

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

RESULTS OF TECHNICAL WORKING GROUP CHAIRS' MEETING
OCTOBER 9 - 11, 2002, EDMONTON, ALBERTA



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

SUMMARY OF INDICATOR COMPILATION AND INTEGRATION BY TWG CHAIRS

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INTRODUCTION:

On March 15, 2002, five Technical Working Groups (TWG) for reviewing the indicators in the Canadian Council of Forest Ministers' (CCFM) framework of Criteria and Indicators (C&I) of Sustainable Forest Management met for the first time via web conference. The objective of this meeting was to define the scope of the work to the TWG members and provide the necessary background information. Each Technical Working Group was assigned the task of refining the indicators under one of Criteria 1, 2, 3, 5 or 6 in the CCFM C&I framework. At this meeting, members were asked to individually produce a preliminary list of indicators for their criterion.

On April 25th and 26th 2002, five Technical Working Groups met for the second time in Ottawa. The goal of this meeting was to sort through an initial list of draft indicators that each group had put together earlier in April and reduce the list to less than 20 potential indicators per criterion. Participants were given a list of attributes that each indicator should possess, and each group was asked to describe the rationale for the indicator and give measurement units.

The groups were also asked to try and provide additional information for each indicator, including approaches to measurement, interpretation, benchmarks, and links to other C&I processes. Some groups were able to provide more of this information than others. By the end of the meeting, each group had compiled a list of indicators with additional information.

During the summer, each group worked on their own, meeting several times by email or teleconference, to further refine their indicators. The groups came back together for a third and final time in Halifax on August 26th & 27th, 2002. The objective of this meeting was to finalize the list of recommended indicators for each criterion. While most TWGs did conclude their work at the meeting, some groups met by email or teleconference during the month following the Halifax meeting to tie up loose ends with their indicators. In September, each TWG chair submitted their group's recommended set of indicators to the C&I Secretariat for compilation.

On October 7th & 8th, 2002, a working group of six technical experts, co-chaired by Tom Niemann and Rory Thompson, assembled in Edmonton, Alberta to review the indicators under criterion 4. The group recommended a revised set of indicators for this criterion.

On October 9th – 11th, 2002, the Technical Working Group chairs met in Edmonton, Alberta with the expert advisors Dr. Peter Duinker and Dr. Vic Adamowicz to examine all of the indicator recommendations made by the five Technical Working Groups, plus the indicator recommendations made by the working group for criterion 4. At this meeting, the chairs and advisors looked for ways to assemble the six sets of indicator recommendations into a logical framework of six criteria and associated indicators. As might be expected, similar indicators were recommended by different TWGs, some TWGs recommended indicators for criteria other than their own, and each group had a slightly different approach to naming indicators. To build the separate recommendations into a single consistent framework, the chairs examined all of the indicators together, removed overlaps and/or redundancies in the indicators, reworded indicators for consistency, brevity or clarity, and moved indicators between elements or criteria. This document summarizes the outcome of this process.

Two additional documents accompany this document:

- 1) *“Technical Working Group draft recommendations for improved CCFM indicators for sustainable forest management: Detailed indicator descriptions”* provides a detailed description of each recommended indicator.
- 2) *“Technical Working Group draft recommendations for improved CCFM indicators for sustainable forest management: Links to the original CCFM C&I, the Montréal Process C&I and public values”* summarizes the relationship between the revised indicators and the original CCFM C&I, the Montréal Process C&I and the values expressed during the focus group research in December 2001.

CRITERIA	INDICATOR (as originally suggested by TWGs after Halifax meeting)	OUTCOME (from TWG chairs meeting in Edmonton)	RATIONALE ¹
1	Element 1.1 Ecosystem Diversity	Retained	
	1.1.1 Area of Forest Types	Combined with 1.1.2	Indicator 1.1.1 can be derived from a report on indicator 1.1.2, therefore it has been combined with indicator 1.1.2
	1.1.2 Area of age class by forest type	Combined with indicator 1.1.1	This indicator provides important information about the diversity of different forest types and habitat types. It also can be used to track changes in forest area over time. The Indicator name has been reworded to “Area of forest, by type and age class, in each ecozone” for clarity.
	1.1.3 Area of forest types in protected areas	Combined with 3.2.1	There are merits to placing this indicator in Criterion 1, because of its potential relationship to biodiversity conservation, or in Criterion 6, because protecting areas is a process that society undertakes, with the hope that it conserves biodiversity. In the end, it was kept in criterion 1 because people often associate protected areas with biodiversity conservation. In addition, this indicator has been combined with the recommended indicator 3.2.1 and reworded to “ Area of forest, by type and age class, soil types and geomorphological features in protected areas. The protection of soil types and geomorphological features, like the protection of forest types is a process that society undertakes with the hope of protecting a diversity of different features. The protection of these features has also been associated with biodiversity protection in some cases.
	1.1.4 Patch size distribution (disturbance and residual).	Not retained	Patch size distribution is one aspect of habitat fragmentation, which is often cited as a key cause of decline in species abundance. However, precise relationships with species diversity remain hypothetical and good data is difficult to acquire. Thus, while potentially useful, indicators of fragmentation require further development before they can be successfully implemented.
	1.1.5 Forest structure – Tree age class structure, size and life status (healthy, declining, dead).	Not retained	The importance of maintaining within stand variability to reduce conservation risk is recognized. However, this indicator is more appropriate for use at the local level than at the national level. In its current form, the indicator would be unwieldy for national level reporting; potentially requiring sample plots both pre- and post-disturbance in many stands across the country. Reporting would either require many tables of individual stand characteristics, or averaged results from across an ecozone or region. In either case, the indicator would likely lose clarity and meaning for most readers.
	1.1.6 Road corridors density	Incorporated under 2.1.3	This is an indirect indicator of the impacts of roads on access, productivity and fragmentation effects on biodiversity. It is not in and of itself a measure of ecosystem diversity. Instead, aspects of this indicator have been captured under indicator 2.1.3. When reporting on ecosystem diversity, linkages can be made to measurements of road area in indicator 2.1.3
	Element 1.2 Species Diversity	Retained	

¹ References to indicator numbers refer to the original numbering provided by the Technical Working Groups after the Halifax meeting in August.

	1.2.1 The status of forest-associated species at risk, Committee on the Status of Endangered Wildlife in Canada (COSEWIC) categories threatened, endangered or of special concern.	Retained, but name modified	This indicator will inform the reader of which species are at risk of becoming extinct/extant, which has a direct impact on species diversity. The indicator name has been shortened, however, to “The status of forest-associated species at risk”. Information on the COSEWIC categories will be included in the approaches to measurement section.
	1.2.2 Population levels for selected species (species at risk, economic, cultural significant species or indicator species).	Retained	This indicator provides important information about the population levels of species of significant interest. It will help to inform whether management actions are having an adverse effect on those populations. The name of the indicator has been modified to “population levels of selected forest-associated species”. Information on which species to measure will be placed in the approaches to measurement section. This indicator will help provide supporting information to indicator 1.2.1
	1.2.3 Distribution of species at risk, economic or cultural significant species and indicator species.	Retained	This indicator will provide supporting information for indicator 1.2.2. For brevity, the indicator has been renamed to “Distribution of selected forest-associated species”
	1.2.4 Number of exotic species by forest type.	Retained, but name reworded	This indicator was retained as a measure of the potential impact of exotic species on native species diversity. The indicator name has been reworded to “Number of invasive, exotic species.”
	1.2.5 Area replanted with exotic species	Incorporated under 2.3.1	Replanting harvested areas with exotic species may lead to serious impacts on native species diversity. However, while associated with biodiversity, the replanting of harvested areas with exotics is also related to ecosystem condition and productivity. Therefore, this indicator has been incorporated under indicator 2.3.1 – “Area of forest successfully regenerated”. When discussing species diversity in the indicator report, links will have to be made to indicator 2.3.1.
	Element 1.3 Genetic Diversity	Retained	
	1.3.6 hetero-zygosity of insitu population.	Revised	Indicator revised to “Genetic diversity of reforestation seed-lots.”
	1.3.7 Gene frequency	Revised	Indicator revised to “Number of <i>in situ</i> and <i>ex situ</i> conservation programs for major tree species within each ecozone.”
2	Element 2.1 Incidence of Disturbance and Stress (biotic and abiotic)	Not retained	Indicators under both this element and element 2.3 were all considered to be so closely related that separating them under different elements would not be fruitful.
	2.1.1 Percent and area of forest disturbed by natural events.	Retained but name reworded	Disturbance is a vital ecological process in Canadian forests. However, human influence has modified these processes, or added new disturbance processes to the landscape. This indicator tracks the level of some of the more significant disturbances in Canada’s forests. The indicator provides important information for decision makers and is of considerable interest to many Canadians. This indicator has been reworded, to make it more specific, to “Area of forest disturbed by fire, insects, pests, disease and timber harvest”. Note that this indicator does not track permanent/long-term conversion of forest due to anthropogenic causes. This is tracked under indicator 2.1.3.
	2.1.2 Percent and area of forest disturbed by anthropogenic activities.	Retained but name reworded	The impairment of forest condition and productivity due to various natural and human causes is of interest to decision makers and Canadians in general. This indicator name has been modified to make it more specific to “Area of forest with impaired function due to drought, ozone and acid rain.”

	2.1.3 Percent and area of forest permanently disturbed by anthropogenic activities.	Retained but reworded	<p>Permanent, or very long-term, conversion of forested areas to non-forest has been captured, in part, by indicator 1.1.2. However, indicator 1.1.2 simply measures the total amount of forest cover. It is also important to measure the area disturbed by each of the major long-term anthropogenic disturbance agents, or visa versa, what areas of long-term anthropogenic disturbance are being converted back to forest. Different types of conversion may have different impacts on forestry and this indicator has relevance to other criteria. For example, conversion of forest to agriculture may remove forest cover, but may not seriously impact the ability of the soil to grow trees in the future, unlike, for example, conversion to mining, which may remove the surface soil. This is relevant to the conservation of soil and water resources (criterion 3). Likewise, the area of forest converted to roads may have implications for the conservation of biodiversity (criterion 1). This indicator has been reworded to “area of forest lost to, and recovered from long-term anthropogenic disturbance”.</p> <p>This indicator has also been moved to be the first indicator in this element, leading to a sequence of indicators dealing with area of long-term stand replacing disturbance, area of temporary stand-replacing disturbance and area of forest impairment.</p>
	2.1.4 Percent and area of forest not disturbed by anthropogenic activities.	Not retained	This indicator was considered redundant since it can be derived from indicators 2.1.1, 2.1.2 and 2.1.3
	2.1.5 Percent and area of forest area affected by ozone exceeding the critical load.	Incorporated under indicator 2.1.2	Ozone can cause serious impairment of forest productivity. This measure has been incorporated into indicator 2.1.2
	2.1.6 Percent and area of forest area affected by wet sulfate deposition and nitrates (acid rain) exceeding the critical load.	Incorporated under indicator 2.1.2	Acid rain can cause serious impairment of forest productivity. This measure has been incorporated into indicator 2.1.2
	2.1.7 Percent and area of forest area affected by UVB based on the UV index.	Not retained	While it is thought that excessive UV light can negatively impact forest productivity and condition, the precise relationship between dosage and impact remains unclear. While this indicator, in its current form, would give some information on the exposure of forests to UV light, it would not provide sufficient insight into changes in condition or productivity to be useful at this time.
	Element 2.2 Climate Change	Not retained	This element was not retained as its indicators were incorporated elsewhere
	2.2.1 Percent change in number of extreme weather events.	Partially incorporated under indicator 2.1.2	This indicator does not function well as a measure of climate change. In part, this is because the relationship between weather events and climate change is extremely poorly understood, and in part, because “extreme” is difficult to define. Some weather events can, however, have significant impacts on forest condition and productivity. Some weather events, such as droughts, have been captured under indicator 2.1.2. For other events, such as ice storms, tornadoes, etc, it may be difficult to determine what constitutes extreme, or to determine the average frequency in order to detect change. Furthermore, such events may have only limited impact upon forest condition or productivity relative to other disturbance events, like fire, thus measuring them will provide little additional information.
	2.2.2 Degree-day Totals.	Partially incorporated under indicator 2.1.2	Changes in average temperature, degree day totals, and similar indicators are of importance to the condition and productivity of forests, this has been partially captured under indicator 2.1.2

	2.2.3 Annual precipitation.	Partially incorporated under indicator 2.1.2	Of more importance to forest productivity is the combined contributions of precipitation, evaporation and transpiration. This has been captured under indicator 2.1.2.
	Element 2.3 Ecosystem Productivity	Not retained	Indicators under both this element and element 2.1 were all considered to be so closely related that separating them under different elements would not be fruitful.
	2.3.1 Percent and area of harvest area successfully regenerated.	Retain, but modify	An important indicator and very much top of mind for Canadians. For reporting purposes, break down into area naturally regenerated, area artificially regenerated with planting or seeding and the area planted or seeded with exotic species. For consistency with other indicators, the indicator has been reworded to “Proportion of harvest area successfully regenerated.”
	2.3.2 Growth rates by forest type & age class by ecozone. (Potential indicator-dependent on the NFI.)	Retained but modified	This indicator was modified to be, “Total growing stock of both merchantable and non-merchantable tree species on forest land available for timber production.” The growth rates of forests are sometimes compared with the amount harvested as a measure of sustainability. However, the use of growth rates as a measure of sustainability is problematic because the growth rate slows as the forest ages. This can lead to the mistaken interpretation that large amounts of harvesting can occur in younger forests while little or no harvesting should occur in older forests. An indicator of total growing stock was considered to be more useful as an indicator as it can be related to the volume harvested each year, increases or decreases can be tracked over time, and it complements an indicator under criterion 5 called “Annual harvest of timber relative to the level of harvest deemed to be sustainable”.
3	Element 3.1 Status of Forest Soil and Water Resources	Not retained	Since indicators under element 3.2 were incorporated elsewhere in the framework, an element was not seen as necessary for this criterion.
	3.1.1 Forest area converted to a land-use that will degrade soil and water resources	Incorporated under indicator 1.1.2 and 2.1.3	This indicator has been incorporated under indicator 1.1.1 and 2.1.3. For reporting purposes, it will be important to ensure a distinction between land-use change that degrades soil, versus land-use change that reduces forest area but does not degrade soil.
	3.1.2 Proportion of harvested area occupied by permanent/long-term roads and associated disturbance,	Incorporated under indicator 1.1.1 and 2.1.3	The concept of efficiently harvesting forest by building as few roads and landings as possible is important. However, the problems with defining which roads are for forestry use and which are for other uses limits the interpretability of this indicator. This issue is also seen as a part of a larger issue of taking forest area out of production, which is addressed in indicator 1.1.1 and 2.1.3.
	3.1.3 Percentage of net harvested area (area to be reforested) in compliance with locally applicable soil disturbance standards	Retain	This indicator was changed from area in compliance to rate of compliance because the rate of compliance is something that is both measurable and can be related to enforcement effort to make it more meaningful. The concept of area in compliance would be very useful if there were not so many methodological problems. For example, if there are ruts in a cut block that do not meet local standards, is the entire cut block area out of compliance or is just the physical area of the ruts out of compliance.
	3.1.4 Rate of compliance with locally applicable road construction, stream crossing and riparian zone management standards	Retain	This indicator provides valuable proxy information on the impact of forest operations on water quality and quantity. It would be better to have information on actual water quality and quantity rather than compliance with standards, however, such data has proven to be very difficult and expensive to collect on a national basis.

	3.1.5 Area of forest land in which the level of acid deposition exceeds the critical load	Incorporated under indicator 2.1.2	While acid deposition can have serious implications for soil quality, the principle outcome of this is poor forest productivity. Therefore, this indicator has been incorporated into indicator 2.1.2
	3.1.6 Incidence of contamination of soil or water by toxic substances (except sediment)	Not retained	This indicator was not retained because it needs to be related to enforcement effort in order to be meaningful. Also, since most forest companies are already tracking this due to their ISO 14000 requirements, the incidence of contamination by accidents or spills is generally very small. Therefore, including this indicator within the CCFM C&I Framework will likely add little additional knowledge to our understanding of sustainable forest management.
	3.1.7 Percentage of managed forest area having slash and coarse woody debris retention guidelines that recognize the importance of these materials in maintaining soil quality and biodiversity	Not retained	While this indicator does address an important concept, it was not retained because it is so difficult to consistently measure. For this indicator, each jurisdiction is likely to claim to have such guidelines, even if the guidelines only marginally touch on the importance of coarse woody debris for soil quality and biodiversity. Therefore, this indicator would most likely always be close to 100% and would never go down. This limits its applicability to sustainable forest management.
	Element 3.2 Evaluating the Effectiveness of Soil and Water Standards	Not retained	Element 3.2 was not retained because the indicators under it were incorporated elsewhere.
	3.2.1 Percentage of soil and watershed types represented in protected areas, by ecoregion	Incorporated under indicator 1.1.3	The proportion of soil types in protected areas has been incorporated under indicator 1.1.3. The concept of “watershed types” was not incorporated under 1.1.3 because the term is still vague and the concept needs development.
	3.2.2 Number of long-term and adaptive management studies that test standards and/or address information gaps on the effects of forest management on soil and water.	Partially incorporated under indicator 6.5.3	While this is an important concept, it was felt that it is better to measure the country’s institutional capacity to undertake research on a wide variety of forest related issues. In reporting on this indicator, it may be possible to address whether a wide variety of standards are being tested, not just soil and water standards. Because this indicator has broad scope, because it addresses institutional capacity, and because it addresses a societal process, it was incorporated under criterion 6 under the indicator “Investment in research and development and education”
4	Element 4.1 Forest Land Area	Not retained	This element was not retained because the indicators under it were incorporated under other elements.
	4.1.1 Total forest area, specifically identifying peatlands and forested permafrost areas	Incorporated under indicator 1.1.1 and 2.1.3	Tracking forest area is important for carbon budget accounting. However, because of its importance to biodiversity conservation and ecosystem condition and productivity, it will be tracked under indicator 1.1.1 and 2.1.3. The tracking of peatlands and forested permafrost is important for carbon accounting as large changes in these areas will have significant impacts on carbon stocks. However, this can be mentioned in the report on carbon stocks if it leads to significant changes and need not be tracked as a separate indicator.
	4.1.2 Changes in forest area	Not retained	This indicator was recommended by working group 4 because of its importance to tracking carbon accounting. Changes in forest area will be captured under indicator 1.1.2 and 2.1.3. Information on the major causes of change in carbon storage can be also be addressed in the text of the report on criterion 4, or readers can be directed to more detailed publications.
	Element 4.2 Carbon cycle	Retained	The Carbon cycle is the only global ecological cycle being addressed under this criterion, therefore the element name has been retained to show that. Other cycles, such as hydrological cycles are addressed elsewhere in the framework.
	4.2.1 Net change in forest ecosystem carbon	Retained	This is information that is clearly of interest to Canadians and of increasing importance to sustainable forest management.

4.2.1 forest ecosystem carbon, by forest type and age class	Retained	This is information that is clearly of interest to Canadians and of increasing importance to sustainable forest management.
4.2.3 Net change in forest products carbon	Retained	This is information that is clearly of interest to Canadians and of increasing importance to sustainable forest management.
Element 4.3 Fossil carbon use and substitution	Merged with element 4.2	This element was not retained, but was merged with the element "Carbon cycle"
4.3.1 Forest sector carbon emissions	Retained	This is information that is clearly of interest to Canadians and of increasing importance to sustainable forest management.
4.3.2 Forest sector energy use	Not retained	The principle interest in energy use relates to carbon emissions generated during the production of that energy. Since carbon emissions are captured in indicator 4.3.1, this indicator was considered to add little additional information. Reference to forest sector energy use, however, may help when interpreting indicator 4.3.1
Element 4.4 Hydrological Cycles	Not retained	This element was not retained because the indicators under it were incorporated elsewhere in the framework
4.4.1 Moisture index	Incorporated under indicator 2.1.2	While moisture levels may change as a result of global cycles, or global climate change, it was felt that the main impact of this would be on forest condition or productivity. Therefore, this indicator was moved to criterion 2 and incorporated under indicator 2.1.2
4.4.2 proportion of forested watersheds with substantial stand replacing disturbance	Retained but moved to criterion 3.	This is an indicator is a proxy indicator for the impact of forest disturbance on water yield, timing and peak flows. This indicator is useful for the CCFM C&I framework because water yield, timing and peak flows are very difficult to collect on a national scale. While there are clear connections between this indicator and global hydrological cycles, it was felt that a stronger connection exists with criterion three and the impact of forest management on water resources. The indicator was also renamed to "proportion of watersheds with substantial stand-replacing disturbance in the last 20 years."
Element 4.5 Energy Cycles	Not retained	This element was not retained because the indicator was not retained.
4.5.1 Albedo	Not retained	While potentially an important concept, it is not clear what the significance of changes in albedo as a result of forest management are on global energy cycles.
Miscellaneous		
Soil Nutrition	Not retained	This indicator was not well enough developed to be retained
Scope, frequency and statistical reliability of forest inventories	Retained but moved to criterion 6	While good quality forest inventories are useful for carbon accounting they are also necessary for effective decision making of all kinds. Therefore, this indicator has been moved to criterion 6. Also, since "scope" refers to both geographic coverage and number of attributes, the indicator has been renamed to "Coverage, attributes, frequency and statistical reliability of forest inventories"
Availability of forest inventories to public	Retained but moved to criterion 6	While publicly accessible forest inventories are useful for carbon accounting, they are, more importantly, necessary for effective decision making of all kinds. Therefore, this indicator has been moved to criterion 6.
Number of people dependant of surface water that comes from forested regions	Reworded and moved to criterion 5	This indicator was reworded to "area of forest land managed primarily for the protection of domestic water supply" and placed under criterion 5 as a measure of socio-economic benefits

5	Element 5.1	Retained	Element renamed to “Economic benefits”
	Contribution to the national economy of timber products	Retained but reworded	Reworded to “Contribution of timber products to the Gross Domestic Product.” When reporting on this indicator, a distinction should be made between Aboriginal and non-Aboriginal contributions where possible (see indicator 6.3.6).
	Value of secondary manufacturing timber products	Retained but reworded	Reworded to “value of secondary manufacturing of timber products per volume harvested.” When reporting on this indicator, a distinction should be made between Aboriginal and non-Aboriginal contributions where possible (see indicator 6.3.6).
	Production, consumption and trade of timber products	Retained but reworded	Reworded to “Production, consumption, imports and exports of timber products.” When reporting on this indicator, a distinction should be made between Aboriginal and non-Aboriginal contributions where possible (see indicator 6.3.6).
	Price trends for selected timber products	Not retained	This indicator was not retained because price trends may or may not be related to forest management practices in Canada.
	Contribution to the national economy of non-timber forest products	Retained but reworded	Reworded to “Contribution of non-timber forest products to the Gross Domestic Product.” When reporting on this indicator, a distinction should be made between Aboriginal and non-Aboriginal contributions where possible (see indicator 6.3.6).
	Non-timber forest products that were not marketed, but are equivalent to goods available in a market	Retained but reworded	Reworded to “Value of unmarketed non-timber forest products.” When reporting on this indicator, a distinction should be made between Aboriginal and non-Aboriginal contributions where possible (see indicator 6.3.6).
	Supply and consumption/use of non-timber forest products	Retained but reworded	Reworded to “Production, consumption, imports and exports of non-timber forest products.” When reporting on this indicator, a distinction should be made between Aboriginal and non-Aboriginal contributions where possible (see indicator 6.3.6).
	Contribution to the national economy of forest-based services	Retained but reworded	Reworded to “Contribution of forest-based services to the Gross Domestic Product.” When reporting on this indicator, a distinction should be made between Aboriginal and non-Aboriginal contributions where possible (see indicator 6.3.6).
	Services that were not marketed, but are equivalent to services available in a market	Retained but reworded	Reworded to “Value of unmarketed forest-based services.” When reporting on this indicator, a distinction should be made between Aboriginal and non-Aboriginal contributions where possible (see indicator 6.3.6).
	Recreation and tourism in forested areas	Incorporated into indicator 5.1.7	The measurement of tourism and recreation in forested areas has been incorporated into the indicator, “Contribution of forest based services to the Gross Domestic Product”
	Carbon and other marketable eco-assets	Incorporated into new indicator 5.1.7	The measurement of carbon and other marketable eco-assets in forested areas has been incorporated into the indicator, “Contribution of forest based services to the Gross Domestic Product”
	Element 5.2	Retained	Element renamed to “Distribution of benefits”
	Land ownership / long-term tenure and land use	Retained but reworded to reduce scope	Reworded to “Forest area by timber tenure”. While an indicator of overall land ownership is valuable context information for users, the relative proportions of crown and private land are not going to change much into the near future. This information could be more useful if provided in the introduction to an indicator report as context information on land management in Canada. Therefore, this indicator has been scaled down to just deal with timber tenure. Users who are interested in land cover or protected areas can refer to indicator 1.1.2 or 2.1.3.
Areas of forest that are undisturbed by man, semi-natural and plantations	Not retained	The concepts measured by this indicator are captured by a number of other indicators, including 1.1.2, 1.1.3, 2.1.1, 2.1.2, 2.1.3, and 2.3.1	
Distribution of financial benefits from the timber products industry	Retained		
Element 5.3	retained	Element renamed to “Sustainability of benefits”	

Timber resource sustainability	Retained but reworded	Reworded to “Annual harvest of timber relative to the level of harvest deemed to be sustainable”. Also, the indicator was changed to measure the harvest relative to the AAC, rather than relative to the net growth, because of problems misinterpreting net growth (see indicator 2.3.2).
Timber resource supply	Not retained	It was felt that one indicator on timber sustainability was sufficient
Annual removal of non-timber forest products relative to the removals deemed sustainable	Retained but reworded	Reworded to “Annual harvests of non-timber forest products relative to the levels of harvest deemed to be sustainable”
Use of forest access roads for recreation and tourism	Incorporated under indicator 5.1.8	The concept of using the forest for recreation and tourism has been captured under indicator 5.1.8
Business viability	Retained but reworded	Reworded to “ return on capital employed”
Forest products index (Toronto Stock Exchange)	Not retained	This indicator was not retained because of the overlap with “Business viability”
Labour productivity	Retained but reworded	Retained, but reworded to “Productivity index.”
Expenditures by timber product industry on machinery	Not retained	This indicator was not retained because of the overlap with “business viability”
Employment	Retained	This information is of great interest to Canadians and is important for sustainable forest management
Proportion of full-time employment	Not retained	This indicator was not retained because its relationship to sustainable forest management was not clear. A reduction in full time staff is not necessarily undesirable, and the replacement of full-time staff at one company by contractors or consultants does not necessarily lead to a reduction in full time employment.
Average income in major employment categories	Retained	
Aboriginal businesses in the timber products industry	Retained but reworded	Reworded to “Revenue generated by Aboriginal businesses in timber products industry”. Also, this indicator has been moved to element 5.2 as it describes the distribution of timber benefits to Aboriginal peoples.
Changes in employment between the timber product industries and the non-timber and forest-based services industries	Not retained	The relative importance of these different industries has already been captured, in part, by indicators on their contribution to the economy. It was felt that this indicator would add little additional information.
Community resilience	Incorporated under criterion 6	The intent of this indicator is captured under the element “resiliency of forest communities” in criterion 6.
Number of Aboriginal communities located in forest	Incorporated under criterion 6	The number of Aboriginal communities located in forests will likely be used as a reference value in the discussions on community resilience indicators under criterion 6. Therefore, a specific measure of this was not retained as an indicator.
Viability and adaptability of communities dependent on timber products industry	Incorporated under criterion 6	The intent of this indicator is captured under the element “resiliency of forest communities” in criterion 6.
Income flows into, out of and within communities	Incorporated under criterion 6	The intent of this indicator is captured under the element “resiliency of forest communities” in criterion 6.
Element 5.4	Incorporated under criterion 6	Element not retained because its indicators were incorporated under criterion 6

	Investment in forest and timber products industry research and development, and education	Retained but moved to criterion 6	This indicator was moved to fall under element 6.5: “Informed decision making”. Now listed as indicator 6.5.3. When reporting on this indicator, special attention should be paid to R and D investments in areas where indicators have traditionally been difficult to measure, especially soil and water conservation and non-timber forest products. Also, case studies or examples of research where standards (e.g. guidelines, regulations, etc.) are being tested would be helpful.
	Forestry education	Not retained	Investment in education is important to ensure that we continue to derive many benefits from the forest. However, measuring the number of graduates from Canadian universities was not considered an adequate indicator since many of the people who work in sustainable forest management have degrees or training in disciplines other than forestry. Contributions to education are also an important part of informed decision-making and this has been captured in part under indicator 6.5.3.
6	Element 6.1 Provision for Duly Established Aboriginal and Treaty Rights within Forest Policy	Retained	
	6.1.1 Number of policies, legislation, and agreements related to forest management that were jointly developed and endorsed with Aboriginal leadership/organizations	Retained but reworded	The concept that this indicator is trying to capture is important but very difficult to quantify. It was felt that it was best to retain this as a qualitative indicator called, “Extent of Aboriginal involvement in the development of policies, legislation and agreements related to forest management”
	6.1.2 Rate of compliance with legal obligations with respect to duly established Aboriginal and Treaty Rights.	Retained but reworded	The concept that this indicator is trying to capture is important but very difficult to quantify. It was felt that it was best to go back to the original wording in the 1995 framework for this indicator, which is “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 Degree of Conflict on the basis of non-recognition of Aboriginal and Treaty Rights in Forest Management in Canada	Integrated with 6.6.1	The concept of conflict is very difficult to measure and may include anything from court challenges, to blockades, to disagreements in planning meetings. Furthermore, conflict may be a positive or negative aspect of forest management. Forest management nearly always involves some degree of conflict followed by a process in which parties hopefully achieve resolution. A measurement of satisfaction with the management process may therefore be a better indicator than a measure of the amount of conflict. A measure of satisfaction with forest management planning has been recommended for criterion 6. Indicator 6.6.1 will be modified to ensure it includes the satisfaction of Aboriginal participants in management processes
	Element 6.2 Participation by Aboriginal Communities in Sustainable Forest Management	Integrated with other elements	The indicators under this element were either merged with other indicators or not retained so the element was integrated with the element “Fair and effective decision making”.
	6.2.1 Percentage of forest-based Aboriginal communities who are satisfied with Aboriginal involvement processes in forest management in Canada	Merged with indicator 6.6.1	Because of there similarities, indicator 6.2.1 and 6.6.1 have been merged together into a single indicator. When reporting on this indicator, it will be important to report on both the Aboriginal and non-Aboriginal levels of satisfaction.
	6.2.2 Number of people dedicated to working with Aboriginal issues in forest management planning across First Nations, governments and industries.	Not retained	Ensuring that there are people from first nations, government and industry working with Aboriginal issues in forest management planning is important. However, the relationship between this indicator and sustainable forest management is unclear. For example, a decline in the number of people working with Aboriginal issues could indicate either a reduction in commitment to Aboriginal issues, or that issues are being resolved and less people are needed. The number of people could also fluctuate due to factors such as economic conditions or the overall size of government, which may not be indicative of any change in commitment or resolution of issues.
	Element 6.3 Sustainable Aboriginal Forest-Based Communities	Merged with element 6.5	This element was merged with element 6.5, “Resiliency of Forest Communities”

6.3.1	Employment rate in Aboriginal Forest-based communities	Retained but reworded	This indicator was retained but reworded to “Employment rate in Forest-based communities” to include both Aboriginal and non-Aboriginal communities. Aboriginal and non-Aboriginal communities should be distinguished in the indicator report.
6.3.2	Education attainment levels in Aboriginal forest-based communities	Merged with indicator 6.5.3	Because of their similarities, indicators 6.3.2 and 6.5.3 have been merged into a single indicator called “Education attainment levels in forest-based communities”. Aboriginal and non-Aboriginal communities should be distinguished in the indicator report.
6.3.3	Incidence of low income in Aboriginal forest-based communities	Merged with indicator 6.5.4	Because of their similarities, indicators 6.3.3 and 6.5.4 have been merged into a single indicator called “Incidence of low income in forest-based communities”. Aboriginal and non-Aboriginal communities should be distinguished in the indicator report.
6.3.4	Median Family income in Aboriginal forest-based communities	Not retained	This is an indicator of community resilience, however, indicators on economic diversity, employment rate, education levels and low income should be able to sufficiently capture the concept of community resilience.
6.3.5	Proportion of managed public forest area under some degree of Aboriginal community control.	Retained but reworded	This indicator was renamed to “Area of forest land owned by Aboriginal Peoples” and moved to element 6.1, “Provision for duly established Aboriginal and treaty rights”. In this way it provides a measure of the area over which Aboriginal peoples have sole control. Areas of co-management will be captured under the new indicator 5.2.1, “forest area by timber tenure”
6.3.6	Extent to which Aboriginal communities use forests for subsistence, commercial non-timber forest products, commercial forest products.	Incorporated under indicators 5.1.1 through 5.1.9	This indicator has a lot of overlap with indicators under element 5.1, which capture various aspects of the value of forest goods and services. When reporting on those indicators under element 5.1, the contribution of forest goods and services to Aboriginal communities should be identified where possible.
Element 6.4 Aboriginal Forest-Based Ecological Knowledge and Traditional Land Use		Retained	Reworded to “Aboriginal Traditional Land-Use and Forest-Based Ecological Knowledge” to correspond with order of core and supporting indicators.
6.4.1	Percent of forest area Aboriginal with traditional land use studies and the extent to which they are incorporated in forest management plans.	Retained but reworded	This indicator was retained, but reworded to “Number of traditional land use studies and the extent to which they are incorporated in forest management plans”. There are merits to reporting on the area with traditional land use studies, but it was felt that this would prove to be too difficult to measure so the number of studies is used instead.
6.4.2	Number of, and compliance with, protocol agreements with Aboriginal communities respecting Protection of Aboriginal Forest-Based traditional knowledge.	Replaced with new indicator	Protocol agreements are agreements between an Aboriginal party and another party regarding the use of Aboriginal traditional ecological knowledge. Since these agreements may not always be made public, it was felt that measuring the number of agreements and the compliance with those agreements would be very difficult. Instead, this indicator was replaced with a new indicator called, “Aboriginal income derived from traditional ecological knowledge”. This indicator measures the extent to which Aboriginal people have been compensated for the use of their traditional ecological knowledge by third parties, especially those third parties that derived a profit from that knowledge.
Element 6.5 Resiliency (Adaptive Capacity) of Forest Communities		Merged with element 6.3	Element reworded to “Forest community well-being and resilience”
6.5.1	Economic Diversity Index of forest-based communities	Retain	
6.5.2	Proportion of managed public forest area under some degree of community control.	Incorporated under indicator 5.2.1	This information is captured under the criterion 5 indicator “Forest area by timber tenure”

6.5.3	Education attainment levels in forest-based communities	Merged with indicator 6.5.3	Because of their similarities, indicator 6.3.2 and 6.5.3 have been merged into a single indicator called "Education attainment levels in forest-based communities". Both Aboriginal and non-Aboriginal communities should be identified in the indicator report.
6.5.4	Incidence of low income in forest-based communities	Merged with indicator 6.5.4	Because of their similarities, indicator 6.3.3 and 6.5.4 have been merged into a single indicator called "Incidence of low income in forest-based communities". Both Aboriginal and non-Aboriginal communities should be identified in the indicator report.
6.5.5	Median Family income in forest-based communities	Not retained	This is an indicator of community resilience, however, indicators on economic diversity, employment rate, education levels and low income should be able to sufficiently capture the concept of community resilience.
6.5.6	Personal Security Index	Not retained	This is an indicator of community resilience, however, indicators on economic diversity, employment rate, education levels and low income should be able to sufficiently capture the concept of community resilience.
6.5.7	Inequality Index	Not retained	This is an indicator of community resilience, however, indicators on economic diversity, employment rate, education levels and low income should be able to sufficiently capture the concept of community resilience.
Element 6.6 Fair and Effective Decision-Making		Retained	
6.6.1	Percentage of participants who are satisfied with public involvement processes in forest management in Canada	Retain	When reporting on this indicator, it will be important to distinguish both Aboriginal and non-Aboriginal levels of satisfaction. For consistency with other indicators in the framework, the indicator was renamed to "Proportion of participants who are satisfied with public involvement processes in forest management in Canada"
6.6.2	Degree of Conflict in Forest Management in Canada	Integrated with 6.6.1	The concept of conflict is very difficult to measure and may include anything from court challenges, to blockades, to disagreements in planning meetings. Furthermore, conflict may be a positive or negative aspect of forest management. Forest management nearly always involves some degree of conflict followed by a process in which parties hopefully achieve resolution. A measurement of satisfaction with the management process, such as indicator 6.6.1, may therefore be a better indicator than a measure of the amount of conflict. Also, since laws, regulations and best management practices are designed to try and promote fair and effective decision-making, A new indicator has been developed to replace the measurement of conflict. This indicator is called "Rate of compliance with sustainable forest laws, regulations and best management practices."
Element 6.7 Informed Decision Making		Retained	
6.7.1	Percentage of Population having minimum knowledge about forests, forest management and associated issues	Replaced with a new indicator	This indicator in its current form would be difficult to measure and potentially have only limited meaning with respect to sustainable forest management. It will be difficult to establish what a suitable minimum knowledge should be. Instead, a more encompassing indicator called "Investment in forest-based research and development, and education" has been moved from criterion 5 to criterion 6 to replace this indicator.
6.7.2	Rate of continuing education among woodlot owners	Replaced with new indicator	This indicator in its current form would be difficult to measure and potentially have only limited meaning with respect to sustainable forest management. The indicator could perhaps be made more meaningful by focusing on education related to forest management, but this would be difficult to define. Instead, a more encompassing indicator called "Investment in forest-based research and development, and education" has been moved from criterion 5 to criterion 6 to replace this indicator.

	6.7.3 Rate of continuing education among forestry professionals	Replaced with new indicator	This indicator in its current form would be difficult to measure and potentially have only limited meaning with respect to sustainable forest management. The indicator could perhaps be made more meaningful by focusing on education related to forest management, but this would be difficult to define. Instead, a more encompassing indicator called "Investment in forest-based research and development, and education" has been moved from criterion 5 to criterion 6 to replace this indicator.
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