

CANADIAN COUNCIL OF FOREST MINISTERS'
CRITERIA AND INDICATORS OF SUSTAINABLE FOREST
MANAGEMENT INDICATOR REVIEW



**CCFM C&I REVIEW
TECHNICAL WORKING GROUP RECOMMENDATIONS
FOR IMPROVED CCFM INDICATORS
FOR SUSTAINABLE FOREST MANAGEMENT**

Submitted To The CCFM C&I Task Force

February 26th, 2003

**CCFM C&I REVIEW
TECHNICAL WORKING GROUP RECOMMENDATIONS
FOR IMPROVED CCFM INDICATORS
FOR SUSTAINABLE FOREST MANAGEMENT**

INTRODUCTION

Forests are essential to the long-term well-being of Canada's communities, economy, and environment. Almost half of Canada's land area is forested, providing Canadians with a multitude of benefits. As stewards of 10% of the world's forests, Canadians have a responsibility to maintain their forests in a healthy state and to manage them in a sustainable manner.

The Canadian commitment to sustainable forest management is well enshrined in both the 1992 and 1998 national forest strategies, endorsed by governments and others concerned with Canada's forests. This commitment has been further strengthened through a number of initiatives at the provincial, territorial, and local levels. At the 1992 United Nations Conference on Environment and Development (UNCED), the importance of sustainable forest management was recognized with the adoption of a Statement of Forest Principles; the concept was embodied in Chapter 11 of the conference's action plan, Agenda 21.

The development of the Canadian Council of Forest Ministers (CCFM) Framework of Criteria and Indicators (C&I) for sustainable forest management in 1995 was an important step in implementing Canada's commitments in the 1992 national forest strategy, as well as the forestry commitments made at UNCED. The CCFM C&I framework is a science-based framework to define and measure Canada's progress in the sustainable management of forests. The criteria represent forest values that Canadians want to enhance or sustain, while the indicators identify scientific factors to assess the state of the forests and measure progress over time.

Since the framework's development in 1995, the capacity of information systems has increased, approaches to forest inventories have changed, data availability has improved and advances in science have improved our understanding of ecosystems. In September 2001, recognizing that sustainable forest management is an adaptive process and that assessing sustainability is a continuous activity, the CCFM approved a plan to review the 83 indicators in its C&I framework.

The overall goal of the review is to improve the relevance and efficiency of the indicators for reporting on and assessing progress toward sustainable forest management at the national level. The review aims to develop the most suitable and functional indicators for assessing the state of Canada's forests while also contributing to a better understanding of the balance in social, environmental and economic objectives of sustainable forest management. Public involvement is an important part of evaluating and refining the indicators in the C&I framework.

The CCFM's C&I Task Force, composed of representatives from the federal, provincial and territorial governments, guides the CCFM C&I process and is leading the framework review with support from the C&I secretariat. In December 2001, in preparation for the review, the Task Force commissioned a focus group study to identify specific values, issues and concerns held by Canadians with respect to sustainable use of the forest. Focus groups, involving different sectors of society, were convened across the country.

In February 2002, the Task Force established six Technical Working Groups (TWGs), one for each criterion, to review the indicators in the C&I framework and recommend revised indicators to the Task Force. Task Force members, or alternates accepted by the Task Force, chaired each of the TWGs, which were comprised of experts from the federal, provincial and territorial governments; academia; the Aboriginal community; industry; and Non-governmental Organizations. Two academic experts also advised the TWGs.

Using the results of the focus group study, the TWGs convened in March, April and August 2002 to review the indicators. One TWG also met in October. Later in October 2002, the TWG Chairs met to compile

and integrate the six separate sets of indicator recommendations into a single, cohesive framework. In total, the six separate sets of recommendations contained 106 indicators. The chairs reduced this number, largely by combining similar indicators recommended by the different TWGs. The TWG Chairs circulated their compilation to the TWG members for feedback in December and made final revisions in January. The 53 indicators contained herein are the result of that review process and are submitted to the Task Force for their consideration to improve the CCFM Framework of Criteria and Indicators of Sustainable Forest Management.

The process the TWGs engaged in provided a broad exchange of views that ensured that their recommended indicators would be based on the best available knowledge. During their review, the TWGs considered the values identified in the focus group study; analyzed the current CCFM indicators and indicators from other C&I processes; and considered whether there are additional long-term issues of critical concern to sustainable forest management in Canada, for which indicators should be developed. Each potential indicator was analyzed to assess:

- relevance to the criterion;
- measurability based on scientifically valid, empirical measurements that can be consistently repeated over time, with data that are both practical and fiscally feasible to collect;
- understandability, not only to forest managers, but also to an informed public;
- ability to be forecast into the future with reasonable accuracy; and,
- whether or not reference values could be determined for the indicator.

The TWGs also considered whether or not each indicator should be identified as a *core* indicator, a *supporting* indicator, or a *potential* indicator. *Core* indicators relate to values, issues or concerns that are clearly of great interest to Canadians. They raise public awareness and focus public attention on what sustainable forest management means. *Supporting* indicators complement core indicators by providing more detailed information on the progress towards sustainable forest management in Canada. *Potential* indicators are future indicators that address important concepts, but which cannot currently be measured or properly defined. Potential indicators may identify areas where further research is warranted.

As with the 1995 CCFM C&I framework, the revised indicators reflect an approach to forest management that is based on:

1. The need to manage forests as ecosystems in order to maintain their natural processes;
2. The recognition that forests simultaneously provide a wide range of environmental, economic, and social benefits to Canadians;
3. The view that an informed, aware, and participatory public is important in promoting sustainable forest management; and,
4. The need for forest management to evolve to reflect the best available knowledge and information.

The revised indicators recommended by the TWGs are intended to provide a better understanding of what is meant by sustainable forest management in the Canadian context. The 1995 C&I framework was considered a "living document", capable of evolving further as our knowledge advanced. This revision ensures that the framework is adaptable, allowing indicators to change as relevant Canadian values, issues and concerns change, while also ensuring that the indicators are as suitable and functional as possible. Collectively, these revised indicators provide an improved framework for describing the state of forests and forest management, and for periodically demonstrating achievements in implementing sustainable forest management. The C&I framework continues to identify those elements of the forest ecosystem, as well as our social and economic system, that must be sustained or enhanced.

The review process allowed the TWGs to add, delete or revise any indicator in the 1995 framework. There are many changes in the revised indicators, but there are also many similarities with the original framework. Many indicators from the original framework for which quantitative indicator reports have been prepared in the past were retained in concept, although the indicator wording often changed. In addition, the TWGs have suggested some slight wording changes for the Criteria names, although the intent of each criterion remains the same.

Consistent with the 1995 framework, the criteria and revised indicators are intended to:

- Clarify sustainable forest management and provide a framework for describing and assessing progress at a national level;
- Provide a reference point for the development of policies on the conservation, management, and sustainable development of forests;
- Contribute to the clarification of issues related to environment and trade, including product certification;
- Provide concepts and terms to facilitate the on-going domestic and international dialogue on sustainable forest management; and,
- Improve the information available to the public and decision-makers.

The criteria and indicators represent a comprehensive framework. It is recognized that no single criterion or indicator alone is an indication of sustainability; rather, the individual criteria and indicators must be considered in the context of other criteria and indicators. Throughout the review, the forest was recognized to be a system with many linkages, which cannot easily be broken down into compartments. As such, values, issues or concerns under one criterion may be linked to indicators under another criterion.

Some of the data required for national reporting on the revised criteria and indicators can be provided through current information systems. However, the reporting on some indicators will need to evolve over time as they may require new types of data, new techniques or further research. During the review process, the TWGs focused on developing quantitative indicators. In a few instances though, reasonable quantitative measures could not be developed, and qualitative or descriptive indicators provide a way of describing the current status of the value being measured, or trends in its maintenance.

The forests of Canada are diverse in composition and ecology. Although the revised indicators are designed for reporting at the national level, some indicators lend themselves to reporting at the ecozone level or the provincial/territorial level. The indicators are not intended to assess sustainability directly at a local or forest management unit level. However, in the past, the CCFM C&I framework has provided a starting point for sub-national C&I frameworks, and it should continue to do so with the revised indicators.

The revised indicators recommended by the TWGs should provide indicators that are more suitable and functional for the values, issues and concerns that have been identified. However, the framework should still be viewed as a flexible framework within which to capture the diverse ecological, social, economic and cultural conditions in Canada. The indicators still need to be interpreted within the context of the different jurisdictions, legislations and policies of the provinces and territories. This was sometimes beyond the capacity of the TWGs, but can be addressed by the C&I Task Force members and their respective governments. The indicators must be made to reflect adequately the range of forest conditions across Canada. It is recognized as well that the implementation process across Canada may not necessarily be uniform, because of differences in the availability of data, expertise and resources.

The TWGs were not given the mandate to revise the criteria. However, slight wording changes have been suggested to shorten the criteria names and eliminate any implied desired future condition. These suggestions improve naming consistency between the criteria and indicators, but do not change the meaning of the criteria in any substantial way.

Internationally, Canada has been actively involved in the "Montreal Process", an indicator initiative aimed at defining criteria and indicators for boreal and temperate forests worldwide. During the review process, the TWGs carefully examined the Montreal Process indicators. The recommended revised indicators are compatible with 52 of the Montreal Process's 67 indicators, while at the same time providing more detail and precision on values of importance to Canada. This will facilitate Canada's international reporting and will provide a basis for any future cooperation on developing and revising international criteria and indicators.

This document lists the revised indicators that the Technical Working Groups are submitting to the C&I Task Force for consideration in revising the CCFM C&I Framework. Task Force members should also consult two appendices that accompany this submission, which describe the indicators in detail and the links between the revised indicators, the 1995 CCFM C&I and the Montreal Process C&I. In addition, detailed documentation on the review process and any documentation produced in the TWG meetings will be made available to the Task Force.

Criterion 1: Biological Diversity

The variability among living organisms and the ecosystems of which they are part

Biodiversity encompasses organization at levels ranging from complete ecosystems to the chemical structures that are the basis of heredity. Maintenance of natural genetic and ecosystem diversity across the landscape is the key to ensuring that species maintain viability through their capacity to evolve and adapt to change. Maintenance of the natural range of ecosystems, and the ability of their components to react to external forces and processes, provides the equilibrium required for the maintenance of species diversity. Diversity is therefore inseparable from the generation and maintenance of ecological patterns. Impacts are evaluated through vulnerability assessments which may, in turn, suggest change in the ways forests are managed, or even suggest that action be taken in respect of the restoration of biodiversity.

Element 1.1: Ecosystem diversity

Ecosystem diversity is the variety and pattern of communities and ecosystems. Maintenance of the variety and quality of the earth's ecosystems is necessary for the preservation of species. Without sufficient quantities of their natural habitats, species become vulnerable.

Element 1.2: Species diversity

The greatest and most readily recognizable form of biological depletion lies with species extinction. Slowing down the rate of species extinction due to anthropogenic factors is a key objective for the conservation of biodiversity. Changes in species population levels may also provide an early warning of changes in ecosystem integrity.

Element 1.3: Genetic diversity

Genetic diversity, or the variation of genes within a species, is the ultimate source of biodiversity at all levels. It is the material upon which the agents of evolution act. Loss of variation may have negative consequences for fitness and prevent adaptive change in populations.

Links to indicators under other criteria

Additional insight into the pattern and variety of communities and ecosystems can be found by an examination of the additions and deletions of forest area, by cause (indicator 2.2). In particular, the area of linear features like roads, may help provide an indication of habitat fragmentation. The pattern and variety of forest types and age classes is also linked to disturbance regimes, with spatial and temporal patterns of fires, harvesting and insect defoliation often driving the distribution of age classes and forest types (indicator 2.3).

Strong relationships between species diversity and ecosystem productivity (indicator 2.1) are also quite common in many ecosystems and should be considered when discussing species diversity.

Similarly, species and genetic diversity may also be influenced by regeneration after harvest, particularly if the area is replanted with exotic species (indicator 2.5). Some exotic species may compete with, interbreed with, or displace native species.

Finally, forested parks and protected areas often provide recreational, preservation and other non-timber benefits (e.g. eco-tourism). The forested area in parks and protected areas can be an important aspect in discussions on benefits (indicators 5.1.7, 5.2.1).

Indicators:

Element 1.1: Ecosystem diversity

- 1.1.1 Area of forest, by type and age class, in each ecozone. (*Core Indicator*)
- 1.1.2 Area of forest, by type and age class, soil types and geomorphological feature types in protected areas. (*Core Indicator*)

Element 1.2: Species diversity

- 1.2.1 The status of forest-associated species at risk. (*Core Indicator*)
- 1.2.2 Population levels of selected forest-associated species. (*Core Indicator*)
- 1.2.3 Distribution of selected forest-associated species. (*Supporting Indicator*)
- 1.2.4 Number of invasive, exotic forest-associated species. (*Supporting Indicator*)

Element 1.3: Genetic diversity

- 1.3.1 Genetic diversity of reforestation seed-lots. (*Core Indicator*)
- 1.3.2 Number of *in situ* and *ex situ* conservation efforts for commercial and endangered tree species within each ecozone. (*Core Indicator*)

Links to indicators under other criteria

- 2.1 Total growing stock of both merchantable and non-merchantable tree species on forest land.
- 2.2 Additions and deletions of forest area, by cause.
- 2.3 Area of forest disturbed by fire, insects, pests, disease and timber harvest.
- 2.5 Proportion of timber harvest area successfully regenerated.
- 5.1.7 Contribution of forest-based services to the gross domestic product.
- 5.2.1 Forest area by timber tenure

Criterion 2: Ecosystem Condition and Productivity

The health, vitality and rates of biological production in forest ecosystems

The sustainable development of a system is dependent upon normal functioning over the long term. In a living system, normal functioning implies appropriate levels of health, vitality and productivity of its components.

Relative freedom from stress (health) and relative level of physical/biological energy (vitality) within a forest ecosystem, together provide an indication of ecosystem condition. Forest productivity refers to rates of flora and fauna production, which depend on the degree to which nutrients, water and solar energy are absorbed and transferred within the ecosystem. Sustainable productivity within a forest ecosystem is dependent upon the ability of the ecosystem's components and their populations to recover from or adapt to disturbances, whether they be natural or human-induced. A healthy and diverse ecosystem is better able to respond to and recover from changes in its environment.

While most disturbance and stress events are fundamental to the recovery and maintenance of forested ecosystems, others may overwhelm an ecosystem's resilience, alter ecosystem patterns and processes, or affect forest health. Measures of long-term forest land conversion, major biotic and abiotic stresses, and impairment of forest function due to pollutants or drought, provide an indication of disturbance and stress, which may negatively or positively affect forest condition over time. This provides a basis for improved decision making in managing forests as a renewable resource. Measures of successful regeneration after harvest assess the effect of human efforts to assist the forest ecosystem's ability to recover from disturbance, while measures of total growing stock on all forest lands provide an indication of the balance of forest productivity and disturbances. Ecosystem condition and productivity are typically closely linked. Ecosystem condition may decline, though, if benefits from timber production are given priority.

Links to indicators under other criteria

Ecosystem condition and productivity is linked to biological diversity in many ways. For example, the ability of a forest ecosystem to recover from disturbance is influenced by the distribution of forest types and age classes. A healthy and diverse ecosystem (indicator 1.1.1) is better able to respond to and recover from changes in its environment. Likewise, changes in ecosystem productivity are often linked to changes in species diversity (indicators 1.2.1 and 1.2.2).

Ecosystem condition and productivity is also linked to soil conservation in many ways. Soil disturbance beyond locally applicable standards (indicators 3.1 and 3.2) can reduce future productivity. Long-term deletions of forest area to roads, mines, reservoirs, etc, can result in the loss of productive soil.

Net productivity is also linked to changes in forest ecosystem carbon (Indicator 4.1.1), and the sustainability of benefits from timber harvests (indicators 5.1.1 and 5.3.1) and other forest values (indicators 5.1.4 and 5.1.7).

These relationships should be considered when discussing ecosystem condition and productivity.

Indicators:

- 2.1 Total growing stock of both merchantable and non-merchantable tree species on forest land. (*Core Indicator*)
- 2.2 Additions and deletions of forest area, by cause. (*Core Indicator*)
- 2.3 Area of forest disturbed by fire, insects, pests, disease and timber harvest. (*Core Indicator*)
- 2.4 Area of forest with impaired function due to drought, ozone and acid rain. (*Core Indicator*)
- 2.5 Proportion of timber harvest area successfully regenerated. (*Core Indicator*)

Links to indicators under other criteria

- 1.1.1 Area of forest, by type and age class, in each ecozone.
- 1.2.1 The status of forest-associated species at risk.
- 1.2.2 The population levels of selected forest-associated species.
- 3.1 Rate of compliance with locally applicable soil disturbance standards.
- 3.2 Rate of compliance with locally applicable road construction, stream crossing and riparian zone management standards.
- 4.1.1 Net change in forest ecosystem carbon.
- 5.1.1 Contribution of timber products to the gross domestic product.
- 5.1.4 Contribution of non-timber forest products to the gross domestic product.
- 5.1.7 Contribution of forest-based services to the gross domestic product.
- 5.3.1 Annual harvest of timber relative to the level of harvest deemed to be sustainable.

Criterion 3: Soil and Water

The quantity and quality of soil and water.

Soil and water are essential components of forests, sustaining the functioning and productive capacity of forest ecosystems. Criterion 3 discusses the conservation of soil and water resources. The primary reason for soil conservation is the maintenance of the living substrate for forest stands, whereas water conservation is important for the provision of potable water for humans and wildlife and the provision of suitable aquatic environments for plants and animals.

The construction of access roads and other forestry practices may impact on the quantity and quality of soil and water in a number of ways. These include soil erosion and compaction, siltation of aquatic habitats, flooding and increased water temperatures. The rapid regeneration of forests following timber harvesting is essential for maintaining moisture and nutrient levels in the soil, minimizing disruptions in stream flow rates and timing and minimizing soil erosion, stream siltation and downstream water quality effects.

While many of the potential impacts of forestry practices on soil and water quantity and quality are understood, national scale, quantitative indicators of the impacts are difficult to develop and implement. In order to ensure that terrestrial and aquatic ecosystems are maintained, jurisdictions

have enacted policies, guidelines and standards to provide for specific management practices or the protection of sensitive sites. Indicators of compliance with locally applicable soil disturbance standards and road construction, stream crossing and riparian zone management standards can provide an effective measure of the impact of forestry practices on soil and water conservation, provided the standards are periodically updated and supported by ongoing long-term research. Compliance with guidelines and standards is most useful when those standards are based upon the best available scientific knowledge.

Links to indicators under other criteria.

Research is a necessary adjunct to policies, guidelines and standards on soil and water conservation. Information on the number of new or updated standards, particularly related to soil and water conservation (indicator 6.5.4) and on investment in forest research and development (indicator 6.5.3) appears under criterion 6. Information on new or updated soil and water conservation standards and on related research should be considered when assessing compliance with various soil and water standards.

Indicators under several other criteria also provide additional information in relation to soil and water conservation. Indicator 1.1.2 provides information on the area of different soil types in protected areas. Indicator 2.2 provides important information on the loss of productive soil from the forest area. In this regard, it is important to remember that a loss of forest cover does not necessarily result in a loss of productive soil. For example, the loss of forest area to roads is an important concern because it is often difficult to reclaim these areas. On the other hand, loss of forest area to power transmission corridors may be of less concern from the point of view of soil and water conservation, as the soil likely remains productive. Indicator 2.4 provides information on the area of forest land impacted by acid rain, a pollutant that can have serious impacts on soil and water quality. All of these indicators should be considered when discussing soil and water conservation.

Indicators:

- 3.1 Rate of compliance with locally applicable soil disturbance standards. (*Core Indicator*)
- 3.2 Rate of compliance with locally applicable road construction, stream crossing and riparian zone management standards. (*Core Indicator*)
- 3.3 Proportion of watersheds with substantial stand-replacing disturbance in the last 20 years. (*Potential Indicator*)

Links to indicators under other criteria

- 1.1.2 Area of forest, by type and age class, soil types and geomorphological feature types in protected areas.
- 2.2 Additions and deletions of forest area, by cause.
- 2.4 Area of forest with impaired function due to drought, ozone and acid rain.
- 6.5.3 Investment in forest research, timber products industry research and development, and education.
- 6.5.4 Number of new or updated forest management guidelines and standards related to ecological issues.

Criterion 4: Role in Global Ecological Cycles

The impact of the forest and forest activities on global ecosystem functions

Global ecological cycles are a complex of self-regulating processes responsible for recycling the earth's limited supply of water, carbon, nitrogen and other life-sustaining elements. The world's forests are critically dependent upon, and make substantial contributions to, these global processes.

The indicators under this criterion primarily deal with the role of forests and the forest sector in the global carbon cycle. Indicators related to hydrological cycles can be found under other criteria. Indicators on global energy cycles and global nitrogen cycles were considered, but, the significance of the impact of forest management on these cycles is unclear.

Element 4.1: Carbon Cycle

Concentrations of greenhouse gases in the atmosphere are increasing as a result of human activities. While the impact is not known with certainty, it is believed that humans are having a discernible influence on the global climate, and that future effects will be potentially more serious. The major source of emissions is the burning of fossil fuels, and the major greenhouse gas in terms of volume emitted is carbon dioxide. Global ecological cycles are believed to be negatively affected by the accelerated release of CO₂ into the atmosphere. Estimates of the total carbon stored in Canada's forests and the balance between carbon sequestration and carbon release from forests and forest products provide indicators of the nation's contribution to atmospheric carbon. Measures of forest sector CO₂ emissions are used to track the industry's reliance on fossil fuels for conversion of raw materials to manufactured products.

Links to indicators under other criteria

Forests make a major positive contribution to global cycles through the uptake and storage of carbon. The longevity and large area of standing crops make forest ecosystems particularly well adapted to long-term positive carbon balance. Conversely, conversion of forest lands to low biomass, short-lived standing crops with rapid turnover rates, or the permanent removal of forest cover reduce the land's capacity to absorb and store carbon. For this reason, information on the area of forest, by type and age class, in each ecozone (indicator 1.1.1), additions and deletions to the forest area, by cause (indicator 2.2) and the area disturbed by fires, pests and harvesting (indicator 2.3) provide important supplemental information when discussing forest contributions to the global carbon budget.

Hydrological cycles are also a vital component of global ecological cycles. Information on the impact of forests and forest practices on hydrological cycles is provided by indicator 3.3, the proportion of watersheds with substantial stand-replacing disturbance in the last 20 years and indicator 5.3.7, the area of forest land managed primarily for the protection of domestic water supply.

Indicators:

Element 4.1: Carbon cycle

- 4.1.1 Net change in forest ecosystem carbon. (*Core Indicator*)
- 4.1.2 Forest ecosystem carbon storage by forest type and age class. (*Supporting Indicator*)
- 4.1.3 Net change in forest products carbon. (*Core Indicator*)
- 4.1.4 Forest sector carbon emissions. (*Core Indicator*)

Links to indicators under other criteria

- 1.1.1 Area of forest, by type and age class, in each ecozone.
- 3.3 Proportion of watersheds with substantial stand-replacing disturbance in the last 20 years.
- 5.3.7 Area of forest land managed primarily for the protection of domestic water supply.

Criterion 5: Economic and Social Benefits

Sustaining the flow of benefits from forests for current and future generations

Forests provide substantial commercial benefits, including timber, non-timber forest products, water and tourism, and significant non-commercial benefits, including wildlife, recreation, aesthetics, and wilderness values. Although not always measurable in monetary terms, all these

activities are highly valued by Canadians and provide significant benefits to Canadian society. The distribution of these benefits is a key aspect of social equity. Sustainable development requires that forests are managed to provide these goods and services over the long term.

Element 5.1: Economic benefits

Canadians receive many economic benefits from the forest. Timber products, non-timber forest products and forest-based services are produced, consumed, and traded internationally. Wealth from forest use flows to Canadians through the market economy (which can be measured with economic indicators such as gross domestic product) and through the subsistence economy (involving income in-kind from the extraction and use of fuel wood; building materials; meat, fish, and fur products; medicinals; ecosystem services like fresh water; etc.). The value of these goods and services and their contribution to the gross domestic product is the focus of this element.

Element 5.2: Distribution of benefits

Another important consideration for this criterion is the question of distribution of benefits. Sustainable development involves more than ensuring economic development. It also requires consideration of the way in which benefits from development are distributed to society. An examination of forest ownership and timber tenures and the distribution of key financial benefits provide important indicators of social equity. The revenue generated by Aboriginal businesses in the timber products industry is a potential indicator of the distribution of market-based economic benefits from the forest to Aboriginal peoples.

Element 5.3: Sustainability of benefits

In order to ensure that resources are conserved while still maintaining a satisfactory flow of benefits, efforts must be made to ensure that resource use is not allowed to exceed the long-term productive capacity of the resource base to provide a wide range of goods and services. Excessive rates of resource use are unsustainable and inconsistent with the concept of sustainable forest management. In order to ensure that economic benefits continue to flow to Canadians, it is vital that a fair and competitive investment climate be maintained within the forest sector. A competitive rate of return is essential if Canada's various forest-based industries are to attract the necessary capital for maintaining their capacity to create jobs and incomes for Canadians.

Non-timber forest products also need to be sustained. Many urban areas receive clean drinking water from forested areas, and the value of the water catchment and filtration abilities of forests can be considerable. The proper management of forests for this purpose is of great importance to Canadians.

Links to indicators under other criteria

Forested parks and protected areas often provide recreational, preservation and other non-timber benefits. The forest area in parks and protected areas (indicator 1.1.2) can be an important aspect in discussions on the distribution of benefits. Also of importance to the sustainability of benefits is the resilience and well-being of forest-based communities (indicators 6.3.1 to 6.3.4). Decision-making processes that do not consider social costs associated with community instability, do not contribute to the sustainable flow of benefits. Similarly, investment in forest research, timber products industry research and development, and education (indicator 6.5.3) is an important aspect of ensuring the continued sustainability of the economic activities based on our forests.

Indicators:

Element 5.1: Economic benefits

- 5.1.1 Contribution of timber products to the gross domestic product. (*Core Indicator*)
- 5.1.2 Value of secondary manufacturing of timber products per volume harvested. (*Supporting Indicator*)
- 5.1.3 Production, consumption, imports and exports of timber products. (*Supporting*)

- Indicator*
- 5.1.4 Contribution of non-timber forest products to the gross domestic product. (*Core Indicator*)
 - 5.1.5 Value of unmarketed non-timber forest products. (*Supporting Indicator*)
 - 5.1.6 Production, consumption, imports and exports of non-timber forest products. (*Supporting Indicator*)
 - 5.1.7 Contribution of forest-based services to the gross domestic product. (*Core Indicator*)
 - 5.1.8 Value of unmarketed forest-based services. (*Supporting Indicator*)

Element 5.2: Distribution of benefits

- 5.2.1 Forest area by timber tenure. (*Core Indicator*)
- 5.2.2 Distribution of financial benefits from the timber products industry. (*Core Indicator*)
- 5.2.3 Revenue generated by Aboriginal businesses in timber products industry. (*Potential Indicator*)

Element 5.3: Sustainability of benefits

- 5.3.1 Annual harvest of timber relative to the level of harvest deemed to be sustainable. (*Core Indicator*)
- 5.3.2 Annual harvests of non-timber forest products relative to the levels of harvests deemed to be sustainable. (*Supporting Indicator*)
- 5.3.3 Return on capital employed. (*Core Indicator*)
- 5.3.4 Productivity index. (*Supporting Indicator*)
- 5.3.5 Employment. (*Core Indicator*)
- 5.3.6 Average income in major employment categories. (*Supporting Indicator*)
- 5.3.7 Area of forest land managed primarily for the protection of domestic water supply. (*Core Indicator*)

Links to indicators under other criteria

- 1.1.2 Area of forest, by type and age class, soil types and geomorphological feature types in protected areas.
- 6.3.1 Economic diversity index of forest-based communities.
- 6.3.2 Education attainment levels in forest-based communities.
- 6.3.3 Employment rate in forest-based communities.
- 6.3.4 Incidence of low income in forest-based communities.
- 6.5.3 Investment in forest and timber products industry research and development, and education.

Criterion 6: Society's Responsibility

Fair, equitable, and effective resource management choices

The concept of sustainable development transcends biological, ecological, and economic benchmarks. Ultimately it is about people. It is about society's values, the quality of life of members of society both individually and collectively, and the effectiveness with which we have organized ourselves as a society to ensure that we are managing the relationship between ourselves and our resources in a way that is in the best interests of present and future generations. Thus, this criterion concerns the effectiveness of institutions in managing resources in ways that accurately reflect social values, the responsiveness of institutions to change as social values change, how we deal with the special and unique needs of particular cultural and/or socio-economic communities, and the extent to which the allocation of our scarce resources can be considered to be fair, equitable, balanced, and just.

Element 6.1: Provision for duly established Aboriginal and treaty rights

Existing Aboriginal and treaty rights are recognized and affirmed in the Canadian Constitution. In order to ensure that duly established Aboriginal and treaty rights are respected, they should be

considered in the context of sustainable forest management. Various levels of government in Canada will aim to meet their legal obligations with respect to duly established Aboriginal and treaty rights in accordance with policy and legislation in their respective jurisdictions. When discussed in relation to renewable resources, such Aboriginal and treaty rights generally relate to hunting, fishing and trapping, and in some cases, gathering.

Forest policies, legislation and agreements related to forest management should be developed, as far as possible, with input from involved Aboriginal communities, as well as other affected groups and communities. The same is true for the forest management and planning processes. Forest management plans should reflect the options considered and actions taken with respect to duly established Aboriginal and treaty rights. Increasingly, Aboriginal people are also taking ownership of land, often as a result of resolved land-claims. Land ownership offers a level of control over resource access that does not exist on publicly owned lands or on co-managed lands.

Element 6.2: Aboriginal traditional land use and forest-based ecological knowledge

Aboriginal peoples possess a vast amount of traditional ecological knowledge related to the forest that has been passed down from generation to generation over the centuries. Efforts need to be made to use this knowledge in forest management planning. In some instances, Aboriginal people may also be compensated for the use of their traditional ecological knowledge when a third party uses that knowledge for profit.

Element 6.3: Forest community well-being and resilience

Sustainability can be viewed at a variety of scales. One important level for assessing sustainable development is at the community level. Unsustainable resource practices have the potential to result in high social costs concentrated among residents of rural communities. Decision-making processes that do not consider social costs associated with community instability, do not contribute to sustainable development. This element considers well-being and resilience of both Aboriginal and non-Aboriginal forest communities.

Element 6.4: Fair and effective decision-making

Decision-making is often complicated by cultural differences, conflicting economic interests, and differences in exposure to risks. Decision-making processes are embedded within the various institutions that have been established to manage and allocate forest resources. The extent to which these institutions effectively incorporate the full range of social values in decisions and the responsiveness of institutions to change in values over time are a determining factor in monitoring our progress toward sustainable development. Decisions are effective only if they are implemented. Compliance with laws and best management practices confirms that decisions have been implemented.

Element 6.5: Informed decision-making

Part of society's responsibility to sustainable development is a commitment to improve our collective understanding of ecosystems and the relationship between the environment and the economy. At the individual level it is important that we make an effort to learn and understand each other's perspectives relative to resource use and forest values and that individuals make an effort to become fully informed about the issues. Each and every member of society has an obligation and responsibility to understand the issues, express their position, and understand and respect the positions of others. At an institutional level, it is important that agencies responsible for forest management use the best available data, that this data is also made available to the public to increase transparency in forest management, that agencies continue to update or add to their forest management standards and these standards are supported by research.

Links to indicators under other criteria

An important aspect of forest community well-being and resilience is the proportion of managed public forest under some degree of community control. This information, captured under indicator 5.2.1 – Forest area by timber tenure, should be considered when discussing forest community well-being and resilience. In addition, aspects of forest community well-being and resilience are

also linked to indicators under element 5.3, especially indicators on annual harvests relative to the level deemed to be sustainable (indicators 5.3.1 and 5.3.2) and indicators on overall employment and average income in the forest sector (indicators 5.3.5 and 5.3.6). These indicators help to provide a measure of the availability of resources that provide employment at good wages.

Indicators:

Element 6.1: Provision for duly established Aboriginal and treaty rights

- 6.1.1 Extent of Aboriginal involvement in the development of policies, legislation and agreements related to forest management. *(Core Indicator)*
- 6.1.2 Extent to which forest planning and management processes consider and meet legal obligations with respect to duly established Aboriginal and treaty rights. *(Core Indicator)*
- 6.1.3 Area of forest land owned by Aboriginal peoples. *(Core Indicator)*

Element 6.2: Aboriginal traditional land-use and forest-based ecological knowledge

- 6.2.1 Number of traditional land use studies and the extent to which they are incorporated in forest management plans. *(Core Indicator)*
- 6.2.2 Aboriginal income derived from traditional ecological knowledge. *(Potential Indicator)*

Element 6.3: Forest community well-being and resilience

- 6.3.1 Economic diversity index of forest-based communities. *(Core Indicator)*
- 6.3.2 Education attainment levels in forest-based communities. *(Core Indicator)*
- 6.3.3 Employment rate in forest-based communities. *(Core Indicator)*
- 6.3.4 Incidence of low income in forest-based communities. *(Core Indicator)*

Element 6.4: Fair and effective decision-making

- 6.4.1 Proportion of participants who are satisfied with public involvement processes in forest management in Canada. *(Core Indicator)*
- 6.4.2 Rate of compliance with sustainable forest management laws, regulations and best management practices. *(Core Indicator)*

Element 6.5: Informed decision-making

- 6.5.1 Coverage, attributes, frequency and statistical reliability of forest inventories. *(Core Indicator)*
- 6.5.2 Availability of forest inventory information to the public. *(Core Indicator)*
- 6.5.3 Investment in forest research, timber products industry research and development, and education. *(Core Indicator)*
- 6.5.4 Number of new or updated forest management guidelines and standards related to ecological issues. *(Core Indicator)*

Links to indicators under other criteria

- 5.2.1 Forest area by timber tenure.
- 5.3.1 Annual harvest of timber relative to the level of harvest deemed to be sustainable.
- 5.3.2 Annual harvests of non-timber forest products relative to the levels of harvests deemed to be sustainable.
- 5.3.5 Employment.
- 5.3.6 Average income in major employment categories.

CCFM C&I REVIEW TECHNICAL WORKING GROUP MEMBERS

TWG 1: Conservation of Biological Diversity

Mr. Rory Thompson, Alberta Sustainable Resource Development (Chair)
Dr. Sherman Boates, Nova Scotia Department of Natural Resources
Dr. Brenda McAfee, Canadian Forest Service
Dr. Stephen Woodley, Canadian Heritage, Parks Canada
Mr. Ed Wiken, Wildlife Habitat Canada
Mr. Gary Merkel, Forest Innovations
Dr. John Innes, University of British Columbia
Mr. Rick Bonar, Weldwood of Canada, Ltd.

TWG 2: Maintenance and Enhancement of Forest Ecosystem Condition and Productivity

Mr. Dwayne Dye, Saskatchewan Environment and Resource Management (Chair)
Mr. Dave Fong, Newfoundland and Labrador Department of Forest Resources and Agri-foods
Mr. Brian Haddon, Canadian Forest Service
Mr. Roj Miller, Ontario Ministry of Natural Resources
Ms. Danielle Cantin, IUCN – The World Conservation Union
Mr. Tony Mercredi, Consultant, First Nations Issues
Dr. Daniel Kneeshaw, Université du Québec à Montréal
Dr. Brian Kotak, Tembec Paper Group.

TWG 3: Conservation of Soil and Water Resources

Dr. Len Moores, Newfoundland and Labrador Department of Forest Resources and Agri-foods (Chair)
Dr. Celina Campbell, Canadian Forest Service
Dr. Patrick Nantel, Canadian Forest Service
Dr. Mike Curan, BC Ministry of Forests
Mr. Jean-Pierre Jété, Ministère des ressources naturelles du Québec
Dr. Stephen Yamasaki, Canadian Parks and Wilderness Society – Montreal Chapter
Mr. Henry Lickers, Mohawk Council of Akwesasne
Dr. Jim Fyles, McGill University
Mr. Mark Hubert, Forest Products Association of Canada

TWG 4: Forest Ecosystem Contributions to Global Ecological Cycles

Mr. Tom Niemann, BC Ministry of Forests (Co-chair)
Mr. Rory Thompson, Alberta Sustainable Resource Development (Co-chair)
Mr. Ed Banfield, Canadian Forest Service
Dr. Jagtar Batti, Canadian Forest Service
Dr. Wenjun Chen, Canada Centre for Remote Sensing
Dr. Dave Spittlehouse, BC Ministry of Forests
Dr. Ted Hogg, Canadian Forest Service
Mr. Michel Campagna, Ministère des ressources naturelles du Québec

TWG 5: Multiple Benefits of Forests to Society

Mr. Tom Niemann, BC Ministry of Forests (Chair)
Mr. Peter MacQuarrie, Nova Scotia Department of Natural Resources
Mr. Laurie Gravelines, Ontario Ministry of Natural Resources
Mr. René Samson, Canadian Forest Service
Mr. Martin von Mirbach, Sierra Club of Canada
Mr. Duane Hiebert, Prince Albert Grand Council
Dr. Gary Bull, University of British Columbia
Mr. Rick Groves, Tembec Industries Inc.

TWG 6: Review: Accepting Society's Responsibility for Sustainable Development

Mr. Dan Cooligan, Ontario Ministry of Natural Resources (Chair)

Mr. Neil Simon, Newfoundland and Labrador Department of Forest Resources and Agri-foods
Ms. Jennifer Dunlap, New Brunswick Department of Natural Resources and Energy
Dr. John Parkins, Canadian Forest Service

Dr. Luc Bouthillier, Laval University
Mr. Tom Tevlin, Forest Alliance of British Columbia

EXTERNAL ADVISORS

Dr. Vic Adamowicz, University of Alberta
Dr. Peter Duinker, Dalhousie University.

CRITERIA AND INDICATORS FRAMEWORK

Technical Working Groups' Recommended Indicators

1 BIOLOGICAL DIVERSITY

1.1

Ecosystem Diversity

1.1.1

Area of forest, by type and age class, in each ecozone

1.1.2

Area of forest, by type and age class, soil types and geomorphological feature types in protected areas

1.2

Species Diversity

1.2.1

The status of forest-associated species at risk

1.2.2

Population levels of selected forest-associated species

1.2.3

Distribution of selected forest-associated species

1.2.4

Number of invasive, exotic forest-associated species

1.3

Genetic Diversity

1.3.1

Genetic diversity of reforestation seed-lots

1.3.2

Number of *in situ* and *ex situ* conservation efforts for commercial and endangered tree species within each ecozone

2 ECOSYSTEM CONDITION AND PRODUCTIVITY

2.1

Total growing stock of both merchantable and non-merchantable tree species on forest land

2.2

Additions and deletions of forest area, by cause

2.3

Area of forest disturbed by fire, insects, pests, disease and timber harvest

2.4

Area of forest with impaired function due to drought, ozone and acid rain

2.5

Proportion of timber harvest area successfully regenerated

3 SOIL AND WATER

3.1

Rate of compliance with locally applicable soil disturbance standards

3.2

Rate of compliance with locally applicable road construction, stream crossing and riparian zone management standards

3.3

Proportion of watersheds with substantial stand-replacing disturbance in the last 20 years

4 ROLE IN GLOBAL ECOLOGICAL CYCLES

4.1

Carbon cycle

4.1.1

Net change in forest ecosystem carbon

4.1.2

Forest ecosystem carbon storage by forest type and age class

4.1.3

Net change in forest products carbon

4.1.4

Forest sector carbon emissions

1.1.1

Core

1.1.1

Supporting

1.1.1

Potential

CRITERIA AND INDICATORS FRAMEWORK

Technical Working Groups' Recommended Indicators

ECONOMIC AND SOCIAL BENEFITS

5.1 Economic Benefits

5.1.1

Contribution of timber products to the gross domestic product

5.1.2

Value of secondary manufacturing of timber products per volume harvested

5.1.3

Production, consumption, imports and exports of timber products

5.1.4

Contribution of non-timber forest products to the gross domestic product

5.1.5

Value of unmarketed non-timber forest products

5.1.6

Production, consumption, imports and exports of non-timber forest products

5.1.7

Contribution of forest based services to the gross domestic product

5.1.8

Value of unmarketed forest-based services

5.2 Distribution of benefits

5.2.1

Forest area by timber tenure

5.2.2

Distribution of financial benefits from the timber products industry

5.2.3

Revenue generated by Aboriginal businesses in timber products industry

5.3 Sustainability of benefits

5.3.1

Annual harvest of timber relative to the level of harvest deemed to be sustainable

5.3.2

Annual harvests of non-timber forest products relative to the levels of harvests deemed to be sustainable

5.3.3

Return on capital employed

5.3.4

Productivity index

5.3.5

Employment

5.3.6

Average income in major employment categories

5.3.7

Area of forest land managed primarily for the protection of domestic water supply

SOCIETY'S RESPONSIBILITY

6.1 Provision for duly established Aboriginal and treaty rights

6.1.1

Extent of Aboriginal involvement in the development of policies, legislation and agreements related to forest management

6.1.2

Extent to which forest planning and management processes consider and meet legal obligations with respect to duly established Aboriginal and treaty rights

6.1.3

Area of forest land owned by aboriginal peoples

6.2 Aboriginal traditional land-use and forest-based ecological knowledge

6.2.1

Number of traditional land use studies and the extent to which they are incorporated in forest management plans

6.2.2

Aboriginal income derived from traditional ecological knowledge

6.3 Forest community well-being and resilience

6.3.1

Economic diversity index of forest-based communities

6.3.2

Education attainment levels in forest-based communities

6.3.3

Employment rate in forest-based communities

6.3.4

Incidence of low income in forest-based communities

6.4 Fair and effective decision-making

6.4.1

Proportion of participants who are satisfied with public involvement processes in forest management in Canada

6.4.2

Rate of compliance with sustainable forest management laws, regulation and best management practices

6.5 Informed decision-making

6.5.1

Coverage, attributes, frequency and statistical reliability of forest inventories

6.5.2

Availability of forest inventory information to the public

6.5.3

Investment in forest research, timber products industry research and development, and education

6.5.4

Number of new or updated forest management guidelines and standards related to ecological issues

1.1.1

Core

1.1.1

Supporting

1.1.1

Potential