The Montréal Process

Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests

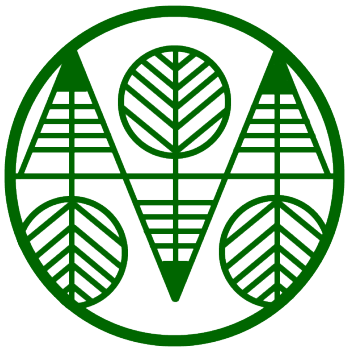

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TABLE OF CONTENTS

ANNEXES

CONTACTS

SECTION I
Introduction

Welcome to the Fifth Edition of the "Booklet" about the Montréal Process Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests. The Booklet presents the Montréal Process framework of seven criteria and 54 indicators, and the rationale for the inclusion of each indicator within the relevant criterion, together with contextual information. The Montreal Process criteria and indicator framework was developed to characterise the essential components of sustainable forest management, the aim of which is to maintain the broad range of forest values in perpetuity.

The indicators were approved by the Montréal Process Working Group at meetings in 2007 and 2008, following a comprehensive review of lessons learned in applying the original set of criteria and indicators established in 1995 in Santiago, Chile.

The 12 member countries of the Montréal Process Working Group use this set of criteria and indicators to prepare Country Reports on progress toward sustainable forest management and, for some countries, as the basis for domestic processes to monitor, assess and report progress towards sustainable forest management.

The Booklet is supplemented by the Montréal Process Technical Notes on Criteria 1-7 which provide rationale statements for the indicators together with suggested approaches to measurement, and a glossary of frequently used terms.

For more information about the Montréal Process, please visit us at http://www.montrealprocess.org/.

An International Process

The Montréal Process Working Group includes 12 countries: Argentina, Australia, Canada, Chile, China, Japan, Republic of Korea, Mexico, New Zealand, Russian Federation, United States of America, and Uruguay.

Together, these 12 countries account for 90 percent of the world's temperate and boreal forests, 49 percent of all forests, 58 percent of planted forests, 49 percent of global roundwood production, and 31 percent of the world's population.

SECTION II
International Context

1. Forests are essential to the long-term well-being of local populations, national economies and the earth's biosphere as a whole. They provide food, fuel, shelter, clean water and air, medicine, livelihoods and employment for people around the world. They reduce concentrations of greenhouse gases in the atmosphere, minimize sedimentation in lakes and rivers, and protect against flooding, mudslides and erosion. Forests are home to 80% of the world's terrestrial animals and plants. When managed sustainably, forests can provide a wide range of economic, social and environmental goods and services for the benefit of current and future generations.

2. The contribution of forests and sustainable forest management to sustainable development first received global recognition in 1992 when the United Nations Conference on Environment and Development adopted the "Rio Forest Principles"* and Chapter 11 of Agenda 21. At about the same time, the International Tropical Timber Organization (ITTO) did some pioneering work on "Criteria for the Measurement of Sustainable Tropical Forest Management."

3. Following the Rio Earth Summit, the concept of "criteria and indicators for sustainable forest management" gained increasing international attention as a tool to monitor, assess and report on forest trends at national and global levels. By 1995, the Ministerial Conference on the Protection of Forest in Europe (MCPFE) and the Montréal Process had adopted comparable sets of national level criteria and indicators for sustainable management of temperate and boreal forests.

4. The importance of criteria and indicators as tools to assess progress toward sustainable forest management has been recognized by the Intergovernmental Panel on Forests (1995-1997) and its successor Intergovernmental Forum on Forests (1997-2000), the United Nations Forum on Forests (UNFF), and the Food and Agriculture Organization of the United Nations (FAO). They are also relevant to the forest-related programs of member organizations of the Collaborative Partnership on Forests,** including the Rio conventions on biodiversity, climate change and desertification. Today, 86 countries use one or more regional and international criteria and indicators processes to report on progress towards Sustainable Forest Management.

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* Non-legally Binding Authoritative Statement of Principles for a Global Consensus on Management, Conservation and Sustainable Development of All Types of Forests

** The CPF was established in 2000. Member organizations include FAO (chair), Center for International Forestry Research (CIFOR), Convention on Biological Diversity (CBD), Global Environment Facility (GEF), ITTO, International Union of Forestry Research Organizations (IUFRO), United Nations Development Program (UNDP), United Nations Environment Program (UNEP), United Nations Forum on Forests Secretariat (UNFF), United Nations Framework Convention on Climate Change (UNFCCC), United Nations Convention to Combat Desertification (CCD), World Agroforestry Center (ICRAF), World Conservation Union (IUCN), and World Bank.

5. In 2004 the UNFF identified the following seven "thematic elements of sustainable forest management," which are drawn from the criteria identified by the Montréal Process and other criteria and indicators processes, as a reference framework for sustainable forest management:

   i. Extent of forest resources
   ii. Forest biological diversity
   iii. Forest ecosystem health and vitality
   iv. Productive functions of forests
   v. Protective functions of forests
   vi. Socio-economic functions of forests
   vii. Legal, policy and institutional framework

6. These thematic elements of sustainable forest management have become the framework for the five-yearly global Forest Resources Assessment coordinated by FAO. They are also enshrined in the Non-Legally Binding Instrument on All Types of Forests adopted by the UNFF in April 2007 and endorsed by the UN General Assembly in December 2007 as a framework for national action and international cooperation on forests.

7. In 2011 the Montréal Process began work with Forest Europe, the International Tropical Timber Organisation (ITTO), and the FAO on development of the Collaborative Forest Resources Questionnaire (CFRQ) that formed part of the 2015 Global Forest Resources Assessment.

Working Together

As demands and pressures on the world's forests increase, so too does the need for countries to work together to address common issues. The Montréal Process is an example of such collaboration. The Montréal Process has helped all 12 member countries identify shared goals and improve capacities to assess and report on forests. It has built confidence and trust within and among countries with diverse forest ecosystems, land ownership patterns and socio-economic conditions.

SECTION III
Background on the Montréal Process

A. Brief History of the Montréal Process

8. The Montréal Process (MP) Working Group on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests --"The Montréal Process" -- was launched in 1994 as a response to the Rio Forest Principles. Today, the Working Group has 12 member countries: Argentina, Australia, Canada, Chile, China, Japan, Republic of Korea, Mexico, New Zealand, Russian Federation, United States of America and Uruguay. These countries account for 90% of the world's temperate and boreal forests, 49% of all forests, 58% of planted forests, 49% of global roundwood production, and 31% of the world's population.

9. In February 1995, member countries adopted the Santiago Declaration affirming their commitment to the conservation and sustainable management of their respective forests and endorsing the following seven criteria and 67 associated indicators as guidelines for policy-makers to use in assessing national forest trends and progress toward sustainable forest management:

    1. Conservation of biological diversity
    2. Maintenance of productive capacity of forest ecosystems
    3. Maintenance of forest ecosystem health and vitality
    4. Conservation and maintenance of soil and water resources
    5. Maintenance of forest contribution to global carbon cycles
    6. Maintenance and enhancement of long-term multiple socio- economic benefits to meet the needs of societies
    7. Legal, institutional and economic framework for forest conservation and sustainable management

10. These MP criteria and indicators were the product of extensive consultations with forest managers and users, researchers, the private sector and other stakeholders in member countries, as well as with technical and policy experts from other temperate and boreal countries and the international technical and scientific community.

11. In 2003 MP member countries developed and published their first Country Reports using the agreed MP criteria and indicators. Illustrative trends drawn from the 12 country reports are highlighted in the Montréal Process First Forest Overview Report 2003. Based on experiences gained in reporting and taking into account international developments, such as the establishment of the UNFF, member countries adopted the Québec City Declaration in September 2003. The Declaration set forth a "Vision for the Montréal Process: 2003-2008," which identified a set of actions to enhance the effectiveness of the MP, including a major effort to review and refine the MP indicators.

12. In November 2007 in Buenos Aires, the Working Group approved a revised set of indicators for Criteria 1-6. Member countries used these improved indicators to prepare their second round of Country Forest Reports in 2009. In establishing an updated set of indicators, the Working Group reconfirmed the national and international relevance of the seven criteria adopted in 1995.

13. Also in November 2007, the Working Group agreed on the conceptual framework for the Montréal Process Strategic Action Plan: 2009-2015. The Strategic Action Plan (SAP) was based on the following five Strategic Directions:

    1. Enhance the relevance of the Montréal Process criteria and indicators for policymakers, practitioners and others;
    2. Strengthen member country capacity to monitor, assess and report on forest trends and progress toward sustainable forest management using the Montréal Process criteria and indicators;
    3. Enhance collaboration and cooperation with forest related regional and international organizations and instruments and other criteria and indicator processes;
    4. Enhance communication on the value of criteria and indicators and the accomplishments of the Montréal Process; and
    5. Enhance the effectiveness and efficiency of the Montréal Process Working Group and its Technical Advisory Committee and Liaison Office.

14. The SAP serves as the overall guiding document for the Montréal Process, as well as a tool for communicating MP objectives and priorities to member countries, domestic stakeholders and the international community.

15. In June 2009 in Jeju Island, Republic of Korea, the Working Group completed work on a revised set of indicators for Criteria 7. This set of indicators is now embedded in the current Montréal Process set of seven criteria and 54 indicators.

B. Operation of the Montréal Process Working Group

16. The MP Working Group brings together countries with highly diverse ecological, economic and social conditions to share experiences related to forest monitoring, assessment and reporting. Regular meetings of the Working Group are hosted by member countries on a rotational basis and are open to representatives of other criteria and indicators processes, international organizations, non-governmental organizations and the private sector.

17. The Working Group is supported by the MP Liaison Office (LO) established in 1995 and the Technical Advisory Committee (TAC) established in 1996. The LO is currently hosted by the Government of Japan. From 1995- 2006, it was hosted by the Government of Canada. The LO facilitates communication among members, helps organize Working Group and TAC meetings, arranges for translation, printing and dissemination of MP documents, maintains the MP website, and coordinates MP representation at regional and international meetings and events.

18. The TAC is comprised of forest experts from all member countries and provides technical and scientific advice to the Working Group on issues related to data collection, indicator measurement and reporting. The work of the TAC, including the development of the revised MP indicators presented here, is coordinated and facilitated by the TAC Convenor, currently hosted by the Government of New Zealand. From 1997 to 2003, the TAC Convenor was hosted by United States. From 1996 to 1997, it was hosted by New Zealand.

SECTION IV
Montréal Process Criteria and Indicators

19. The MP criteria and indicators provide a common framework for member countries to describe, monitor, assess and report on national forest trends and progress toward sustainable forest management. They also provide a common understanding within and across countries of what is meant by sustainable forest management, and may be understood to constitute an implicit definition of sustainable forest management at the country level.

20. As such, the MP criteria and indicators help provide an international reference for policy-makers in the formulation of national policies and a basis for international cooperation aimed at supporting sustainable forest management.

21. Taken together, the MP criteria and indicators reflect a holistic approach to forests as ecosystems, addressing the full range of forest values. No single criterion or indicator is alone an indication of sustainability. Rather, individual criteria and indicators should be considered in the context of other criteria and indicators.

22. The seven MP criteria characterize the essential components of sustainable forest management (e.g. biodiversity conservation). Each criterion is characterized by a set of indicators, which provides a way to measure or describe the criterion. No priority or order is implied in the listing of seven criteria or their associated indicators.

23. While many MP indicators are quantitative in nature, others are qualitative or descriptive. Some indicators can be readily measured (e.g. percent of forest cover). Others may require the collection of new or additional data, the establishment of systematic sampling or even basic research.

24. When indicators are measured periodically over time, they indicate change and trends in conditions relevant to sustainable forest management, including natural, social, economic and policy conditions. Monitoring these changes provides information that can be used to evaluate a country's progress toward sustainable forest management. This information is essential for evidence-based forest policy decision making.

25. Each MP country is unique in terms of the quantity, quality and characteristics of its forests. Countries also differ in terms of population and land ownership patterns, stages of economic development, governance structures, and expectations of how forests should contribute to society. These differences affect the capacity of countries to collect data, as well as the data collection methods employed. While the MP criteria and indicators facilitate harmonized approaches to forest assessment and reporting among countries, they also allow for flexibility in application to reflect national circumstances.

26. An informed, aware and participatory public is indispensable to promoting the sustainable management of forests. The MP criteria and indicators are a useful tool for engaging stakeholders in data collection processes and forest discussions at national and sub-national levels, which is likely to improve the quality of forest-related information available to decision-makers and the general public. Stakeholder involvement and awareness should better inform the policy debate at national and international levels.

27. As national level assessment tools, the MP criteria and indicators provide a basis for reporting on all forests in a country, including public and private forests, natural forests and plantation forests. Although they are not performance standards or designed to assess sustainability at the forest management unit level, they also provide a framework for developing policies, plans and inventories at both national and sub-national levels, and can serve as a model for monitoring and reporting on other natural resources, such as rangelands, freshwater and minerals.

28. Concepts of forest management evolve over time based on enhanced scientific knowledge about how forest ecosystems function and respond to human interventions, as well as in response to changes in how the public views forest values. The MP Working Group will continue to periodically review and, as needed, refine the MP criteria and indicators to reflect new information, advances in technology and research, and improved understanding of sustainable forest management.

SECTION V
The Montréal Process Criteria and Indicators

29. The current set of Montréal Process criteria and indicators continues to be based on contemporary scientific understanding of temperate and boreal forest ecosystems and the values society attaches to forests. Criteria 1-6 and associated indicators relate specifically to forest conditions or functions, and to the values or benefits associated with forest goods and services. Criterion 7 and its indicators relate to the overall legal, institutional and economic frameworks needed to facilitate and support forest conservation and sustainable management. This framework includes aspects often external to the forest itself but which affect efforts to conserve, maintain or enhance one or more of the conditions, functions, values or benefits captured in Criteria 1-6.

Photos courtesy of USDA Natural Resources Conservation Service (*above left*) and Christopher Burns (*above right*)

Criterion 1: Conservation of biological diversity

Forests, and particularly native forests, support a substantial proportion of the planet's biological diversity and terrestrial species. Biological diversity enables an ecosystem to respond to external influences, to recover after disturbance, and to maintain essential ecological processes.

Human activities and natural processes can impact adversely on biological diversity by altering and fragmenting habitats, introducing invasive species, or reducing the population or ranges of species. Conserving the diversity of organisms and their habitats supports forest ecosystems and their ability to function, reproduce, and remain productive.

1.1 Ecosystem diversity

Maintenance of the variety and quality of forest ecosystems is necessary for the conservation of species. Without sufficient habitat size, adequate connectivity, necessary structural diversity and appropriate protection and management measures, species may decline and become vulnerable to extinction. These indicators provide information on the area and extent of ecosystem types, forest area under formal protection and the effects of fragmentation.

1.1.a Area and percent of forest by forest ecosystem type, successional stage, age class, and forest ownership or tenure

Rationale: This indicator provides information on the area and extent of forest ecosystem types, including successional stage, age class and the nature of tenure or ownership. The sustainability and stability of forest ecosystems may depend on their size and diversity. If these are not maintained, forests may become vulnerable to habitat degradation and loss. Tenures or ownership types may have a variety of management regimes associated with them - each with a different impact on biological diversity.

1.1.b Area and percent of forest in protected areas by forest ecosystem type, and by age class or successional stage

Rationale: This indicator provides information on the area and extent of forest by ecosystem type, age class or successional stage protected to safeguard biological diversity and representative examples of forest ecosystem types. This indicator will also help identify forest types of conservation value that are in need of protection. The level of formal protection given to forests is a reflection of the importance society places on their conservation.

1.1.c Fragmentation of forests

Rationale: This indicator provides information on the extent to which forests are being fragmented over time by human activities and natural processes. Fragmentation may lead to the isolation and loss of species and gene pools, degraded habitat quality, and a reduction in the forest's ability to sustain the natural processes necessary to maintain ecosystem health.

1.2 Species diversity

The greatest and most readily recognisable aspect of biological diversity is the variety of species and their population levels. A key objective for the conservation of biological diversity is slowing down the rate of population decline, and species depletion and extinction due to human factors. Changes in species population levels and distribution may also provide an early warning of changes in ecosystem stability and resilience, as will increases in the number of invasive, exotic forest-associated species.

1.2.a Number of native forest associated species

Rationale: This indicator provides information on the health of forest ecosystems through the number of native forest-associated species. Knowledge of the number of native forest-associated species highlights the importance of certain forest types in meeting conservation objectives and in understanding the relationships species have within ecosystems. The loss or addition of species in an ecosystem can provide valuable insights into the overall health and productivity of that system.

1.2.b Number and status of native forest associated species at risk, as determined by legislation or scientific assessment

Rationale: This indicator provides information on the number and status of forest-associated species at risk or in serious decline. As a result, these species may require specific action or intervention to ensure their survival. The number of species at risk and their status is a measure of the health of forest ecosystems and their ability to support species diversity.

1.2.c Status of on-site and off-site efforts focused on conservation of species diversity

Rationale: This indicator provides information that describes on-site (or in situ) and off-site (or ex situ) efforts to conserve species diversity. Some forest species and habitats may have declined to such an extent that intervention is required to safeguard them for the future.

1.3 Genetic diversity

Genetic diversity, or the variation of genes within populations and species, is the ultimate source of Biological Diversity at all levels and is important for the functioning of healthy forest ecosystems. Threats to gene pools come from climate change, catastrophic events, and human activities and pressures. Loss of genetic variation reduces the ability of species to adapt to environmental change and for society to maximise the potential benefits available from forest species, for example for medicines and other bio-resources. High levels of genetic diversity within populations are usually a measure of their greater potential for survival. The loss of genetic variation within species also makes forest ecosystems less resilient to change.

1.3.a Number and geographic distribution of forest associated species at risk of losing genetic variation and locally adapted genotypes

Rationale: This indicator provides information on the number and distribution of forest-associated species at risk of losing genetic variation across their population. This erosion in genetic variation makes species less able to adapt to environmental change and more vulnerable to extinction. Some local populations with unique gene pools may also risk being swamped by larger populations introduced intentionally, by accident, or by natural processes.

1.3.b Population levels of selected representative forest associated species to describe genetic diversity

Rationale: This indicator provides information on the population status of selected forest-associated species that are considered to reflect the genetic diversity present in forest ecosystems. Some forest species support or rely heavily on particular forest structures, patterns, associations and processes and can therefore be used to describe the status of genetic diversity in forests as a whole.

1.3.c Status of on-site and off-site efforts focused on conservation of genetic diversity

Rationale: This indicator provides information that describes on site (or in situ) and off-site (or ex situ) efforts to conserve genetic diversity within species. Some species have suffered from a loss of genetic variability due to population decline and a reduction in their former range and distribution. Continued loss of genetic variability will threaten the viability of these species and may accelerate a decline that may lead ultimately to extinction.

Criterion 2: Maintenance of productive capacity of forest ecosystems

Many communities depend on forests directly or indirectly for a wide range of forest- based goods and services. The sustainable provision of these services is clearly linked to the productive capacity of the forest. If this capacity is exceeded there is the risk of ecosystem decline and collapse.

For forests to be sustainable it is necessary to understand the levels at which goods and services may be extracted or used without undermining the functioning of forest ecosystems and processes. The nature of goods and services provided by forests change over time due to social and economic trends, and technological developments. Change in the productive capacity of forests may be a signal of unsound forest management practices or other agents that are affecting forest ecosystems in some way.

2.a Area and percent of forest land and net area of forest land available for wood production

Rationale: This indicator measures the availability of forest land for wood production compared with the total forest area of a country. It provides information that will help assess the capacity of forests to produce wood to meet society's needs.

2.b Total growing stock and annual increment of both merchantable and non-merchantable tree species in forests available for wood production

Rationale: This indicator measures the growing stock and annual increment of forest area available for wood production to meet society's needs. The annual increment and growing stock can be related to the volume harvested each year to provide a means to demonstrate the sustainable management of forest resources.

2.c Area, percent, and growing stock of plantations of native and exotic species

Rationale: This indicator provides information on the nature and extent of plantation forests. Changes in the area of plantation reflect society's present and future needs or the impact of competing land uses on forest cover. The use of both native and exotic plantation species may enhance the range and quantity of goods and services available.

2.d Annual harvest of wood products by volume and as a percentage of net growth or sustained yield

Rationale: This indicator compares actual harvest levels against what is deemed to be sustainable. The purpose is to assess whether forests are being harvested beyond their ability to renew themselves or are being under- utilised for wood products.

2.e Annual harvest of non-wood forest products

Rationale: This indicator reports on the sustainability of the harvest of non- wood forest products. The wellbeing of indigenous and other communities dependent on non-wood forest products may be closely allied to the forest's ability to maintain its productive capacity over time.

Criterion 3: Maintenance of forest ecosystem health and vitality

The maintenance of forest health and vitality is dependent upon the ability of the ecosystem's functions and processes to recover from or adapt to disturbances. While many disturbance and stress events are natural components of forest ecosystems, some may overwhelm ecosystem functions, fundamentally altering their patterns and processes and reducing ecological function.

Decline in forest ecosystem health and vitality may have significant economic and ecological consequences for society including a loss of forest benefits and the degradation of environmental quality.

Information gained on the impacts of biotic and abiotic processes and agents may inform management strategies to minimise and mitigate risk. The maintenance of forest ecosystem health and vitality is the foundation of sustainable forest management.

3.a Area and percent of forest affected by biotic processes and agents (e.g. disease, insects, invasive species) beyond reference conditions

Rationale: This indicator identifies the impact that biotic processes and agents have on forests. Where change due to these agents and processes occurs beyond a critical threshold, forest ecosystem health and vitality may be significantly altered and a forest's ability to recover could be reduced or lost. Monitoring and measuring the effects of these processes provides information helpful in the formulation of management strategies to mitigate risk.

3.b Area and percent of forest affected by abiotic agents (e.g. fire, storm, land clearance) beyond reference conditions

Rationale: This indicator identifies the impact that abiotic agents, both natural and human induced, have on forests. Where change occurs due to these agents and processes beyond a critical threshold, forest ecosystem health and vitality may be significantly altered and a forest's ability to recover from disturbance could be reduced or lost. Monitoring and measuring the extent of forest affected by physical agents provides information to guide the formulation of management strategies to mitigate risk.

Photo courtesy of USDA Forest Service

Criterion 4: Conservation and maintenance of soil and water resources

Soil and water underpin forest ecosystem productivity and functions. Forest ecosystems play an important role in the regulation of surface and groundwater flow and, together with associated aquatic ecosystems and clean water, they are essential to the quality of human life.

The interactions of soil, water, climate, topography, and biological activities influence the character and health of streams and rivers flowing through and from forests. Monitoring change in the chemical, physical, and biological characteristics of soil, water and aquatic systems provides valuable information to support sustainable forest management.

Forest management activities can significantly alter forest soils, water quality and quantity, and associated aquatic habitats. Appropriate forest management can protect and conserve the soil and water values of a forest and of downstream land uses. Inappropriate management may result in soil compaction, soil erosion, loss of riparian buffering capacity, increased sediment loads in streams, degradation and destruction of riparian and aquatic habitats and altered flow regimes. The quantity of water flowing from a catchment can vary due to forest management activities in the catchment, including both forest harvesting and the establishment of new forests, depending on previous land use in that catchment. Change in water flow can lead to an increased risk of flooding or to a reduction in the quantity and flow of water in streams and affect other land use activities downstream. Both outcomes can have detrimental implications for human safety, property, and economies.

Soil and water health, quality and resources may be protected through the allocation of land for that purpose or through appropriate management regimes and best management practices.

4.1 Protective function

Healthy and productive forests depend on the maintenance of the soil and water resource. Forests also regulate these resources by moderating the flow of water, controlling erosion, maintaining water quality, and preventing catastrophic events such as flooding, avalanches and mudslides.

4.1.a Area and percent of forest whose designation or land management focus is the protection of soil or water resources

Rationale: The area and percent of forest designated or managed primarily for the protection and regulation of soil and water reflects the importance of these resources to society, including the tradeoffs made between other uses.

4.2 Soil

Forest soils support forest productivity and other ecological and hydrological functions through their ability to cycle, hold and supply water and nutrients, store organic matter and provide habitats for plant roots and for a wide range of soil organisms. These soil related functions mainly occur on or near to the forest floor. A reduction or loss of the soil resource, or the inappropriate disturbance of the forest floor, may result in a decline and degradation in forest health and in the provision and regulation of other ecosystem services.

4.2.a Proportion of forest management activities that meet best management practices or other relevant legislation to protect soil resources

Rationale: This indicator provides information about the extent to which soil resource protection, legislation and best management practices have been identified and integrated into forest management activities. Inappropriate activity may result in loss, compaction, contamination or degradation of soils, which in turn causes the loss of soil nutrients, forest productivity and other ecosystem services that soils provide.

4.2.b Area and percent of forest land with significant soil degradation

Rationale: This indicator provides information on the extent of significant soil degradation in forests likely to affect productivity, hydrology, ecosystem processes or social and cultural benefits. This indicator is primarily concerned with degradation caused directly or indirectly by human activity.

4.3 Water

Water is one of the most valuable of forest ecosystem services. Forests and soils and how they are managed, influence the quantity, quality and timing of surface-water and ground-water flows. This includes changes to forest structure and species composition through planned activities including timber harvesting and planting of forests on previously non-forest land, and unplanned activities such as wild fire. Changes to water quality and flow can have a severe impact on forest resources as well as human wellbeing. In addition, associated aquatic and riparian forest habitats are some of the most biologically diverse and productive forest ecosystems.

Photo courtesy of USDA Forest Service

The quality and quantity of water flowing from forested areas, including annual and longer-term patterns, are commonly regarded as key components in an indicator of the quality of forest management. Water quality and quantity is widely understood to be measures that capture many potential impacts on forest sustainability and are a good indicator of overall ecosystem health.

4.3.a Proportion of forest management activities that meet best management practices, or other relevant legislation, to protect water related resources

Rationale: This indicator provides information about the extent to which water resources have been identified and safeguarded during forest management. This indicator is primarily concerned with activities that may affect riparian zones, water quality, quantity and flow rather than the designation of land for water-related conservation. The protection of the water resources and associated forest and aquatic ecosystems is vital for the human populations dependent on them.

4.3.b Area and percent of water bodies, or stream length, in forest areas with significant change in physical, chemical or biological properties from reference conditions

Rationale: This indicator provides information relating to water quality in forests. Significant changes in the physical, chemical or biological properties of water in forest lakes, rivers and streams may reveal the extent to which management activities or natural events are affecting water quality.

Maintaining water quality is important for human use and consumption and to support healthy forest and aquatic ecosystems. Where water quality is being adversely affected by human activity, forest management practices may be adapted to protect water values.

Criterion 5: Maintenance of forest contribution to global carbon cycles

Forests are renewable and one of the largest terrestrial reservoirs of biomass and soil carbon. They have an important role in global carbon cycles as sinks and sources of carbon. Carbon stocks in forests include above ground biomass, belowground biomass, dead and decaying organic matter and soil carbon. Carbon is also stored in wood products.

Photo courtesy of Tracy Hancock

The biosphere has a significant influence on the chemical composition of the atmosphere. Vegetation draws CO_2 from the atmosphere, through photosynthesis and returns it through respiration and the decay of organic matter. The interchange between the biosphere and atmosphere is large; approximately a seventh of total atmospheric CO_2 passes into vegetation each year.

Global climate change could have significant impacts on the structure, distribution, productivity, and health of temperate and boreal forests as well as impacts on forest carbon stocks and fluxes, and the prevalence of forest fires, disease and insect outbreaks, and storm damages.

Forest management practices also affect the carbon cycle and fluxes. Deforestation has a negative impact, but management activities that maintain and enhance the carbon stored in forests and forest products over the medium to long term can make a positive contribution to mitigating atmospheric carbon dioxide levels. In addition, biomass from forests can be used as a substitute for fossil fuels thereby reducing greenhouse gas emissions.

Change in the global carbon cycle and associated climate change will have major impacts on human wellbeing, especially rural communities and indigenous peoples dependent directly on the natural environment.

5.a Total forest ecosystem carbon pools and fluxes

Rationale: This indicator provides information about the total amount of carbon stored in forest ecosystems. It also describes changes, fluxes or flows in carbon between forests and the atmosphere. A better understanding of these processes will aid the development of appropriate responses to the effects of climate change.

5.b Total forest product carbon pools and fluxes

Rationale: This indicator provides information on the role that forest products play in storing, cycling and releasing carbon. Forest products delay the release of carbon into the atmosphere and are more sustainable than products with manufacturing processes that have significant carbon footprints.

5.c Avoided fossil fuel carbon emissions by using forest biomass for energy

Rationale: This indicator provides information about the amount of energy produced from forest biomass and the extent to which it offsets the need to burn fossil fuels, thereby benefiting the global carbon budget and lowering carbon emissions.

Criterion 6: Maintenance and enhancement of long-term multiple socio-economic benefits to meet the needs of societies

Forests provide a wide variety of social, cultural and economic goods, services and other benefits that contribute to meeting the needs of society. Many people and communities, including indigenous peoples, are dependent on forests for their livelihood and well-being. Information on the production and consumption of forest products, investment and employment in the forest sector, forest-based recreation and tourism, and other social and cultural forest values illustrate the many benefits forests provide.

6.1 Production and consumption

These indicators provide information on the contribution of wood and non-wood products and environmental services to national economies. The value, volume and revenues associated with domestic production and consumption of forest products and services, including through international trade, demonstrates the type and magnitude of the contribution of forests to domestic economies. They also provide information about market conditions relevant to forest management and the forest sector.

6.1.a Value and volume of wood and wood products production, including primary and secondary processing

Rationale: This indicator provides information on the value and volume of wood and wood products at various stages of processing. The value and volume of wood and wood products reflects one aspect of the importance of forests and the wood processing sector to domestic economies.

6.1.b Value of non-wood forest products produced or collected

Rationale: This indicator provides information on the value of non-wood forest products. The collection, processing and use of non-wood forest products are important dimensions of the economic value of forests. In some countries, non-wood forest products are vital to the livelihoods and lifestyles of indigenous and other rural communities.

6.1.c Revenue from forest based ecosystem services

Rationale: This indicator provides information about forest-based ecosystem services for which markets and revenues are emerging or currently exist. Revenues from forest-based ecosystem services can be an important component of the economic value of forests.

6.1.d Total and per capita consumption of wood and wood products in round wood equivalents

Rationale: This indicator provides information on consumption, including consumption per capita, of wood and wood products. The quantity of wood and wood products consumed illustrates one aspect of society's dependence on forests as a source of raw materials.

6.1.e Total and per capita consumption of non-wood forest products

Rationale: This indicator provides information on the consumption of non- wood forest products. The quantity of non-wood products consumed illustrates society's dependence on forests as a source of these products.

6.1.f Value and volume in round wood equivalents of exports and imports of wood products

Rationale: This indicator provides information about the value and volume of a country's exports and imports in wood products and their contribution to the domestic economy. International trade in wood products may be a significant factor in the management, commercial use and economic value of forests.

6.1.g Value of exports and imports of non-wood forest products

Rationale: This indicator provides information about the value of a country's exports and imports of non-wood products and their contribution to the domestic economy. International trade in non-wood products may be a significant factor in the management, commercial use and economic value of forests.

6.1.h Exports as a share of wood and wood products production and imports as a share of wood and wood products consumption

Rationale: This indicator provides information on the relative importance of international trade in wood and wood products to domestic production and consumption. Wood and wood product exports can be a significant source of revenue for domestic economies. Imports may supplement or substitute for production from domestic forest sources.

6.1.i Recovery or recycling of forest products as a percent of total forest products consumption

Rationale: This indicator provides information on the extent to which forest products are recycled or recovered. Recycled and recovered products are an important source of wood fibre for many industries and may compete with or substitute for harvested wood. Such products can help meet the demand for forest products without increasing harvest levels.

6.2 Investment in the forest sector

These indicators provide information on long-term and annual expenditures to enhance forest management, forest-based enterprises, and the knowledge and skills of people who are engaged in the forest sector. Maintaining and enhancing the long-term multiple socio-economic benefits derived from forests depends in part on investment in the forest sector, including both long-term capital investments and annual operating expenditures.

6.2.a Value of capital investment and annual expenditure in forest management, wood and non-wood forest product industries, forest-based ecosystem services, recreation and tourism

Rationale: This indicator quantifies investment and expenditure in developing, maintaining and obtaining goods and services from forests. Maintaining and enhancing forests and their benefits often depends on regular investments in restoration, protection and management, as well as in operations, forest industries and forest-based ecosystem services. When the capacity to protect, manage and use forests is eroded through lack of funding, the benefits that forests provide may decline or be lost.

6.2.b Annual investment and expenditure in forest-related research, extension and development, and education

Rationale: This indicator provides information on annual investment and expenditure in forest-related research, extension and development, and education. Research underpins scientific understanding, including the ability to practice improved forest management and to develop and apply new technologies. Education, including extension activities, increases public awareness of the multiple benefits provided by forests.

6.3 Employment and community needs

Forest-based and forest-related employment is a useful measure of the social and economic importance of forests at the national and local level. Wage and income rates and injury rates are indicators of employment quality. Communities whose economies are concentrated in forest industries, or who rely on forests for

subsistence purposes, may be vulnerable to the short or long-term effects of economic or policy changes in the forest sector. These indicators provide information on levels and quality of forest employment, community resilience to change, use of forests for subsistence purposes, and the distribution of revenues from forests.

6.3.a Employment in the forest sector

Rationale: This indicator provides information on the level of direct and indirect employment in the forest sector. Employment is a widely understood measure of economic, social and community wellbeing.

6.3.b Average wage rates, annual average income and annual injury rates in major forest employment categories

Rationale: This indicator provides information on average wage, income and injury rates. These are important aspects of employment quality and the economic value of forests and forest related employment to communities.

6.3.c Resilience of forest-dependent communities

Rationale: This indicator provides information on the extent to which communities dependent on forests for their wellbeing, livelihoods, subsistence, quality of life or cultural identity are able to respond and adapt to social and economic change.

6.3.d Area and percent of forests used for subsistence purposes

Rationale: This indicator provides information on the extent to which indigenous and other communities rely on forests as a source of basic commodities, such as food, fuel, shelter and medicinal plants. The practice of forest-based subsistence reflects the dependence of rural communities and individuals on forests for essential resources and may be closely linked to cultural identity and quality of life.

6.3.e Distribution of revenues derived from forest management

Rationale: This indicator provides information about the flow and distribution of revenues derived from forest services, management and use back into forest-based communities, wider society and the forest sector. The distribution of those revenues provides information on the extent to which forest-based communities, the forest sector, and the wider society share in the economic benefits generated by forests.

6.4 Recreation and tourism

Forests have long been used as a place for recreation and other leisure activities. The location and accessibility of forests and the availability of recreation facilities are important to forest-based recreation and tourism. Levels of use are an indication of the extent to which forests are valued by society for these uses.

6.4.a Area and percent of forests available and/or managed for public recreation and tourism

Rationale: This indicator provides information on the area and extent of forests available and/or managed for recreation and tourism activities. The availability and management of forests for these activities is a reflection of society's recognition of the value of forests for recreation and tourism.

6.4.b Number, type, and geographic distribution of visits attributed to recreation and tourism and related to facilities available

Rationale: This indicator provides a measure of the level and type of recreation and tourism use in forests. The number and geographic distribution of visits and the facilities available reflect the extent to which people participate in forest-based leisure activities and the importance of forests for recreation and tourism.

6.5 Cultural, social and spiritual needs and values

People and communities, in both rural and urban areas, have a variety of cultural, social, and spiritual connections to forests based on traditions, experiences, beliefs, and other factors. Among them, the spiritual and cultural connections of indigenous people to forests often form part of their identity and livelihood. These values may be deeply held and influence people's attitudes and perspectives towards forests and how they are managed. These indicators provide information on the extent to which cultural, social, and spiritual needs and values exist and are recognized by society.

Photo courtesy of Tracy Hancock

6.5.a Area and percent of forests managed primarily to protect the range of cultural, social and spiritual needs and values

Rationale: This indicator measures the extent of forests managed primarily for their cultural, social and spiritual values to people and communities, including indigenous communities and others with strong ties to forests. The protection of forests to meet such needs and values is a reflection of the extent to which they are recognised by society.

6.5.b The importance of forests to people

Rationale: This indicator provides information on the range of values that communities and individuals hold for forests. These values shape the way people view forests, including their behaviours and attitudes to all aspects of forest management.

Photos courtesy of Natural Resources Canada (*above left*) and Tracy Hancock (*above right*)

Criterion 7: Legal, institutional and economic framework for forest conservation and sustainable management

Criterion Seven relates to the overall economic, legal, institutional, and policy environment of a country. This Criterion provides a context for the consideration of Criteria One to Six.

Legislation, institutional capacity and economic arrangements, with associated policy measures at both national and sub-national levels, create an enabling environment for the sustainable management of forests. Reporting against these indicators contributes to raising public and political awareness of issues affecting forests and builds support for their sustainable management.

7.1.a Legislation and polices supporting the sustainable management of forests

Rationale: This indicator provides information on legislation and policies, including regulations and programmes, which govern and guide forest management, operations and use. Legislation and policies designed to conserve and improve forest functions and values are prerequisite to achieving the sustainable management of forests.

7.1.b Cross-sectoral policy and programme coordination

Rationale: This indicator provides information on the extent to which policies and programmes are coordinated across sectors to support the sustainable management of forests. Non-forest sector land use and development decisions may have a significant impact on forests and their use.
Cross sector coordination of forest and non-forest related policies and programmes can promote improved forest management by helping to minimise adverse impacts and by strengthening the ability of countries to respond to national and global issues.

7.2.a Taxation and other economic strategies that affect the sustainable management of forests

Rationale: This indicator provides information on the economic strategies that affect the sustainable management of forests. Government policies and strategies on investment, taxation and trade may influence both forest management and the level of long term investment in forestry.

7.3.a Clarity and security of land and resource tenure and property rights

Rationale: This indicator provides information on land, forest and resource tenure, laws and rights. Clear title identifies rights and responsibilities under the law with respect to land and resources, while due process ensures that these rights can be protected or disputed. Lack of clear ownership or due process may hinder the active engagement of stakeholders in the sustainable management of forests, or leave forests vulnerable to illegal or unsustainable use.

7.3.b Enforcement of laws related to forests

Rationale: This indicator provides information on the extent to which forest- related laws and regulations are enforced. The ability to successfully prosecute offenders is essential in combating harmful activities that may threaten forests and their sustainable management (e.g. illegal forest conversion and illegal logging).

7.4.a Programmes, services and other resources supporting the sustainable management of forests

Rationale: This indicator provides information on the capacity of both government and private organisations to deliver programmes and services, to maintain and develop infrastructure and to access the financial and human resources necessary to support the sustainable management of forests.

7.4.b Development and application of research and technologies for the sustainable management of forests

Rationale: This indicator provides information on the capacity to develop and incorporate new science, research, and technologies into forest management. Continuous improvement in the depth and extent of knowledge and its application will help ensure advances in the sustainable management of forests.

7.5.a Partnerships to support the sustainable management of forests

Rationale: This indicator provides information on partnerships and their contribution to the sustainable management of forests. Partnerships may help create a shared purpose and are important tools in building capacity; leveraging financial, technical and human resources; strengthening political commitment; and in developing public support to advance the sustainable management of forests.

7.5.b Public participation and conflict resolution in forest-related decision making

Rationale: This indicator provides information on the processes that promote public participation in forest-related decision making and reduce or resolve conflict amongst forest stakeholders. Public participation in decision making processes and conflict resolution efforts can lead to decisions that are widely accepted and result in better forest management.

7.5.c Monitoring, assessment and reporting on progress towards sustainable management of forests

Rationale: This indicator provides information on the capacity to monitor, assess and report on forests. An open and transparent monitoring and reporting system that provides up-to-date and reliable forest-related information is essential for informed decision making, in generating public and political awareness of issues affecting forests, and in the development of policies to underpin the sustainable management of forests.

Photos courtesy of Department of Primary Industries and Resources, South Australia (*above left*) and USDA Forest Service (*above right*)

ANNEXES

Annex 1. Web Links

Other C&I processes

Forest Europe (Ministerial Conference on the Protection of Forests in Europe): http://www.foresteurope.org/

International Tropical Timber Organization (ITTO): http://www.itto.int/

The Tarapoto Proposal: Criteria and Indicators for the Sustainability of the Amazon Forest: http://www.otca.info/

The Central American Process of Lepaterique: http://www.fao.org/forestry/ci/16609@45891/en/

FAO Indicators Site: http://www.fao.org/forestry/ci/en/

Other International Organizations

Center for International Forestry Research: http://www.cifor.cgiar.org/

European Forest Institute: http://www.efi.int/portal/

Food and Agriculture Organization (FAO) of the United Nations: http://www.fao.org/

International Tropical Timber Organization (ITTO): http://www.itto.int/

International Union of Forestry Research Organizations (IUFRO): http://iufro.boku.ac.at/

United Nations Forum on Forests (UNFF): http://www.un.org/esa/forests/

Collaborative Partnership on Forests (CPF): http://www.fao.org/forestry/cpf/en/

Annex 2.

Québec City Declaration

Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests

Montréal Process

We, the Member countries of the Montréal Process Working Group, the Governments of Argentina, Australia, Canada, Chile, China, Japan, Mexico, New Zealand, the Republic of Korea, the Russian Federation, the United States of America, and Uruguay,

Reaffirming the important contribution of forests and their sustainable management to sustainable development;

Also reaffirming the important contribution of criteria and indicators to improving forest monitoring, assessment and reporting, as well as policies and practices to achieve sustainable forest management in member countries;

Recalling the Santiago Declaration of 3 February 1995, by which countries endorsed a comprehensive set of Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests;

Recognizing the widespread interest among countries in implementing criteria and indicators for sustainable forest management and the applicability of lessons learned in the Montréal Process to other criteria and indicators processes;

Encouraged by the contributions of member countries to the collaboratively produced Montréal Process First Approximation Report (1997), and Progress and Innovation in Implementing Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests (2000);

Also encouraged by the release by Member countries of their first Country Forest Reports using the Montréal Process set of 7 criteria and 67 indicators to convey to policy makers and the public the state of and trends in forests at the national level based on contemporary scientific understanding of forest ecosystems and their values to society, as well as the release of the collaborative Montréal Process First Forest Overview Report: 2003, which highlights the information and progress reflected in the country reports;

Pleased that despite the challenges of data collection and indicator measurement, member countries will continue to strive to improve their ability to monitor, assess and report on forests using the criteria and indicators in the next five years;

Also pleased that countries are increasingly using the criteria and indicators as a framework for strategic planning, forest inventory, stakeholder involvement and communicating progress to policy makers, and as a model for monitoring, assessment and reporting on other natural resources, such as rangelands and freshwater;

Affirming the value of the Montréal Process Working Group as a forum for international collaboration, including catalyzing national efforts, promoting a shared view of sustainable forest management and how to measure it, and fostering bilateral and regional partnership and cooperation among Members to build capacity; and

Believing the seven criteria endorsed by the Montréal Process represent the essential components of sustainable forest management of all types of forests;

Decide to:

Reaffirm our commitment to implementing the Montréal Process Criteria and Indicators as an important means of national monitoring, assessing and reporting.

Continue our active engagement and collaboration in the Montréal Process Working Group.

Endorse the actions annexed hereto as the means to further increase Member country capacity to report on forests using criteria and indicators and better inform policy-makers and other stakeholders on national progress toward sustainable forest management.

Request the Government of Canada on our behalf to present this Declaration to the XII World Forestry Congress now convening in Québec City and the fourth session of the United Nations Forum on Forests in Geneva, May 2004.

Québec City, Canada 22 September 2003

Annex 3.

Santiago Declaration

Statement on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests

The Governments of Australia, Canada, Chile, China, Japan, Mexico, New Zealand, the Republic of Korea, the Russian Federation and the United States of America, which are participating in the Working Group on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests ("Montreal Process") and whose countries contain a significant portion of the world's temperate and boreal forests:

Recognizing that the sustainable management of all types of forests, including temperate and boreal forests, is an important step to implementing the Statement of Forest Principles and Agenda 21, adopted by the United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro in June 1992, and is relevant to the United Nations conventions on biological diversity, climate change and desertification,

Also recognizing the value of having an internationally accepted understanding of what constitutes sustainable management of temperate and boreal forests, and the value of agreed criteria and indicators for sustainable forest management in advancing such an understanding,

Mindful that the application of agreed criteria and indicators will need to take account of the wide differences among States regarding the characteristics of their forests, including planted and other forests, land ownership, population, economic development, scientific and technological capacity, and social and political structure,

Taking note of other international initiatives regarding the development of criteria and indicators for sustainable forest management,

Affirming their commitment to the conservation and sustainable management of their respective forests, and

Having undertaken substantive discussions to develop agreed criteria and indicators for the conservation and sustainable management of temperate and boreal forests,

> ***Endorse*** the non-legally binding Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests annexed to this Statement as guidelines for use by their respective policy-makers;
>
> ***Encourage*** other States which have temperate and boreal forests to consider the endorsement and use of these criteria and indicators;
>
> ***Note*** the ongoing nature of the discussion on these criteria and indicators and the need to update the annex as new technical and scientific information and data become available and assessment capability increases; and
>
> ***Request*** the Government of Chile, on behalf of the above States, to present this Statement, together with its annex, to the FAO Meeting of Ministers Responsible for Forestry, to be held in Rome, March 16-17, 1995, and the third session of the United Nations Commission on Sustainable Development, to be held in New York, April 11-28, 1995.

Santiago, Chile February 3, 1995

CONTACTS

Montréal Process Liaison Office
http://www.montrealprocess.org/The_Montreal_Process/contacts.shtml

Montréal Process Member Countries
http://www.montrealprocess.org/The_Montreal_Process/Member_Countries/index.shtml