystems, including considerations to forest fragmentation.

Related definitions:

Biological diversity; Conservation of biodiversity; Forest policy; Protected forest; Policies supporting sustainable forest management; Institutional framework

CRITERION 4: MAINTENANCE, CONSERVATION AND APPROPRIATE ENHANCEMENT OF BIOLOGICAL DIVERSITY IN FOREST ECOSYSTEMS

Indicator 4.1: Diversity of tree species

Full text: Area of forest and other wooded land, classified by number of tree species occurring

Rationale:

Species diversity and dynamics of forest and other wooded land ecosystems depend considerably also on richness of tree species.

Multispecies forest and other wooded land are usually richer in biodiversity than monospecific forest and other wooded land. However, it has to be considered that some natural forest ecosystems have only one or two tree species, e.g. natural subalpine spruce stands.

This indicator is mainly linked to indicators 1.1, 1.2, 1.3 and 4.3.

International data sources:

- FOREST EUROPE/UNECE/FAO
- ICP Forests (Level I)

Measurement units:

Status: ha

Changes: ha yr⁻¹

Current periodicity of data availability: Usually associated with NFI, typically 10 years, but note that many countries with a continuous NFI are capable of providing annual estimates.

Reporting notes:

Threshold to indicate a tree species:

>5% of tree cover or basal area by this tree species.

Separate figures to be reported on:

Area of forest, other wooded land and total with number of tree species occurring (1; 2-3; 4-5; 1; 2-3; 4-5; ≥6).

When reflecting on the Diversity of tree species consider asking on the 'origin' of the data, if feasible. Be aware that some countries use figures from forest management plans, while some other have different sizes of referent units (1ha, 10 ha or more).

Related definitions

Forest, Other wooded land, Stand, Tree

CRITERION 4: MAINTENANCE, CONSERVATION AND APPROPRIATE ENHANCEMENT OF BIOLOGICAL DIVERSITY IN FOREST ECOSYSTEMS

Indicator 4.2: Regeneration

Full text: Total forest area by stand origin and area of annual forest regeneration and expansion

Rationale:

Natural regeneration contributes to conserving the diversity of the genotype and to maintaining the natural species composition, structure and ecological dynamics. However, it has to be considered, that natural regeneration is not always feasible to reach adequate management and conservation goals.

Regeneration types are natural regeneration, natural regeneration enhanced by planting, regeneration by planting and seeding, and coppice sprouting.

This indicator is mainly linked to indicator 1.1, 1.2, 4.1 and 4.3.

International data sources:

- FRA/CFRQ
- FOREST EUROPE/UNECE/FAO

Measurement units:

Status: ha

Changes: ha yr⁻¹

Current periodicity of data availability: Usually associated with NFI, typically 10 years, but note that many countries with a continuous NFI are capable of providing annual estimates.

Reporting notes:

Classification of expansion and regeneration types according to FRA/CFRQ 2015:

- Expansion: Afforestation / Natural expansion
- Regeneration: Natural regeneration / Planting and/or seeding / Coppice sprouting

Separate figures to be reported on:

- Total forest area by expansion and regeneration type:
 - Natural expansion and natural regeneration
 - Afforestation and regeneration by planting and or seeding
 - Coppice
- Annual forest expansion and regeneration, classified by:
 - Expansion of forest area: Afforestation / Natural expansion
 - Regeneration of forest area: Natural regeneration / Planting and/or seeding / Coppice

The mixed forms of regeneration (“*natural regeneration enhanced by planting*” and “*regeneration by planting and/or seeding enhanced by natural regeneration*”) should be reported according to the prevailing form of regeneration.

Related definitions

Forest, Forest expansion, Regeneration (natural, by planting and/or seeding, coppice sprouting), Afforestation, Natural expansion of forest.

CRITERION 4: MAINTENANCE, CONSERVATION AND APPROPRIATE ENHANCEMENT OF BIOLOGICAL DIVERSITY IN FOREST ECOSYSTEMS

Indicator 4.3: Naturalness

Full text: Area of forest and other wooded land by class of naturalness

Rationale:

The degree of naturalness of forest ecosystems shows the intensity of human interventions. Different levels of utilisation intensity are characterised not only by changing structures but also by different species communities. The composition and structure determine the functional diversity and these factors constitute the biological diversity of an area. The existence of forest and other wooded land undisturbed by man, i.e. forests where natural processes and species to a considerable extent remain or have been restored, has a high conservation value for understanding the ecological principles, and for reference when setting up management priorities and plans and models for silvicultural planning.

Semi-natural forests can keep certain characteristics, allowing natural dynamics and biodiversity closer to the original ecosystem. Plantations usually represent ecosystems on their own, with artificial dynamics establishing species communities completely distinct from the original ecosystem.

In European conditions, most forests are “semi-natural”, and it is desirable in the future to introduce one or more subdivisions along the spectrum from forests managed in a “close-to-nature” way to those whose management is close to plantation silviculture. In practice however, it is not yet possible to make a workable classification.

This indicator is mainly linked to indicators 1.1 and 1.3 and to indicators under Criterion 4.

International data sources:

- FRA/CFRQ
- FOREST EUROPE/UNECE/FAO
- EEA
- Berne Convention data
- Council of Europe: EMERALD data
-

Measurement units:

Status: ha

Changes: ha yr⁻¹

Current periodicity of data availability: Usually associated with NFI, typically 10 years, but note that many countries with a continuous NFI are capable of providing annual estimates.

Reporting notes:

Separate figures to be reported on area of forest and on area of other wooded land for:

- Undisturbed by man
- Semi-natural
- Plantations

Forest undisturbed by man implies the meaning is the same as “Primary forest” in FRA2015

Related definitions:

Forest, Other wooded land, Naturalness, Undisturbed by man, Semi-natural, Plantation

CRITERION 4: MAINTENANCE, CONSERVATION AND APPROPRIATE ENHANCEMENT OF BIOLOGICAL DIVERSITY IN FOREST ECOSYSTEMS

Indicator 4.4: Introduced tree species

Full text: Area of stands of forest and other wooded land dominated by introduced tree species.

Rationale:

Non-indigenous tree species have been introduced for various reasons like forestry or gardening. Introduced tree species make a significant contribution to wood supply in many countries, however, through their ecological characteristics, e.g. competitiveness, may change the dynamics of forest ecosystems and may influence sites, species composition, structure and functional diversity. Some introduced species have become problematic, i.e. invasive, c.f. the guiding principles on combating alien invasive species adopted by the Convention on Biological Diversity (CBD).

This indicator is mainly linked to indicators 1.1, 1.2, 4.1 and 4.3.

International data sources:

- FRA/CFRQ
- FOREST EUROPE/UNECE/FAO
- ICP Forests

Measurement units:

Status: ha

Changes: ha yr⁻¹

Current periodicity of data availability: Usually associated with NFI, typically 10 years, but note that many countries with a continuous NFI are capable of providing annual estimates.

Reporting notes:

Threshold for stands dominated by introduced tree species:

> 50 % of tree cover or basal area by tree species introduced

Separate figures to be reported on:

- Area of stands of forest dominated by introduced tree species and of which invasive*
- Area of stands of other wooded land dominated by introduced tree species and of which invasive*
- Area of stands of total forest and other wooded land dominated by introduced tree species and of which invasive*
- Forest area occupied by introduced tree species classified by introduced tree species
- Forest area occupied by invasive tree species classified by invasive tree species*

*Invasive species according to CBD definition

Related definitions:

Forest, Other wooded land, Introduced tree species (synonyms: non-indigenous species, exotic species, alien species, non-European species), Invasive introduced tree species.

CRITERION 4: MAINTENANCE, CONSERVATION AND APPROPRIATE ENHANCEMENT OF BIOLOGICAL DIVERSITY IN FOREST ECOSYSTEMS

Indicator 4.5: Deadwood

Full text: Volume of standing and of lying deadwood on forest and other wooded land

Rationale:

Deadwood (coarse woody debris) in form of snags (dead standing trees) and logs (dead lying trees) is a habitat for a wide array of organisms and after humification an important component of forest soil. Many species are dependent, during some part of their life cycle, upon dead or dying wood of moribund or dead trees (standing and fallen), or upon wood-inhabiting fungi or other species. Because of lack of deadwood many of the dependent species are endangered.

The volume of dead wood should be compared and related with the average volume of wood of the forests in order to provide a more ecological interpretation on the local / regional scales.

This indicator is mainly linked to indicators 1.2, 1.3, 2.1 and 4.3.

International data sources:

FOREST EUROPE/UNECE/FAO

Measurement units:

Status: $\text{m}^3 \text{ha}^{-1}$

Changes: $\text{m}^3 \text{ha}^{-1} \text{yr}^{-1}$

Current periodicity of data availability: Usually associated with NFI, typically 10 years, but note that many countries with a continuous NFI are capable of providing annual estimates.

Reporting notes: -

Separate figures to be reported on:

- Volume of total deadwood on forest land, on other wooded land and total
- Volume of standing trees deadwood on forest land, on other wooded land and total
- Volume of lying trees deadwood on forest land, on other wooded land and total
- Volume of deadwood in total forests and other wooded land (FOWL) by species groups (coniferous and broadleaved)
- % Total deadwood volume compare to the total growing stock

The recommended minimum size of standing and lying dead trees reported under this indicator should be:

- Standing deadwood equal or bigger than 10 cm of d.b.h. and in consequence the height should be at least 1.3m above ground level.
- Lying deadwood: equal or bigger than 10 cm of diameter measured 1.0 m from the thicker end of a piece of lying deadwood; equal or longer than 1.0 m.

Related definitions:

Forest, Other wooded land, Deadwood

CRITERION 4: MAINTENANCE, CONSERVATION AND APPROPRIATE ENHANCEMENT OF BIOLOGICAL DIVERSITY IN FOREST ECOSYSTEMS

Indicator 4.6: Genetic resources

Full text: Area managed for conservation and utilisation of forest tree genetic resources (*in situ* and *ex situ* genetic conservation) and area managed for seed production

Rationale:

Genetic diversity is the ultimate source of biodiversity at all levels. It ensures that forest trees can survive, adapt and evolve under changing environmental conditions. Genetic resources of forest trees should be conserved for the future, both to maintain the genetic diversity of tree populations and to ensure the availability of genetic resources for different uses and sites. A loss of genetic diversity may have negative consequences for fitness and productivity, and may prevent adaptation of tree populations to climate change, and to alter properties such as for CO₂ uptake and storage.

This indicator is mainly linked to indicator 1.1.

International data sources:

EUFORGEN / Bioversity International (*International Data Provider*)

[NOTE: Information for this indicator is provided separately by an International Data Provider (IDP) - European Forest Genetic Resources Programme (EUFORGEN) at Bioversity International, and presented to National Correspondents. If a National Correspondent wishes to request any changes to the data provided, these changes must be agreed with the country's EUFORGEN focal point and transmitted to Bioversity International.]

Measurement units:

Status: ha

Changes: ha yr⁻¹

Current periodicity of data availability: associated with IDP surveys

Reporting notes:

Separate figures to be reported on:

- Area managed for *in situ* genetic conservation per country and per species
- Area managed for *ex situ* genetic conservation per country and per species
- Area managed for seed production per country and per species
- Index of genetic conservation effort (I):

$$I = \text{NFSC} / \text{NFSO}$$

where:

NFSC is the total number of forest tree species conserved in a given country

NFSO is the total number of relevant forest tree species occurring within the country.

The Index of genetic conservation effort will be calculated based on the EUFGIS listed species occurring in the country.

Related definitions:

Forest genetic resources, *Ex-situ* conservation, *In-situ* conservation, Seed collection stand, Area managed for *in situ* genetic conservation, Area managed for *ex situ* genetic conservation, Area managed for seed production.

CRITERION 4: MAINTENANCE, CONSERVATION AND APPROPRIATE ENHANCEMENT OF BIOLOGICAL DIVERSITY IN FOREST ECOSYSTEMS

Indicator 4.7: Forest fragmentation

Full text: Area of continuous forest and of patches of forest separated by non-forest lands

Rationale:

Landscape-level spatial pattern of forest cover refers to the spatial arrangement (or configuration) of the forested land across the landscape, it reflects the potential of a landscape to provide forest habitats. The CBD takes into account “Forest fragmentation” as a process that results in the conversion of formerly continuous forest into patches of forest separated by non-forested lands, and includes “fragmentation” in Aichi Target 5. Relevant information may help decision-makers in adjusting land use policies to discourage changes that result in further forest fragmentation, and for alleviating the effects of climate change on species and ecosystems.

Fragmentation historically occurred in many European regions. It can occur permanently due to the expansion of agricultural areas, settlements and transport networks or it may be temporary and recoverable within forested areas after forest operations such as cuttings or replanting.

Fragmentation of forest lands and ecosystems can have positive and negative impacts. On one hand, fragmentation of forests may result in forest loss and isolation of ecosystems i.e. through a loss of connectivity. In this respect it may substantially contribute to habitat and biodiversity loss at global level. On the other hand, forest fragmentation is a tool to protect forests, e.g. for countries where the fire risk is high a certain degree of fragmentation is important to combat forest fires and to avoid losing vast areas of continuous forest.

This indicator is mainly linked to indicator 1.1

This indicator needs to be further elaborated before implementation and measurement methods should be the subject of an in-depth review and discussion at the implementation stage.

International data sources:

- EEA
- CORINE Land Cover
- EC JRC Ispra

Measurement units:

To be established (see Reporting notes)

Current periodicity of data availability:

To be established (see Reporting notes)

Reporting notes:

Data could be collected by remote sensing. Forest fragmentation can be measured and monitored in a powerful new way by combining Remote Sensing, GIS, and analytical software.

Note:

The reporting approach to the indicator should be further developed. However, current information on Equivalent Connected Area (ECA) can be taken into account:

Equivalent Connected Area (ECA) is defined as the size of a single patch (maximally connected) that would provide the same value of the Probability of Connectivity index based on intra and inter-patch connectivity, than the actual habitat pattern. ECA is calculated per 50 km fixed area cell.

The method uses a network-based habitat availability index which combines landscape graph theory, a probabilistic connection model and the habitat availability concept. It is based on

CRITERION 4: MAINTENANCE, CONSERVATION AND APPROPRIATE ENHANCEMENT OF BIOLOGICAL DIVERSITY IN FOREST ECOSYSTEMS

topology (inter patch distances) and patch attributes (area) for forest dwelling species with a specific dispersal ability.

Each link between every two patches is characterized by a probability of dispersal, obtained as a function of distance (a decreasing exponential function of the Euclidean (straight-line) edge-to-edge distance, matching to a probability of 0.5 for the average dispersal distance at focus. Dispersal distances are 1, 5, 10 and 25 km. The matrix (non-forest landscape) is first treated as homogeneous. Precisely, the method used the Equivalent Connected Area (ECA) index, which is a modification of the Probability of Connectivity index (Saura, Estreguil et al, 2010 (accepted) based on an adapted version of the software Conefor Sensinode (Saura and Torne, 2009 at <http://www.conefor.udl.es>).

In addition to the state in connectivity at one point in time, changes in connectivity are also quantified and directly compared with the temporal changes in forest habitat area. The method was already applied at broader scale (25ha MMU) for European forests in the period 1990-2000 (Saura, Estreguil et al., 2010). More information on the methodology can be found at www.forest.jrc.ec.europa.eu/ select forest pattern (see EUR23841, Estreguil and Mouton, 2009)

The former figures related to ECA used were:

- Status of equivalent connected area (ECA), for forest-dwelling species (with 1km and 10 km dispersal capability).
- Change in of equivalent connected area (ECA), for forest-dwelling species (with 1km and 10 km dispersal capability).

Related definitions:

Forest fragmentation; Equivalent Connected Area (ECA).

CRITERION 4: MAINTENANCE, CONSERVATION AND APPROPRIATE ENHANCEMENT OF BIOLOGICAL DIVERSITY IN FOREST ECOSYSTEMS

Indicator 4.8: Threatened forest species

Full text: Number of threatened forest species, classified according to IUCN Red List categories in relation to total number of forest species

Rationale:

The most recognisable form of depletion of biodiversity lies in the loss of species (fauna and flora). Slowing down the rate of species extinction due to anthropogenic factors is a key objective of the conservation of biodiversity. Changes in forest species population levels may also provide an early warning of changes in vital forest ecosystem functions.

The majority of threatened species are limited in their geographical distribution to single countries. Therefore, this indicator is of high importance for the implementation of SFM at national level.

This indicator is mainly linked to indicator 2.1.

International data sources:

- IUCN (Red Lists)
- FOREST EUROPE/UNECE/FAO
- EEA

Measurement units:

Status: absolute number of selected taxa

Status: % of total number of selected taxa

Changes: absolute number of selected taxa · yr⁻¹

Current periodicity of data availability: variable

Reporting notes:

Detailed national Red Lists should be used whenever possible.

Threatened forest species are to be classified according to the following IUCN Red List categories:

- vulnerable
- endangered
- critically endangered
- extinct in the wild

and to be broken down to the following species groups as far as available data exist:

- trees
- birds
- mammals
- other vertebrates
- invertebrates
- vascular plants
- cryptogams and fungi

CRITERION 4: MAINTENANCE, CONSERVATION AND APPROPRIATE ENHANCEMENT OF BIOLOGICAL DIVERSITY IN FOREST ECOSYSTEMS

It is up to the countries if they give priority to report on forest species belonging to main species groups (i.e. trees, birds and mammals) or report on all groups.

Whenever possible it should be explained the reasons behind the changes of species between Red Lists categories.

Related definitions:

Forest species, Vulnerable, Endangered, Critically endangered, Extinct in the wild.

CRITERION 4: MAINTENANCE, CONSERVATION AND APPROPRIATE ENHANCEMENT OF BIOLOGICAL DIVERSITY IN FOREST ECOSYSTEMS

Indicator 4.9: Protected forests

Full text: Area of forest and other wooded land protected to conserve biodiversity, landscapes and specific natural elements, according to MCPFE categories

Rationale:

Protected forest areas per se focus on the conservation of biological diversity and the maintenance of natural ecological processes.

Protected forest areas represent one of the oldest instruments for protecting nature and natural resources. Protected forest areas are included as a main pillar in nature conservation laws in all European countries.

This indicator is mainly linked to indicators 1.1, 4.3, 5.1, 5.2 and 6.11.

International data sources:

- FRA/CFRQ
- FOREST EUROPE/UNECE/FAO

Measurement units:

Status: ha

Changes: ha yr⁻¹

Current periodicity of data availability: Variable

Reporting notes:

According to MCPFE categories separate figures to be reported on:

- Area of forest land, of other wooded land and total according to MCPFE Class 1.1
- Area of forest land, of other wooded land and total according to MCPFE Class 1.2
- Area of forest land, of other wooded land and total according to MCPFE Class 1.3
- Area of forest land, of other wooded land and total according to MCPFE Class 2

According to ANNEX 2 to the Vienna Resolution 4 "MCPFE Assessment Guidelines for Protected and Protective Forest and Other Wooded Land in Europe (Vienna, 2003):

Protected forest and other wooded land have to comply to the following general principles in order to be assigned according with the MCPFE Assessment Guidelines:

- Existence of legal basis
- Long term commitment (minimum 20 years)
- Explicit designation for the protection of biodiversity, landscapes and specific natural elements of forest and other wooded land

"Explicit designation" in the context of these Guidelines comprises both:

- Designations defining forest and other wooded land within fixed geographical boundaries delineating a specific area.
- Designations defining forest and other wooded land not within fixed geographical boundaries, but as specific forest types or vertical and horizontal zones in the landscape.

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Data on forest and other wooded land according to these two designation types should be distinguished in the reporting.

In addition to the regimes complying with these principles, the MCPFE takes account of protected forest and other wooded land based on voluntary contributions without legal basis. As far as possible, these forests and other wooded land should be assigned to the same classes as used for the legally based regimes. However, data on these forests and other wooded land should be compiled separately.

Explanatory notes on General principles and on Definitions of MCPFE Categories and Classes as well as considerations on Natura 2000 and the linkages between MCPFE classes with IUCN and EEA categories, can be consulted in the document "FOREST EUROPE Information Document on Data Collection and Compiling the Statistics on Protected and Protective Forest and Other Wooded Land in Europe. Madrid 2015" (updating the document generated by the European COST Action E 27: Protected Forest Areas in Europe - analysis and harmonization during the years 2002-2006, supporting and clarifying data collection on protected forest areas).

Related definitions:

Forest; Other wooded-land; Protected forest; MCPFE Classes 1.1, 1.2, 1.3, and Class 2

CRITERION 4: MAINTENANCE, CONSERVATION AND APPROPRIATE ENHANCEMENT OF BIOLOGICAL DIVERSITY IN FOREST ECOSYSTEMS

Indicator 4.10. Common forest bird species

Full text: Occurrence of common breeding bird species related to forest ecosystems

Rationale:

Birds can act as excellent indicators of trends in the state of nature and of the sustainability of human land use and environmental health. Birds occur in all habitats, and can reflect trends in ecosystems, other animals and plants, and can be sensitive to environmental changes.

This biodiversity indicator is an excellent way to report not only on general trends within wildlife populations, but also on the state of the wider environment. Birds are recognised as good indicators of environmental change and as useful proxies of wider changes in nature.

A great deal of high quality data exists on birds and new data are relatively inexpensive to collect. One widely adopted index is “Wild Bird Index” that measures average population trends of a suite of representative wild birds. The CBD includes “Wild Bird Index” (WBI), in main Aichi Biodiversity Target 12, and in secondary Aichi Target 5 and 7. It can be easily calculated for different habitats, including woodlands, and geographic areas and it is recognized to be useful for analysis, interpretation of environmental issues and communication matters.

This indicator is mainly linked to indicator 1.1, 1.3, 4.1, 4.3, 4.5, 4.7, and 4.9.

This indicator needs to be further elaborated before implementation and measurement methods should be the subject of an in-depth review and discussion at the implementation stage.

International data sources:

- European Bird Census Council (EBCC) / RSPB / BirdLife International / Statistics Netherlands
- Royal Society for the Protection of Birds (RSPB)
- Pan-European Common Bird Monitoring Scheme (PECBMS)

Measurement units:

Mean of the set of individual: indicators (multi-species indices) are a geometric mean of the set of individual (or supranational) species indices.

Current periodicity of data availability: Annual

Reporting notes:

The index for each group of species is constructed by setting the first year in the series for each species trend to 1 and taking the geometric mean of the population trend across species, so that each species is given equal weight in the multi-species index (Sheehan, D.K., Gregory, R.D., Eaton, M.A., Bubb, P.J., and Chenery, A.M. (2010). The Wild Bird Index – Guidance for National and Regional Use. UNEP-WCMC, Cambridge, UK) (the reference contains also some case studies relevant to Europe).

The software package TRIM (TRends and Indices for Monitoring data) has been developed for analysis of count data obtained from monitoring wildlife populations. It is currently the standard to analyse count data obtained from bird monitoring schemes and is freely available from Statistics Netherlands via www.ebcc.info (Pannekoek and Van Strien 2001).

Related definitions:

CRITERION 5: MAINTENANCE AND APPROPRIATE ENHANCEMENT OF PROTECTIVE FUNCTIONS IN FOREST MANAGEMENT (NOTABLY SOIL AND WATER)

Indicator C.5. Policies, institutions and instruments to maintain and appropriate enhance of the protective functions in forest management

Rationale:

The policy dialog related to the maintenance and appropriate enhancement of the protective functions in forest management, is basic to implement and achieve the sustainable management of the forests and the forest sector.

Forests fulfil important protective functions for soils, water resources, infrastructure, managed natural resources and – directly or indirectly – human beings. Policies, and changes in policies, related to protective functions of forests, including actions to combat land degradation / desertification, as protection against soil and wind erosion, and to prevent floods and avalanches, reflect the progresses made, the ability to adapt policies to new challenges, identify needs, and can provide support for the sustainable forest management processes and public and private forest owners.

This indicator focus on forest ecosystems services (FES) including in the general category of “regulation” mainly related with water, soil and infrastructures protection. Other regulations are attended in other criterion and related indicators: criterion 2 (health protection), criterion 4 (biodiversity protection) or criterion 1 (climate regulation).

Measures and actions to increase the forest area through reforestation or afforestation with protective functions as main objective, are historically, in several countries, one of the main measures to protect soil, water and other forest ecosystem functions, or to protect infrastructure and managed natural resources against natural hazards.

Policy framework, legislation/regulations, institutional capacity, economic and financial instruments and informative means, with associated policy actions/measures on protective functions of forests soil, water, other ecosystem functions, infrastructure and managed of natural resources, including also policies, measures and actions taken to combat land degradation / desertification as reforestation and afforestation for protective functions, soil and water conservation practices, integrated watershed management, protection against floods, etc., both at national and sub-national levels, create an enabling environment for the sustainable management of the forests and the forest sector.

Policies to combat land degradation / desertification are broadly addressed under indicator B.2. Under this indicator B.5, the focus is on those policies related to the maintenance and appropriate enhancement of protective functions in forest management (notably soil and water).

Descriptive questions:

Information, where appropriate, on main policy objectives, relevant institutions, main policy instruments (legal/regulatory, financial/economic, informational) and significant changes related to the maintenance and appropriate enhancement of the protective functions in forest management.

Questions to be considered:

- Existence of forest policies and instruments, including specific policy objectives, related to the maintenance and appropriate enhancement of the protective functions in forest management.
- Existence and capacity of an institutional framework to develop and maintain institutional instruments and their implementation to regulate forest management practices in protective forests.
- Existence of a legal / regulatory framework, and its extent to provide for legal instruments to regulate or limit forest management practices in protective forests.
- Existence of economic policy framework and financial instruments, and its extent to support the management in protective forests.
- Existence of informational means to implement the policy framework.

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- Related actions and measures taken to maintain and appropriately enhance the protective functions in forest management, including considerations to protection against floods, water management, to combat land degradation/desertification (both qualitative and quantitative dimensions).

In this respect it can be included as appropriate quantitative information on average in the period of annual area of reforestation and afforestation with protective functions as main objective – (units: ha)

Related definitions:

Afforestation; Combat desertification; Desertification; Land degradation; Forest policy; Policies supporting sustainable forest management; Protection; Protective forest; Reforestation.

CRITERION 5: MAINTENANCE AND APPROPRIATE ENHANCEMENT OF PROTECTIVE FUNCTIONS IN FOREST MANAGEMENT (NOTABLY SOIL AND WATER)

Indicator 5.1. Protective forests – soil, water and other ecosystem functions; - infrastructure and managed natural resources

Full text: Area of forest and other wooded land designated to prevent soil erosion, preserve water resources, maintain other forest ecosystem functions, protect infrastructure and managed natural resources against natural hazards.

Rationale:

Forests have several very important protective functions. They protect the soil or the surface under the forest cover, e.g. protection against erosion.

Forest cover has also many very important functions for the maintenance of water resources and of water cycles like the protection of water reservoirs (ground water and aquifers) or filtering of water, and the modification of water cycle and run-off.

Forests fulfil also other important functions, e.g. maintenance of clean air, stabilisation of local climate, combating land degradation / desertification, securing the timber line in alpine and polar areas, etc.

In addition, forests fulfil important protective functions for infrastructure (e.g. roads, settlements against avalanches) but also for the protection of managed natural resources (e.g. vineyards, orchards, meadows) or directly for the protection of humans (e.g. from noise or visibility protection).

Whereas all forests fulfil these protective functions to some degree, for some forests these are the primary management objectives.

The intention of this indicator is to identify those forests where (i) protection of soil, water and other ecosystem functions, and (ii) protection of infrastructure and managed natural resources respectively, are the primary management objective.

There is a clear distinction between protected forests and protective forests, as the first are especially dedicated to the conservation of forest biodiversity, while protective forests are mainly managed for the protection of natural resources, soil and water mainly, infrastructures and people.

This indicator is mainly linked to indicators 1.1, 2.1, 2.2, 2.4, 3.4, 4.7 and 4.9.

International data sources:

- FRA/CFRQ
- FOREST EUROPE/UNECE/FAO

Measurement units:

Status: ha

Changes: ha yr⁻¹

Current periodicity of data availability: Variable

Reporting notes:

If possible, the total area with main management objective “Protective Functions”, according to MCPFE Class 3 should be divided into areas with:

1) management clearly directed to protect soil and its properties, or water quality and quantity or other forest ecosystem functions; and

CRITERION 5: MAINTENANCE AND APPROPRIATE ENHANCEMENT OF PROTECTIVE FUNCTIONS IN FOREST MANAGEMENT (NOTABLY SOIL AND WATER)

2) management clearly directed to protect infrastructure and managed natural resources against natural hazards.

There might be an overlap with indicator 4.9 (protected forests): if this is the case, that fact should be indicated.

The intention of the sub class “Infrastructure and managed natural resources” is to identify those forests where protection of infrastructure and managed resources is the primary management objective. “*Infrastructure*” includes roads, railways, settlements, buildings, etc. “*Natural resources*” includes e.g. agriculture land, vineyards, orchards. This class also includes protective forests with the primary management objective being the protection of humans (e.g. from noise or visibility).

Separate figures to be reported on:

- Total area of forest land, of other wooded land and total designated to prevent soil erosion, preserve water resources, or maintain other forest ecosystem functions, and to protect infrastructure and managed natural resources against natural hazards (according to MCPFE Class 3).
- Area of forest land, of other wooded land and total designated to prevent soil erosion, preserve water resources, or maintain other forest ecosystem functions.
- Area of forest land, of other wooded land and total designated to protect infrastructure and managed natural resources against natural hazards

According to ANNEX 2 to the Vienna Resolution 4 “MCPFE Assessment Guidelines for Protected and Protective Forest and Other Wooded Land in Europe (Vienna, 2003):

Protective forest and other wooded land have to comply to the following general principles in order to be assigned according with the MCPFE Assessment Guidelines:

- Existence of legal basis
- Long term commitment (minimum 20 years)
- Explicit designation for the protective functions of forest and other wooded land

“Explicit designation” in the context of these Guidelines comprises both:

- Designations defining forest and other wooded land within fixed geographical boundaries delineating a specific area.
- Designations defining forest and other wooded land not within fixed geographical boundaries, but as specific forest types or vertical and horizontal zones in the landscape.

Data on forest and other wooded land according to these two designation types should be distinguished in the reporting.

In addition to the regimes complying with these principles, the MCPFE takes account of protective forest and other wooded land based on voluntary contributions without legal basis. As far as possible, these forests and other wooded land should be assigned to the same classes as used for the legally based regimes. However, data on these forests and other wooded land should be compiled separately.

Explanatory notes on “General principles” and on “Definition of MCPFE Class 3” can be consulted in the document “FOREST EUROPE Information Document on Data Collection and Compiling the Statistics on Protected and Protective Forest and Other Wooded Land in Europe. Madrid 2015” (updating the document generated by the European COST Action E 27: Protected Forest Areas in Europe - analysis and harmonization during the years 2002-2006, supporting and clarifying data collection on protected forest areas).

Related definitions:

Forest, Other wooded land, Protective forest; MCPFE Class 3.

Indicator C.6. Policies, institutions and instruments to maintain other socioeconomic functions and conditions

Rationale:

The policy dialog related to the maintenance of other socioeconomic functions and conditions, is basic to implement and achieve the sustainable management of the forests and the forest sector.

Policies related to socio-economic functions of forests, as key element of sustainable forest management and of considerable importance for promoting the multiple benefits forests provide to society, includes production, consumption and trade of wood and wood for energy, related forest employment policies (including its safety and health), favor human livelihoods in rural and mountain areas, considers recreation and tourism, cultural and spiritual value of forests, as well as their contribution to rural development as a main policy objective.

Policy framework, legislation/regulations, institutional capacity, economic and financial instruments and informative means, with associated policy actions/measures on related forest socio-economics functions, including forest holdings, economic viability, production, consumption and trade of wood and of wood for energy, rural development, employment (including safety and health), recreation on forests, cultural and spiritual values of forests, etc., both at national and sub-national levels, create an enabling environment for the sustainable management of the forests and the forest sector.

Forests have many cultural and spiritual values for societies and individuals, notably for religious, aesthetic and historical reasons, as archaeological sites in forests, giant or unusual trees, the sites of historical events or of special ceremonies or customs, particularly beautiful landscapes, sites linked to famous individuals etc. Although frequently intangible and/or personal often these values are manifested in particular sites, which are increasingly being identified, listed and protected.

Descriptive questions:

Information, where appropriate, on main policy objectives, relevant institutions, main policy instruments (legal/regulatory, financial/economic, informational) and significant changes related to the maintenance of other socioeconomic functions and conditions.

Questions to be considered (as appropriate):

- Existence of forest policies and instruments, including specific policy objectives, related to the maintenance of other socioeconomic functions and conditions of forests, as forest employment, economic viability, rural development, recreation, cultural and spiritual values of forests, etc.
- Existence and capacity of an institutional framework to develop and maintain efficient infrastructure to facilitate the economic viability of forests and the forest sector, including, production, consumption and trade of wood and wood for energy, rural development, employment (including safety and health); develop and maintain institutional instruments to enhance forest related research and education; strengthen organizations to provide extension services; promote sustainable use of forests for recreation; develop and maintain programmes to conserve culturally valuable sites and landscapes; etc.
- Existence of a legal/regulatory framework to clarify property rights and provide for appropriate land tenure arrangements; to provide for legal instruments to ensure development of the forest sector; to provide means of resolving access disputes; to provide legal instruments for securing income levels in forest sector; etc.
- Existence of economic and financial instruments to conserve and enhance special environmental, cultural, social and scientific values of forests; to support programmes to ensure employment in rural areas in relation to forestry; to provide public and private funding for research, educational and extension programmes; etc.
- Existence of informational means to implement the policy framework.
- Related actions and measures taken to maintain other socioeconomic functions and conditions, including cultural and spiritual values (both qualitative and quantitative dimensions).

CRITERION 6: MAINTENANCE OF OTHER SOCIO-ECONOMIC FUNCTIONS AND CONDITIONS

Regarding cultural and spiritual values of forests it can be included as appropriate:

- Total number of “cultural heritage” sites, “forest landscape” sites, “trees” sites and/or “other sites” designated as having cultural or spiritual values within forests and other wooded land (Units: number; number/year)

[NOTE: Sites reported should be sites that are officially and explicitly designated for the protection of cultural and spiritual values and/or are officially recognized for such values, e.g. through governmental bodies, and/or are formally recorded, e.g. in a national database of veteran trees.]

Related definitions:

Forest policy, Policies supporting sustainable forest management, Cultural and spiritual values, Cultural heritage, Forested landscapes with cultural & spiritual values, Trees with cultural & spiritual values, Other sites with cultural and spiritual values.

CRITERION 6: MAINTENANCE OF OTHER SOCIO-ECONOMIC FUNCTIONS AND CONDITIONS

Indicator 6.1: Forest holdings

Full text: Number of forest holdings, classified by ownership categories and size classes

Rationale:

The number of forest holdings is an important social indicator, especially for the sustainable development in rural areas due to significant changes within the last decades.

International data sources:

- FRA/CFRQ
- FOREST EUROPE/UNECE/FAO

Measurement units:

Status: Absolute number

Changes: Absolute number/yr.

Status: ha

Changes: ha yr⁻¹

Current periodicity of data availability: Variable

Reporting notes:

Forest holdings are those in ISIC/NACE⁴ 02.0 (Forestry, logging and related services).

Separate figures to be reported on, according to the following classification of forest holdings:

A) Ownership categories

- In public ownership
- In private ownership
- Unknown ownership

B) Size classes

- <10 ha
- 11 - 50 ha
- 51 - 500 ha
- >500 ha

Related definitions:

Forest, Forest holding, Forest ownership, Public ownership, Private ownership, Unknown ownership.

⁴ ISIC = International standard industrial classification of all economic activities.

NACE= General industrial classification of economic activities within the European communities (Nomenclature générale des activités économiques dans les communautés Européennes).

CRITERION 6: MAINTENANCE OF OTHER SOCIO-ECONOMIC FUNCTIONS AND CONDITIONS

Indicator 6.2: Contribution of forest sector to GDP

Full text: Contribution of forestry and manufacturing of wood and paper products to gross domestic product

Rationale:

From the national viewpoint, the contribution of forestry and manufacturing of wood and paper products to gross domestic product indicates its macro-economic importance but can also be used for the assessment on how forest management contributes to the overall sustainable development as well as, more specifically, to rural development and whether this contribution is sustainable.

Subsidies are not included in this figure.

International data sources:

- FRA/CFRQ
- EUROSTAT (Economic Accounts/Forestry accounts)

Measurement units:

Status: Absolute figures in national currency

Changes: Absolute figures in national currency/yr.

Status: % of GVA

Changes: % of GVA yr⁻¹

Current periodicity of data availability: annual

Reporting notes:

For the estimation of contribution to Gross Domestic Product (GDP), data on Gross Value Added (GVA) should be used. GVA measures the contribution to the economy of each individual producer, industry or sector in the country. The link between GVA and GDP can be defined as: $GVA + \text{taxes on products} - \text{subsidies on products} = GDP$

Separate figures to be reported on:

- Contribution of ISIC/NACE 02.0 (Forestry, logging and related services) to GVA
- Contribution of ISIC/NACE 16 (Manufacture of wood and articles in wood) to GVA
- Contribution of ISIC/NACE 17 (Manufacture of paper and paper products) to GVA

Related definitions:

Gross Domestic Product, Gross Value Added, Forest sector (ISIC/NACE categories 02, 16 y 17), Forestry (ISIC/NACE 02), Manufacture of wood and of products of wood (ISIC/NACE 16), Manufacture of paper and paper products (ISIC/NACE 17).

CRITERION 6: MAINTENANCE OF OTHER SOCIO-ECONOMIC FUNCTIONS AND CONDITIONS

Indicator 6.3: Net revenue

Full text: Net revenue of forest enterprises

Rationale:

The level of net revenue of forest enterprises (public and private) is an important indicator of the degree of economic sustainability of forest management. The net revenue of forest enterprises includes all sources of income of the forest owner directly related to forestry, including subsidies, excluding taxes.

From the national viewpoint, an increasing net revenue from forestry contributes to economic growth and to an increasing economic sustainability of the forest owners.

International data sources:

EUROSTAT (Economic Statistics/Forestry account)

Measurement units:

Status: National currency · ha⁻¹

Changes: Annual changes in national currency · ha⁻¹

Current periodicity of data availability: annual

Reporting notes:

Forest enterprises are those in ISIC/NACE 02.0 (Forestry, logging and related services).

Related definitions:

Factor income, Net entrepreneurial income

CRITERION 6: MAINTENANCE OF OTHER SOCIO-ECONOMIC FUNCTIONS AND CONDITIONS

Indicator 6.4: Investments in forests and forestry

Full text: Total public and private investments in forests and forestry

Rationale:

This indicator focuses on governments' investments in public and private forests and revenues. This approach, which is consistent with the one applied in the FRA2015, should allow an analysis of public aspects of forest management financing.

The indicator should include private investments to have an inclusive and detailed assessment of the financial tools in the forest sector.

This indicator on investments is linked with qualitative indicator A.4, Financial and economic instruments.

International data sources:

- FRA/CFRQ

Measurement units:

€ National currency for status and changes

Current periodicity of data availability: annual

Reporting notes:

Separate figures to be reported on:

- Total public investments, subdivided in: Gross expenditure on public forests; Transfer payment to private sector; Cost of forest administration.
- Total public revenue, subdivided in: Gross revenue from public forests; All other government revenues from forestry and forest products.
- Total private investments.
- Total private revenue.

Take note that some of this quantitative information, specially the one on public expenditure on forest related activities is also included in the "Indicator 4. Financial and economic instruments" (under Forest Policy and Governance), since it is also necessary for the description of the existence, effectiveness and efficiency of financial and economic instruments. So, quantitative information provided on both indicators should be consistent.

Note: The reporting approach related to private investments and revenues should be further developed.

Related definitions:

Forest, Other wooded land, Government investments, Government revenues. *(Definitions related to private investments and revenues should be further developed)*

Indicator 6.5: Forest sector workforce

Full text: Number of persons employed and labour input in the forest sector, classified by gender and age group, education and job characteristics.

Rationale:

Employment provided by forestry is an important indicator for the social and economic benefits generated by forests, especially for a sustainable rural development. At the same time, an adequate workforce in terms of numbers and qualifications is a critical input to SFM.

Employment in the forestry sector has been falling in almost all European countries due to rapid increases in labour productivity. This trend continues notwithstanding policy efforts to maintain rural employment. There are often trade-offs between economic viability and the maintenance or creation of employment. Indicators help to make such trade-offs visible and amenable to decision making. Qualification requirements for the remaining workforce are higher due to the use of advanced equipment and machines as well as to growing attention to environmental parameters in forestry and mill operations. Particularly for work in the forest many countries face an ageing workforce and encounter difficulties to recruit new personnel.

It has to be specially mentioned the contribution of the forest owners to the economic benefit of forests, to the workforce and to the livelihoods.

International data sources:

- Eurostat (Social Statistics, Labour Force Survey)
- UNIDO (United Nations Industrial Development Organization, for data for ISIC 20 and 21)

Measurement units:

Status: Number of persons employed

Changes: Annual change in number of persons employed

Current periodicity of data availability: annual

Reporting notes:

Separate figures to be reported for

a) sectors:

- ISIC/NACE 02.0 (Forestry, logging and related services)
- ISIC/NACE 16 ff (Manufacture of wood and articles in wood) and ISIC/NACE 17 ff (Manufacture of paper and paper products)

and according to the following classifications:

b) gender categories:

- male
- female

c) age-group categories:

- 15-49 yr.
- >50 yr

CRITERION 6: MAINTENANCE OF OTHER SOCIO-ECONOMIC FUNCTIONS AND CONDITIONS

d) educational categories:

Categories ISCED 1997

- 0-2: From pre-primary education to lower secondary or first stage of basic education
- 3-4: From (upper) secondary education to post-secondary non tertiary education
- 5-6: From first stage of tertiary education (not leading directly to an advanced research qualification) to second stage of tertiary education (leading to an advanced research qualification)

e) job characteristics:

- Employees
- Self-employed

Those who own and operate their own business or professional practice, sometimes in conjunction with a partner, are considered as “self-employed”. For the purpose of reporting unpaid family workers should be included in self-employed.

Related definitions:

Labour Force Survey, Education, Job characteristics

Indicator 6.6: Occupational safety and health

Full text: Frequency of occupational accidents and occupational diseases in forestry

Rationale:

Forestry continues to be one of the most hazardous sectors in most European countries. The prevention of occupational accidents and occupational diseases of the forestry workforce is an important social aspect of SFM.

Occupational accidents are occurrences arising out of or in the course of work which result in fatal occupational injuries or non-fatal occupational injury.

Occupational diseases in forestry comprise diseases contracted as a result of an exposure to risk factors arising from work activity.

International data sources:

- ILO (International Labour Organisation)

Measurement units:

Occupational accidents:

Status: Absolute number of occupational accidents

Changes: Annual changes in number of occupational accidents

Status: Number of fatal occupational accidents .

Annual rate per 1000 workers of fatal occupational accidents

Status: Number of non- fatal occupational accidents

Annual rate per 1000 workers of non-fatal occupational accidents

Changes: Annual changes in number of fatal occupational accidents per 1000 workers/yr.

Annual changes in number of non-fatal occupational accidents per 1000 workers/yr.

Occupational diseases:

Status: Frequency of cases per number of persons exposed multiplied by number of years of exposure

Changes: Annual changes in frequency of cases per number of persons exposed multiplied by number of years of exposure

Current periodicity of data availability: annual

Reporting notes:

Separate figures to be reported for

Figures to be reported are for forestry (ISIC/NACE 02). Do not include injuries in wood processing or injuries to the public visiting forests.

- Fatal occupational accidents
- Non-fatal occupational accidents
- Occupational diseases (if feasible)

Related definitions:

Occupational accident, Occupational disease

CRITERION 6: MAINTENANCE OF OTHER SOCIO-ECONOMIC FUNCTIONS AND CONDITIONS

Indicator 6.7: Wood consumption

Full text: Consumption per head of wood and products derived from wood

Rationale:

Sound use of wood, a renewable and environmentally friendly raw material, is an essential part of the sustainable development of the forest and forest products sector. Income from sales of wood and forest products is the most important element in the economic sustainability of the sector.

This indicator demonstrates the intensity of wood consumption, and may be correlated with other indicators, notably population and GDP.

Taken with indicator 6.8 (trade in wood), it indicates how the country's own forest resources contribute to the provision of raw materials for the domestic markets and those abroad and whether this is sustainable.

Primary processed products (i.e. sawnwood, wood based panels, pulp, paper and paperboard, and, where appropriate, new innovative products) as well as wood used in the rough and energy wood should be included. Secondary process products (e.g. furniture, paper products, joinery) should not be included to avoid double counting and because of problems with conversion factors.

The use of wood instead of non-renewable raw materials is an indicator of sustainable consumption patterns in a society.

This indicator is mainly linked to indicator 6.8 and 6.9.

International data sources:

- UNECE- JFSQ (*International Data Provider*)

Measurement units:

Status: $\text{m}^3 \text{EQ} \cdot \text{head}^{-1} \cdot \text{yr}^{-1}$ (EQ = Equivalent)

mt EQ $\cdot \text{head}^{-1} \cdot \text{yr}^{-1}$ (paper and board)

Changes: Annual changes in $\text{m}^3 \text{EQ} \cdot \text{head}^{-1} \cdot \text{yr}^{-1}$

Annual changes in mt EQ $\cdot \text{head}^{-1} \cdot \text{yr}^{-1}$

Current periodicity of data availability: annual

Reporting notes:

Figure to be reported on:

- (Apparent) consumption (per head) of fuelwood, other industrial roundwood, sawnwood, wood based panels, paper and board.

Related definitions:

(Apparent) consumption per head of fuelwood, other industrial roundwood, sawnwood, wood based panels, paper and board.

CRITERION 6: MAINTENANCE OF OTHER SOCIO-ECONOMIC FUNCTIONS AND CONDITIONS

Indicator 6.8: Trade in wood

Full text: Imports and exports of wood and products derived from wood

Rationale:

International trade plays an important role in supplying renewable products at competitive prices to consumers worldwide, and help to encourage the economic sustainability of the forest sector in many exporting countries. Knowledge of import and export figures in wood trade is necessary to fully understand information provided under indicator 6.7 (wood consumption).

This indicator is mainly linked to indicator 6.7.

International data sources

- UNECE–JFSQ (*International data provider*)

Measurement units:

Status: Volume: m³ EQ yr⁻¹, mt (Pulp, Paper and board); Value: National currency

Changes: Annual changes of m³ EQ yr⁻¹

Current periodicity of data availability: annual

Reporting notes:

Separate figures to be reported on:

- Imports of wood and of products derived from wood (aggregated, in m³ roundwood equivalent)
- Imports of wood and of products derived from wood (aggregated, in value)
- Exports of wood and of products derived from wood (aggregated, in m³ roundwood equivalent)
- Exports of wood and of products derived from wood (aggregated, in value)

Related definitions:

Imports of wood and products derived from wood, Exports of wood and products derived from wood

CRITERION 6: MAINTENANCE OF OTHER SOCIO-ECONOMIC FUNCTIONS AND CONDITIONS

Indicator 6.9: Wood energy

Full text: Share of wood energy in total primary energy supply, classified by origin of wood

Rationale:

Wood is one of the major sources of renewable energy, whose importance is often underestimated, notably because of measurement problems. The objective of this indicator is to measure the relative importance of energy from wood compared to other sources of energy. This also helps to assess the sustainability of the energy sector in a country. Wood energy arises from a number of different sources, many of which are difficult to measure.

For the purposes of this indicator the origin of wood for wood energy includes:

- Energy from direct wood fibre sources from forests and from other land (trees outside forests)
- Energy from co-products and residues of the wood processing industries
- Energy from processed wood-based fuels (pellets, briquettes, charcoal)
- Energy from post-consumer recovered wood
- Energy from unknown/unspecified sources

This indicator is mainly linked to indicators 1.4 and 6.7.

International data sources:

- Eurostat: Energy Statistics
- IEA (International Energy Agency)
- FOREST EUROPE/UNECE/FAO
- UNECE-JWEE

Measurement units:

Status: Energy terms (TJ) yr⁻¹

Changes: Annual changes in TJ yr⁻¹

Status: metric tonnes of dry matter/yr.

Changes: Annual changes in metric tonnes of dry matter

Current periodicity of data availability: variable

Reporting notes:

Separate figures of the share of wood energy to be reported on for each of the following wood resources:

- Total primary energy supply
- Total renewable energy supply
- Total energy supply from wood:
 - Energy from direct wood fibre sources:
 - of which from forests and other wooded land
 - of which from other land (trees outside forests)
 - Energy from co-products and residues of the wood processing industries:
 - of which solid residues (chips, particles, wood residues, bark, excluding processed wood-based fuels)

CRITERION 6: MAINTENANCE OF OTHER SOCIO-ECONOMIC FUNCTIONS AND CONDITIONS

- Energy from processed wood-based fuels (pellets, briquettes, charcoal):
 - of which imported
- Energy from post-consumer recovered wood
- Energy from unknown/unspecified sources

Related definitions

Forest, Other wooded land, Trees outside forests, Total primary energy supply, Renewable energy, Direct wood fibre sources, Chips and particles, Wood residues, Black liquor, Energy from processed wood-based fuels, Wood pellets, Briquettes, Charcoal, Post consumer recovered wood

CRITERION 6: MAINTENANCE OF OTHER SOCIO-ECONOMIC FUNCTIONS AND CONDITIONS

Indicator 6.10: Recreation in forests

Full text: The use of forests and other wooded land for recreation in terms of right of access, provision of facilities and intensity of use.

Rationale:

Ownership patterns and property rights affect public access to forest and other wooded land.

Access to forests enables people to benefit from the recreational value of forests which contributes to quality of life. Since many recreational uses are not marketable or based on legal or effective rights of free access, this indicator complements any data under indicator 3.3 (non-wood goods) and 3.4 (services) from the societal point of view.

Some activities by the visiting public may however be forbidden or restricted.

International data sources:

- FRA/CFRQ
- FOREST EUROPE/UNECE/FAO

Measurement units:

Accessibility for recreation

Status: ha

Changes: Annual ch

Status: number of visits

anges/ha

Status: % of total area of forest and other wooded land

Changes: Annual changes in % of total area of forest and other wooded land

Intensity of use

Status: year

Current periodicity of data availability: Variable

Reporting notes:

Separate figures to be reported on:

Accessibility for recreation

- Total area of forest and other wooded land with access available to the public for recreational purposes.
- Total area of forest and other wooded land primarily designated or managed for public recreation

Intensity of use

- Number of visits in total forests and other wooded land

Related definitions:

Forest, Other wooded land, Access for recreation, Area primarily designated or managed for public recreation, Visit