The State of British Columbia's Forests – 2004

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THE STATE OF
British Columbia's Forests
2004

BRITISH COLUMBIA

Ministry of Forests

Cover photo – Coastal rainforest along the West Coast Trail on Vancouver Island. The large tree is a western redcedar, British Columbia's official tree. This species has played a key role in the lives of West Coast aboriginal people and continues to be a valuable resource for the province.
Photo credit: Tom Ryan

Library and Archives Canada Cataloguing in Publication Data
Main entry under title:
The state of British Columbia's forests, 2004

ISBN 0-7726-5202-3

1. Sustainable forestry - British Columbia. 2. Forest conservation - British Columbia. 3. Forest ecology - British Columbia. 4. Forest policy – British Columbia. 5. Forests and forestry – British Columbia. I. British Columbia. Ministry of Forests.

SD387.S87S72 2005 333.75'09711 C2004-960099-0

This is the first of three planned editions. Future editions are planned for the years 2005 and 2006.

Chief Forester's Message

This report on the state of British Columbia's forests is designed to inform both general and technical readers about our forests from a particular viewpoint – that of sustainability.

As chief forester, it is my role to advise government and inform the public on sustainable forest management. Currently, many sources provide factual information on parts of this complex topic, but few if any provide an overview that is both accessible and comprehensive. In addition to providing factual information, this report presents assessments of sustainability by Ministry of Forests staff.

I hope that both the facts and the assessments will encourage informed, constructive discussion. A periodic review of our forests, including environmental, economic, social and governance aspects, can show us how far we've come and help us decide where future actions would be desirable.

The report's framework of indicators, or measures, of sustainability is based on international and national frameworks for assessing sustainable forest management, with an emphasis on issues of particular importance to British Columbia. Six indicators are presented here. Future editions of the report will fill out the full framework of 24 indicators and provide updates on previously presented indicators.

Your feedback on this report's approach, format and level of information is welcomed and will help us improve subsequent editions.

With public ownership of 95% of all land in the province, British Columbians have a real opportunity to contribute to sustainable forest management. By using the best science-based information available to make informed decisions, we can ensure that the forests of British Columbia continue to provide their many benefits to future generations.

Jim Snetsinger, RPF
Chief Forester
Ministry of Forests

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* The complete framework is listed here. The indicators in **bold** type are presented in this report. The rest will be addressed in future reports.

Appendices

List of Figures in Introduction and Overviews

Executive Summary

Forests figure prominently in the well-being of British Columbia's environment, economy and communities. Ensuring sustainable forest management is therefore vital to the province's health on many levels.

British Columbia's progress in achieving sustainable forest management is challenging to assess, not only because of the subject's complexity, but also because of the varying opinions and viewpoints people bring to the topic. An understanding of current conditions and of the adequacy of information to assess them will provide a basis on which to make informed decisions into the future.

This report is part of the Ministry of Forests' efforts to enable assessment of sustainable forest management across the province. The purpose is two-fold:

- To provide information and links to enable readers to assess for themselves the province's progress in achieving sustainable forest management.
- To provide the ministry's assessment of that progress.

The information and assessment provided in this report are for six of 24 indicators that merge national-level frameworks of indicators with issues important to British Columbia. The ministry is committed to publishing a second report in 2005 that will add 6 more indicators and a third report in 2006 that will cumulatively address all 24 indicators.

Summaries for the first six indicators covered in this report are presented below and in Figure 1.

Environmental Indicators

Information and the ministry's assessment are provided for 2 of 10 environmental indicators: Ecosystem diversity and Protected forests.

British Columbia's rich natural resources include vast and diverse forests. In terms of forest types and ages, most of this diversity still exists 150 years after the start of European settlement.

A reasonably representative 10% of the province's forests are today protected in parks and other protected areas. These protected forests, along with other forest areas, provide large tracts of natural habitat for plants and animals, as well as undeveloped areas for scientific study and wilderness recreation.

Some forest types and their associated plants and animals are threatened by development.

Despite the substantial databases already assembled for these two indicators, information needs for assessing sustainable forest management in these areas are being only partially met.

Ministry's partial assessment based on these two indicators
Despite some concerns, the prospects for environmental sustainability in British Columbia's forests are positive.

Economic and Social Indicators

Information and the ministry's assessment are provided for 2 of 10 economic and social indicators: Timber harvest and First Nations involvement.

Much of British Columbia's economic development in the 1800s and 1900s depended on the forest sector. After a century of rapidly increasing timber harvest, the level of cut stabilized in the 1990s and is forecast to be sustainable. However, significant decreases in some local timber supplies are expected and will require transition strategies for forest-dependent communities.

The involvement of First Nations people in the timber-based economy has increased in recent years and is expected to grow further. While First Nations participation in forest management has increased, many issues regarding aboriginal rights and title remain to be settled.

Many of the information needs for assessing sustainable forest management are being met for these two indicators, but some gaps remain.

Ministry's partial assessment based on these two indicators
Despite some localized timber supply problems and the need to complete treaty negotiations with First Nations, the prospects for economic and social sustainability in British Columbia's forests are positive.

Indicators of Governance and Support

Information and the ministry's assessment are provided for two of four governance and support indicators: Law and Certification.

British Columbia continues to develop new laws and policies to support sustainable forest management, and has done so since before the 1992 Earth Summit – the United Nations Conference on Environment and

Development (UNCED). Concerns about high operational and administrative costs were addressed through a recent redesign of the legal framework to improve economic competitiveness while maintaining high environmental standards. The province's legal framework includes compliance and enforcement activities, and public reporting by the independent Forest Practices Board. To enable continual improvement, the effectiveness of the law in achieving sustainable forest management is being systematically reviewed.

Forest certification led by non-government organizations complements the governance provided by British Columbia's legal framework. British Columbia's forest industry is a leader in forest certification in North America. It has pursued this course to maintain access to markets and demonstrate the province's high quality of forest management. Progress in achieving certification varies considerably by tenure type.

Many of the information needs for assessing sustainable forest management are being met for these two indicators, but information on the ultimate effectiveness of governance and support is still in an early stage of development.

Ministry's partial assessment based on these two indicators
The prospects for legal and other means to ensure governance and support for sustainability in British Columbia's forests are positive.

Conclusion

British Columbia has made substantial efforts to ensure sustainable forest management is carried out in the province, and these efforts have been largely successful. Overall, the prospects for sustainability are positive.

Summary of Ministry of Forests' Partial Assessment			
Environmental Indicators	**State**	**Trend**	**Information**
Ecosystem diversity - underlies ongoing environmental, economic and social sustainability	 good	 mixed	 partial
Protected forests - provide natural habitats for plants and animals	 good	 improving	 partial
Economic and Social Indicators	**State**	**Trend**	**Information**
Timber harvest - supports a large part of the province's economy	 good	 mixed	 partial
First Nations involvement - recognizes their cultural and economic relationship with forests	 mixed	 improving	 adequate
Governance and Support Indicators	**State**	**Trend**	**Information**
Law - ensures the government's management objectives are enforced	 good	 improving	 partial
Certification - provides non-government verification of well-managed forests	 good	 mixed	 adequate

FIGURE 1. Summary of the Ministry of Forests' partial assessment, based on six indicators, of British Columbia's progress in achieving sustainable forest management.

About This Report

Rocky Mountain Trench – Wayne Erickson

Vancouver – Tom Ryan

Sections:

Purpose

Forests figure prominently in the well-being of British Columbia's environment, economy and communities.

The purpose of this report is two-fold:

- To provide information and links to enable readers to assess for themselves the province's progress in achieving sustainable forest management.
- To provide the Ministry of Forests' assessment of that progress.

Content

The first three parts following "About This Report" provide an overview of British Columbia's forests and society, and general discussions of sustainable forest management and indicators.

The indicators used to assess sustainable forest management form the main body of this report. These indicators are based on those found in national-level frameworks, but reflect an emphasis on issues of particular significance to British Columbia. The indicators are grouped into three broad categories: environmental, economic and social, and governance and support.

Six of 24 indicators are addressed in this first of three reports. In 2005, the second report will add 6 more indicators. The third report in 2006 will contain all 24 indicators.

For each indicator, the report provides summary information relevant to several questions, along with links to further information, maps, data, and related international and national indicators. Each indicator ends with the Ministry of Forests' assessment of what the indicator tells us about sustainable forest management.

Readers' independent assessments

The text under each indicator question includes some explanation of the information, but no assessment of implications for sustainability. This is intended to enable readers to make their own assessments of sustainability.

The Ministry of Forests' assessment

For each indicator, the ministry assessed the state, trend and adequacy of information, as follows:

- the **state** – whether conditions identified by the indicator suggest good, poor, mixed or fair progress towards sustainable forest management;
- the **trend** – whether those conditions are improving, deteriorating, mixed, uncertain or showing no change; and
- the adequacy of **information** – whether information available for the indicator is adequate, inadequate or partial.

The symbols used to summarize the assessment are shown in Figure 2.

This report does not describe or assess the Ministry of Forests' activities, goals, targets or performance, as these are covered in the ministry's service plans and annual reports. Similarly, it does not examine the activities or performance of individual forest companies. Information about these can be found elsewhere.

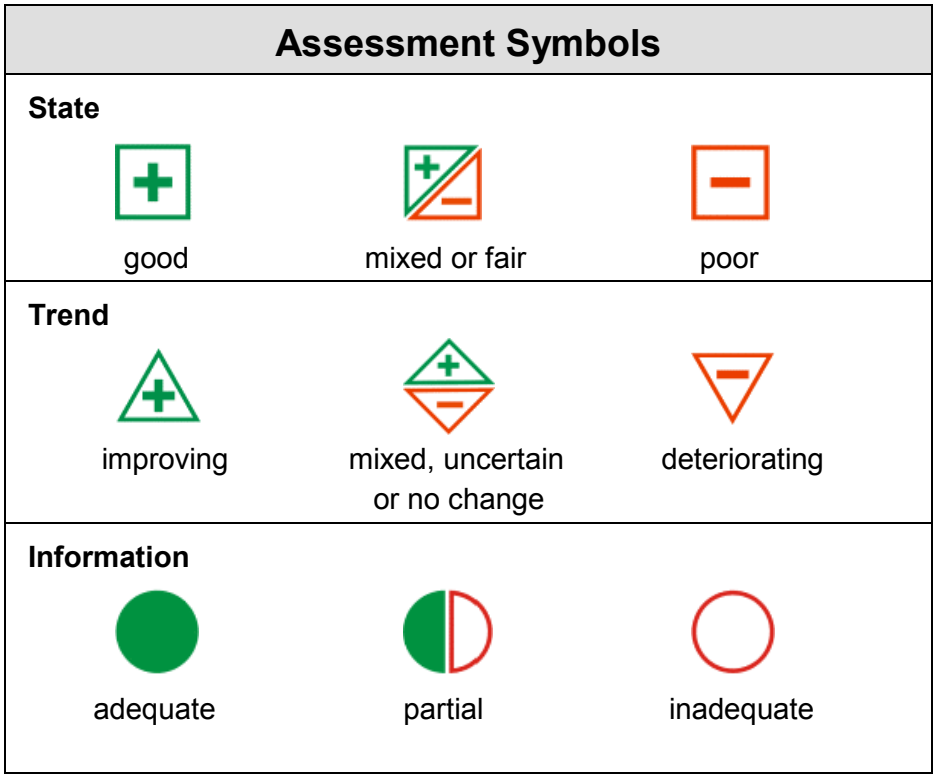


FIGURE 2. Assessment symbols used in this report.

How to Use This Report

All parts of the report, individual maps and graphs, and related data tables are available in printer-friendly formats so that they can be used for overheads or illustrations for teaching and other applications. Copyright rules apply: be sure to obtain permission before using any of the material in other publications or making large numbers of copies for distribution. To obtain copyright permission, please see the appendix, Contact.

Terms, such as “forest,” that have a technical meaning specific to this report are listed in the glossary and are highlighted the first time they occur within each indicator.

Your comments on the information and assessments presented in this report – and especially ideas for improving the report – are welcomed and will be considered as future editions are prepared. The appendix, Reader Comments, suggests some topics for feedback.

Accountability

The information presented in this report was collected from a variety of sources, each accountable for the quality of the data it provided. Any errors in the presentation or interpretation of those data are, of course, the responsibility of the authors of this report.

Indicators of sustainable forest management cover a scope that is broader than that of the direct accountabilities of any individual government agency or company. While each organization is accountable for specific aspects of forest management, no one organization is necessarily wholly accountable for the states and trends shown by the indicators.

Turning Assessment into Action

An important goal of this report is to inform the ongoing development of forest policy and management – and thereby to support progress in achieving sustainable forest management.

British Columbia's Forests and Society: An Overview

It seems clear beyond possibility of argument that any given generation of men can have only a lease, not ownership, of the earth; and one essential term of the lease is that the earth be handed on to the next generation with unimpaired potentialities.

– Roderick Haig-Brown
(British Columbia conservationist and winner of a Governor General's Award. *Measure of the Year*, 1950. Toronto: Collins)

Sections:

The Forests

At 95 million hectares, British Columbia is larger than any European country except Russia, about four times the size of the United Kingdom, and larger than the combined areas of the states of Washington, Oregon and California.

About two-thirds of the province is forested, as shown in Figure 3. This makes the province, on a global scale, as important as many forest nations.

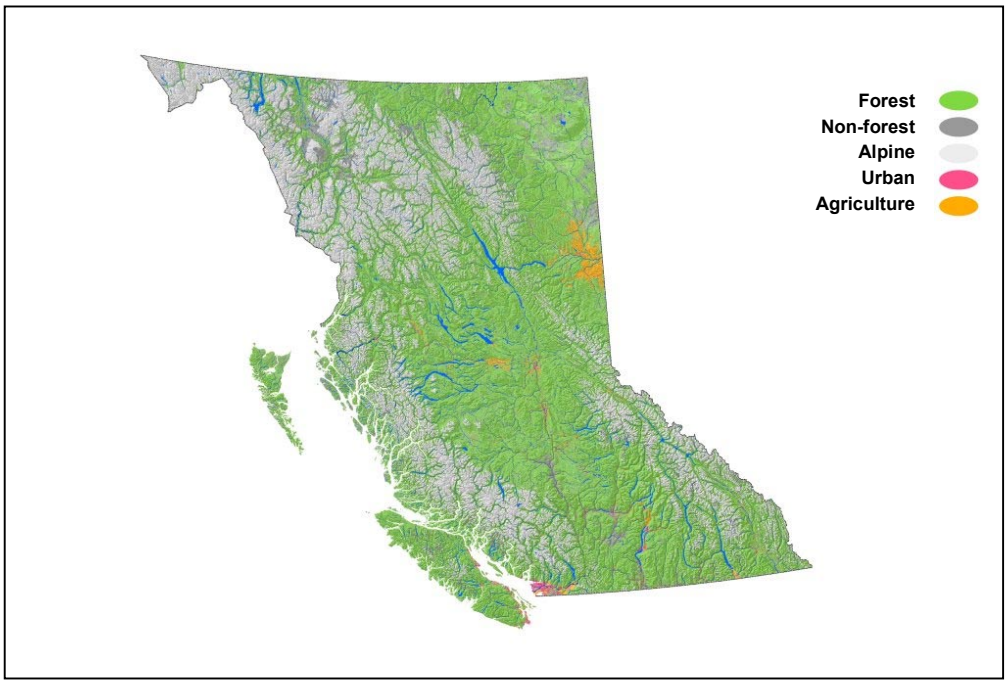


FIGURE 3. Forest land of British Columbia, 2000.

British Columbia is ecologically diverse

The province's mountainous terrain creates a range of distinct climatic zones. Along the Pacific coast, temperatures are mild and rainfall is abundant. The interior plateau, lying in the rain shadow of the Coast Mountains, has a dry continental climate. The northeast, which is part of North America's Great Central Plains, has an extreme continental climate with very cold winters.

This variety of climates, combined with the extensive and varied terrain, has resulted in a complex pattern of many distinct ecosystems. Among them are grasslands, oak parklands, temperate rain forests, dry pine forests, desert-like steppes, boreal black spruce muskegs, tundra and alpine meadows.

The many ecosystems have made British Columbia home to a great diversity of flora and fauna – in fact, a greater diversity than any other province in Canada. British Columbia has an estimated 2,790 species of native vascular plants, 1,000 mosses and liverworts, 1,600 lichens, 522 attached algae and more than 10,000 fungi. As well, 1,138 species of vertebrates have been identified, including 488 birds, 468 fish, 142 mammals, 22 amphibians and 18 reptiles. Invertebrate species are estimated to number between 50,000 and 70,000, including 35,000 insect species.

Three-quarters of Canada's mammal species are found in the province, 24 of which occur only in British Columbia. Some 162 species of birds that breed in British Columbia breed nowhere else in Canada.

The Society

British Columbia has been inhabited for about 10,000 years. When Spanish and British explorers first reached the province's coast in the late 1700s, they found thriving First Nations societies and cultures. Trading posts sprang up throughout the province during the early 1800s, soon giving way to more established towns and cities as settlers arrived in the new British colony from Europe, the United States, Asia and elsewhere.

Before the arrival of Europeans, about 40% of all the native people in Canada lived within the area that became British Columbia. Their population was probably over 80,000, but introduced diseases resulted in severe losses.

The population is concentrated in urban centres in the southwest

The province's total population expanded from 33,000 in 1867 to over 4 million in 2003 (see Figure 4). About half of the population now lives in the province's southwest corner (the Lower Mainland), in Vancouver, Surrey and other communities making up the Greater Vancouver Regional District.

Another 30% live on Vancouver Island (mainly in Victoria and Nanaimo) or in the southern Interior's Thompson-Okanagan region (Kelowna and Kamloops). The remaining 20% live primarily in smaller rural communities throughout the province.

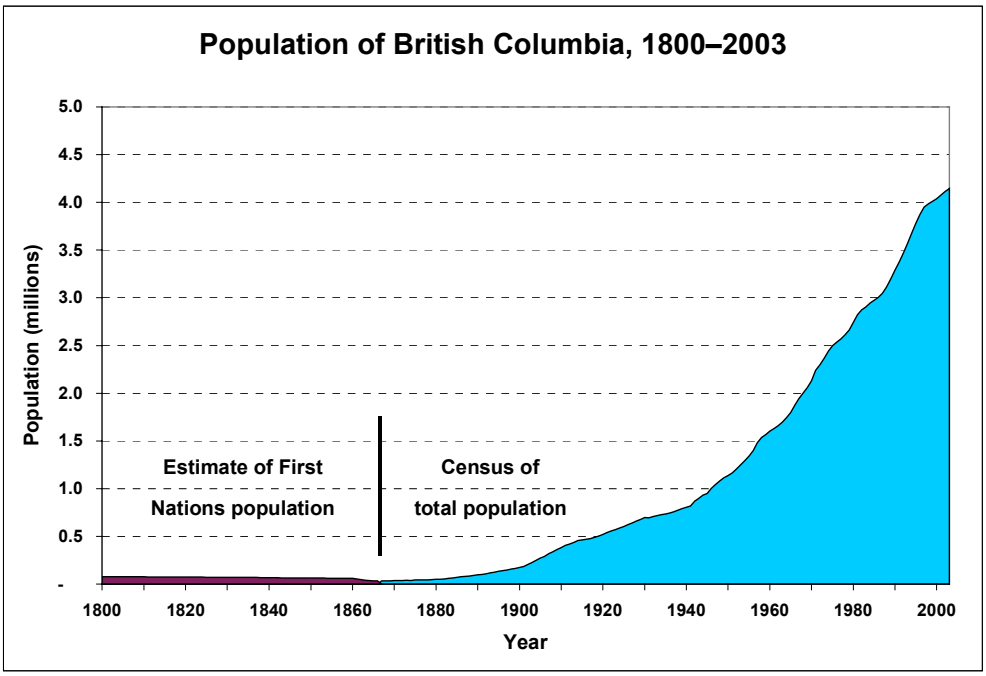


FIGURE 4. Population of British Columbia, 1800–2003.

The growing population has exerted considerable pressure on British Columbia's resources, not only timber, but also water, fish, wildlife, range, wilderness and others. This has often resulted in competing demands and conflicting public expectations for the use of forest resources (e.g., ecosystem and watershed protection vs. jobs and other economic benefits). It has also led to increasing risks of wildfires in the wildland/urban interface.

For thousands of years, aboriginal people depended on the forest for shelter, food, clothing, tools and medicine. The first European settlers also came to rely on the forest – primarily for timber, using the wood to construct buildings, ships and even roads and railway trestles. Industries and communities grew up around timber harvesting and processing, producing logs, lumber, pulp, paper and other products for export and domestic use. Recognition of the value of non-timber forest products and services, such as drinking water and wilderness recreation, is well established and growing.

Today, all communities in British Columbia, urban and rural, continue to have significant cultural, recreational and economic connections with the province's forests.

Forestry is the province's most important industry

The forest sector continues to be the foundation of British Columbia's economy, accounting for 14% of employment and 15% of all economic activity when indirect and induced economic activity are included. Although its significance has diminished as the economy has matured and diversified over the past few decades, the forest sector remains the most important employer in many rural communities.

Sustainable forest management is vital to British Columbians

With about 95% of the province in public ownership, the British Columbia government manages the land in the public interest, trying to balance environmental, economic and social issues.

The government and people of the province have many years of experience in developing and using tools and processes to enable balanced consideration of environmental, economic and social values. The Protected Areas Strategy, Land and Resource Management Planning, Forest Practices Code and Timber Supply Review are just a few of the initiatives begun in the 1990s that support sustainable forest management.

British Columbians, along with buyers of the province's forest products and tourists who come to see its great outdoors, have an interest in the sustainability of the province's forests, because their continuing use and enjoyment of the forests depend on the province's progress in achieving sustainable forest management.

About Sustainable Forest Management

Forestry isn't rocket science. It is much more complicated.

– Fred Bunnell
(Professor, University of British Columbia)

Sections:

The Concept

Forest practices have addressed aspects of sustainability for centuries, but "sustainable forest management" is a relatively recent concept. It is more comprehensive than earlier concepts such as "sustained yield of timber," explicitly encompassing environmental, economic and social dimensions. Like the broader concept of sustainable development, sustainable forest management is widely supported and viewed as a global goal. However, exactly what sustainable forest management entails is (just as for sustainable development) somewhat contentious and not always clear.

The concept of sustainable development, first given prominence by the Brundtland Commission's 1987 report, "Our Common Future," emphasizes the interdependence of environmental integrity and economic development in meeting the needs of current society and future generations. This interdependence is often portrayed with one of the two models illustrated in Figure 5. The first is a "three-legged stool" with legs representing the

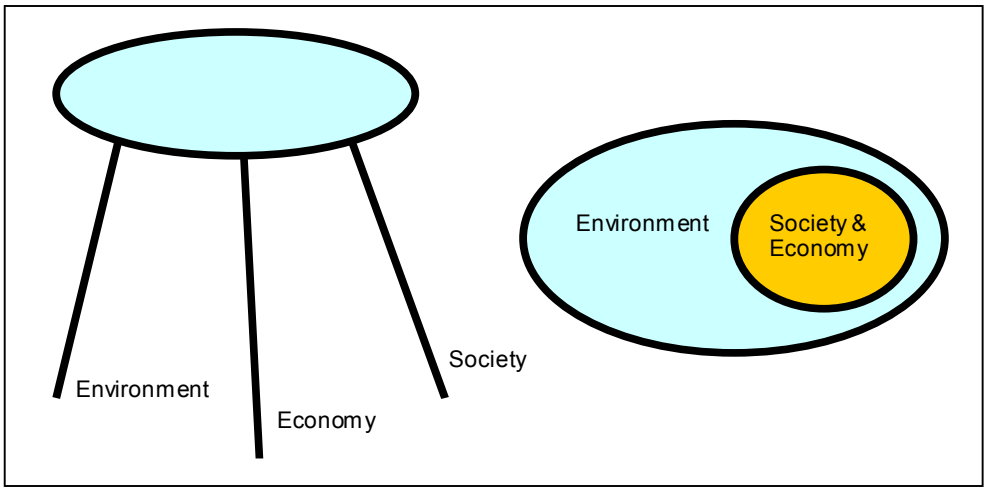


FIGURE 5. Sustainable development models.

environment, economy and society, and all three legs needing to be sound to prevent the stool from falling over. The second is an egg – society and the economy being the yolk surrounded by the egg white of environment, illustrating that humans act within, and depend on, the environment.

Concepts of sustainable development are being applied in numerous industries and are sometimes referred to in a business context as the "triple bottom line" or "the three Ps" of people, place and profit.

Definition

This report uses the vision statement in Canada's National Forest Strategy as its definition of sustainable forest management:

> *The long-term health of Canada's forest will be maintained and enhanced, for the benefit of all living things, and for the social, cultural, environmental and economic well-being of all Canadians now and in the future.*
>
> – National Forest Strategy Coalition, National Forest Strategy, 2003–2008

Criteria, Indicators and Forest Certification

Sustainable forest management gained prominence at the 1992 Earth Summit, or United Nations Conference on Environment and Development (UNCED), in both the Forest Principles and in Chapter 11: Combating Deforestation of the conference's programmes for the 21st century, called Agenda 21.

Two streams of global action followed from UNCED:

1. governments committed themselves to developing and using indicators to define, assess and promote progress towards sustainable forest management at the national level; and

2. non-government organizations (NGOs) – some of them dissatisfied with government-led efforts to address forestry – developed forest certification systems to promote sustainable forest management at the operational forestry level.

Both streams use indicators to measure or describe aspects of sustainability and their trends (for more details, see the section About Indicators). Governments have typically grouped indicators into categories, referred to as criteria of sustainable forest management.

Criteria and indicators have been developed by nine regional groups of nations that contain most of the world's forests. One of these groups, known as the Montréal Process, involves 12 nations including Canada. Its goal is to define and promote the conservation and sustainable management of temperate and boreal forests. In 1995, the Montréal Process published its framework of 67 indicators, grouped under seven criteria that address the environment, economy, society, and institutional and other frameworks that support sustainable forest management. The framework was re-issued in 1999 with a new numbering of the indicators (MP 1999 indicators). Some of the member countries have published national reports based on these criteria and indicators.

The Canadian Council of Forest Ministers (CCFM) also developed a framework of criteria and indicators to reflect the unique aspects of Canadian forests and values of particular concern to Canadians. This framework of six criteria and 83 indicators was also published in 1995 (CCFM 1995 indicators). The first full report based on these indicators was published in 2000. A revised framework of 46 indicators was published in 2003 (CCFM 2003 indicators), reflecting experience from use of the framework and advances in scientific knowledge.

This report, *The State of British Columbia's Forests – 2004*, cross-references relevant indicators of the Montréal Process (1999), CCFM (1995) and CCFM (2003) for the convenience of readers.

While many governments were developing criteria and indicators, several NGOs and a few nations developed forest certification systems to encourage companies to practise sustainable forestry at the operational level. These systems share many aspects of the governmental criteria and indicators frameworks. Both are based on the concepts of sustainable development: both use indicators to report on progress and trigger appropriate actions; and both share the goal of sustainable forest management.

The two streams of action have interacted in several ways. The use of criteria and indicators has spread from the national level to the operational level, NGOs and governments have advised each other on indicators, and some governments have obtained certification for their forest management. For example, the CCFM's 1995 criteria and indicators were the basis for the Canadian Standards Association's forest certification system published in 1996 and revised in 2002. This and other forest certification systems are now used widely in British Columbia, as discussed in the indicator on Certification.

Reporting on Sustainable Forest Management

Reporting on sustainable forest management is challenging.

Sustainable forest management is not just about trees. It involves other plants, as well as wildlife, soil and water, air quality and greenhouse gases; all economic activities that depend on the forests; the communities that depend on those economic activities; and other social and cultural activities and values related to forests.

For these reasons, the scope of reports on sustainable forest management is typically broader than that of the direct accountabilities of a single government agency or the actions of individual forest industry operators.

Ensuring relevance and credibility

The Montréal Process and CCFM criteria and indicators offer a good starting point for selecting relevant indicators for any jurisdiction in Canada, since they were developed through consultation with experts on all aspects of sustainable forest management. To be locally relevant, however, reporting must also reflect the unique aspects of the nature, history and culture of a jurisdiction and its forests.

The credibility of reporting depends on the use of the best science-based information available and the inclusion of both positive and negative findings. Credibility is further supported by identifying knowledge gaps and, where possible, using information from public sources.

Challenges in reporting

Several factors pose practical challenges to finding and presenting relevant, useful information and data on the indicators. This report attempts to address and balance all of these challenges:

- *Cost* – The cost of detailed inventories of all forest resources is high and data may be unavailable.
- *Time* – Assembling and analyzing extensive datasets to provide meaningful information is time-consuming, making presentation of recent information difficult.
- *Technical/scientific* – Exactly what to measure and how to measure it are the subjects of technical debate, and all of the potential approaches have different technical merits and problems.
- *Administrative* – Access to information, as well as permission to report on it, is sometimes limited by proprietary concerns (e.g., information related to commercial interests and private land) or the sensitivity of information (e.g., rare ecosystems that might be threatened by vandals or nature lovers if their locations were made public).

Assessing Sustainable Forest Management

Assessing sustainable forest management is difficult because of the complex and intertwined nature of its many aspects. Nonetheless, questions about sustainability need to be asked, and answered, to help inform future actions.

The conditions of forests and societies continually change, as do interactions between the two. Perceptions of what is sustainable or unsustainable change over time.

An indicator may be assessed relative to historical conditions, technical or scientific thresholds, and desired targets. Where these reference values are unknown, unclear or disputed, meaningful assessment of the indicator is difficult.

Assessment of several indicators collectively is conceptually even more problematic. First, indicators that use different units of measure cannot simply be added together unless they are converted to a common unit. Conversion may be technically problematic or wholly inappropriate. Second, the relationships between indicators are often complex, making interpretation of their interactions unreliable. Third, because the importance of any one indicator relative to another depends on the values and perspective of the assessor, even experts have trouble developing a consensus on overall assessments.

While various approaches have been developed to assess multiple indicators collectively, no one approach is entirely satisfactory.

About Indicators

Not everything that can be counted counts, and not everything that counts can be counted.

– Albert Einstein

Sections:

The Concept

The indicators in this report provide information that enables people to assess aspects of forest management. A meaningful assessment usually requires more than one indicator.

Definition

An indicator is defined in this report as follows, based on the definition used in the Montréal Process:

> *A quantitative or qualitative variable used to describe a state or condition. When observed periodically, it shows a trend. It provides information that is factual, usually for a specific time and place.*

Indicators of Sustainable Forest Management

Indicators are central to any report on the state of forests. They are used at all strategic and operational levels of forest management – global, national, provincial or state, forest management unit, and specific plot of land – to describe the state of forests and human interactions with forests.

They are used to:

- help explain the context or background situation;
- clarify management goals (by the choice of performance indicators);
- check for compliance with regulations and policies;
- check the implementation of plans;

- assess overall outcomes and effectiveness of management efforts; and
- improve understanding of how forests and societies function.

Tracking an indicator over time is called monitoring. The above uses of indicators are referred to, respectively, as background monitoring, performance monitoring, compliance monitoring, implementation monitoring, effectiveness monitoring and improvement monitoring. The last includes validation monitoring – checking the validity of assumptions and models used in management.

These different types of monitoring are most helpful when used in combination. For example, monitoring that confirms full compliance with laws is reassuring to a certain extent, but more meaningful when combined with effectiveness monitoring that confirms compliance is achieving desired outcomes.

Sustainable forest management requires continual improvement and adjustment based on the monitoring of indicators. Reports on the state of forests may draw from several types of monitoring, but typically emphasize the assessment of overall outcomes to assist decision-making about future directions.

Types of Indicators

The indicators in this and other similar reports can be grouped into several complementary types:

- *Quantitative, qualitative* – Of the two, quantitative indicators are generally preferred. However, qualitative (descriptive) indicators are sometimes all that is available. This report mostly uses quantitative indicators.
- *Input, process, output, outcome* – Inputs and processes are used in management systems to achieve desired outputs and outcomes. For example, inputs of money, workers and time are applied to activities (processes) such as planting and tending trees. This results in outputs of areas planted with different species and, over time, outcomes such as habitat for animals and economic activities related to timber harvesting and milling. Indicators are used to track all of these stages. This report emphasizes outcome indicators, with output indicators used as surrogates where necessary. Input and process indicators may also be used to monitor activities that support sustainability.
- *Pressure, state, response* – Problem management can be informed by knowledge about a problem's cause or driving force (pressure), its

effect (state) and the actions undertaken to address both cause and effect (response). For example, growing human populations (pressure) tend to cause loss of wildlife habitat and reduced wildlife populations (state), leading to the need for corrective measures such as protection of critical habitat (response). Trends of all three types of indicators help to show if a problem is being resolved. In this report, the relationships between indicators are described in terms of pressure, state and response.

- *Environmental, economic, social, institutional* – Environmental, economic, social and institutional indicators must be considered together, in a balanced way. Overemphasis or omission of one or more of these types of indicators is likely to lead to a lack of sustainability. In this report, the more descriptive phrase "governance and support" is used in place of "institutional."

Selection of Indicators

Given the complexity of sustainable forest management, selecting a list of indicators that is sufficiently comprehensive for the topic, yet also limited to a useable number that readers can comprehend, is challenging.

The selection of indicators for this report was guided by the attributes of good indicators used for the development of the CCFM's 2003 criteria and indicators (Background Information on the CCFM C&I Review, scroll down and click on "Description of TWG Review Process"). A good indicator is one that:

- is relevant,
- is measurable,
- is understandable,
- can be forecast, and
- has reference values.

An indicator must be relevant to an important aspect of sustainable forest management, sensitive to changes in the environment and human activities, and appropriate for the spatial scale being assessed. It should be a variable that is necessary (and, if possible, sufficient) to illustrate that aspect of forest management and to inform decisions.

A measurable indicator is one for which it is technically and financially feasible to obtain timely, reliable data and, ideally, for which there is sufficient historical information to provide meaningful trends. Qualitative indicators must be sufficiently precise in their descriptions to permit meaningful comparisons over time.

Intended audiences must readily understand the information conveyed by an indicator, and be able to use it to form their own assessments.

Indicators that can be forecast using science-based predictions of the effects of management choices and other factors are particularly useful for assessing future sustainability.

Reference values – for instance, historical baselines, technical or scientific thresholds and desired targets – provide a context for assessment of states and trends.

The indicators selected for this report satisfied the above five attributes more completely than did other candidate indicators. While keeping the same indicators over a long period enables assessment of trends, experience in the use of the indicators and changes in scientific knowledge over time make rethinking the list of indicators periodically necessary.

Indicator 1 – Ecosystem diversity

Coastal forest – Alex Inselberg

Palliser River Valley – John Parminter

Dry open forest – Don Gayton

Overview

- British Columbia is the most biologically diverse of any province or territory in Canada, and includes parts of 6 of the world's 30 terrestrial ecoregions. Ecosystem diversity refers to the variety of ecosystems, their organisms and the interactions of those with their environment.
- Most of this diversity still exists 150 years after the start of European settlement, but development is critically threatening some ecosystems such as wetlands, grasslands and Garry oak meadows.

STATE  good

TREND  mixed

INFORMATION  partial

Questions about ecosystem diversity

1-1 How varied and extensive are B.C.'s ecosystems?
1-2 What are the areas, types and ages of B.C.'s forest ecosystems?
1-3 How have B.C.'s forests changed over the last century?
1-4 How much older forest does B.C. have?

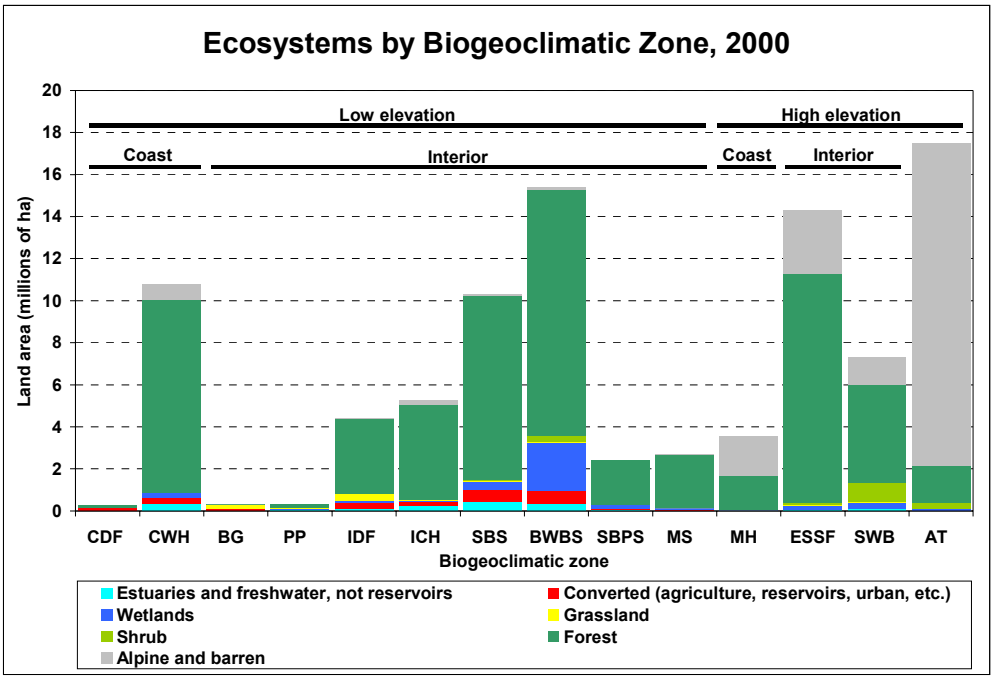
➨ What does this indicator tell us about sustainable forest management?

Related indicators

- Agricultural and urban development, fires and logging (see Ecosystem dynamics, Timber harvest, Silviculture) are pressures that have modified the province's ecosystem diversity to date. Climate change (see Greenhouse gases) may cause extensive further changes.
- The state of forest ecosystems affects wildlife habitats (see Species diversity), may ameliorate climate change (see Greenhouse gases) and supports economic activity (see Forest products, Jobs and communities).
- Management responses include protected areas (see Protected forests) and ecosystem restoration.

Indicator 1-1

How varied and extensive are B.C.'s ecosystems?



- B.C.'s maritime and continental climates, combined with its mountainous terrain, have resulted in a wide variety of ecosystems, from desert to alpine tundra. They are often grouped under 14 biogeoclimatic zones.
- Forests occur in all 14 zones, dominating in most of them. Varied conditions within each zone have led to diverse forest types.
- Since 1850, ecosystem conversion to agriculture, reservoirs, urban areas and other land uses has occurred on 2% of the province.
- About 3% of former forests have been converted to other land uses. Only the three smallest, warmest biogeoclimatic zones have had more than 10% of their former forests converted. The Coastal Douglas-fir zone has been most affected, with 46% of its former forests now converted.
- Conversion impacts on former grasslands and some former wetlands are greater than those on most former forests, and are endangering some of these ecosystems and the species dependent on them.
- Fire exclusion has resulted in forest encroachment onto former grasslands and in-growth of more trees in formerly open forests.

Information

- Recent satellite imagery provides reasonably accurate information on the location and extent of major ecosystems and converted ecosystems.
- Estimates of forest encroachment and in-growth are incomplete.
- Various inventories are available or planned for different purposes.

Sources: MoF's BEC, MSRM's BEI, BTM, CDC, NFI and SEI

Related maps: Biogeoclimatic Zones, Land Use Conversion

Detailed information: http://www.for.gov.bc.ca/hfp/sof/

Related international and national indicators:

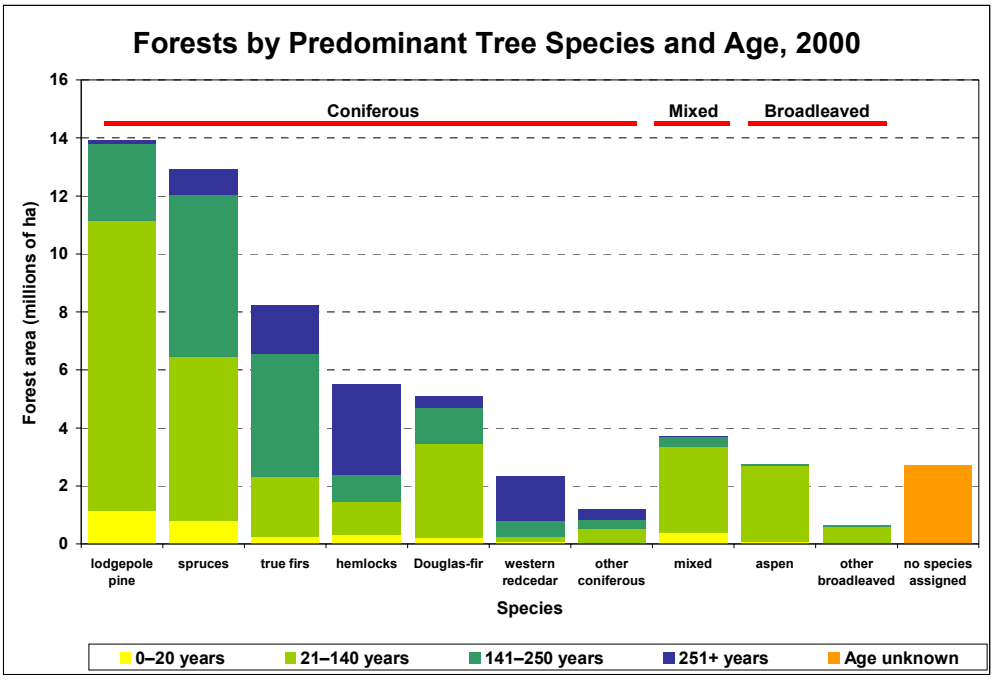
MP (1999) 3.a

CCFM (1995) 3.1.2, 4.2.2

CCFM (2003) 2.2

Indicator 1-2

What are the areas, types and ages of B.C.'s forest ecosystems?



- Forests provide habitats for most of the province's plants, animals and fungi, and support a wide variety of human activities and livelihoods.
- They cover 59 million ha, or about two-thirds of B.C.'s 95 million ha. A further 4 million ha are other wooded land with woody shrubs, stunted trees or scattered trees.
- About 83% of the forests are predominantly coniferous, 6% are mixed, 6% are broadleaved, and the remaining 5% are regenerating forests with no species assigned. Lodgepole pine, spruces and true firs are the most widespread predominant trees.
- About 6% of the forests are less than 20 years old.
- Many of B.C.'s forests are old: 62% are over 100 years old, 41% are over 140 years old, and 14% are over 250 years old.
- Some forest types have trees over 1,500 years old.

Information

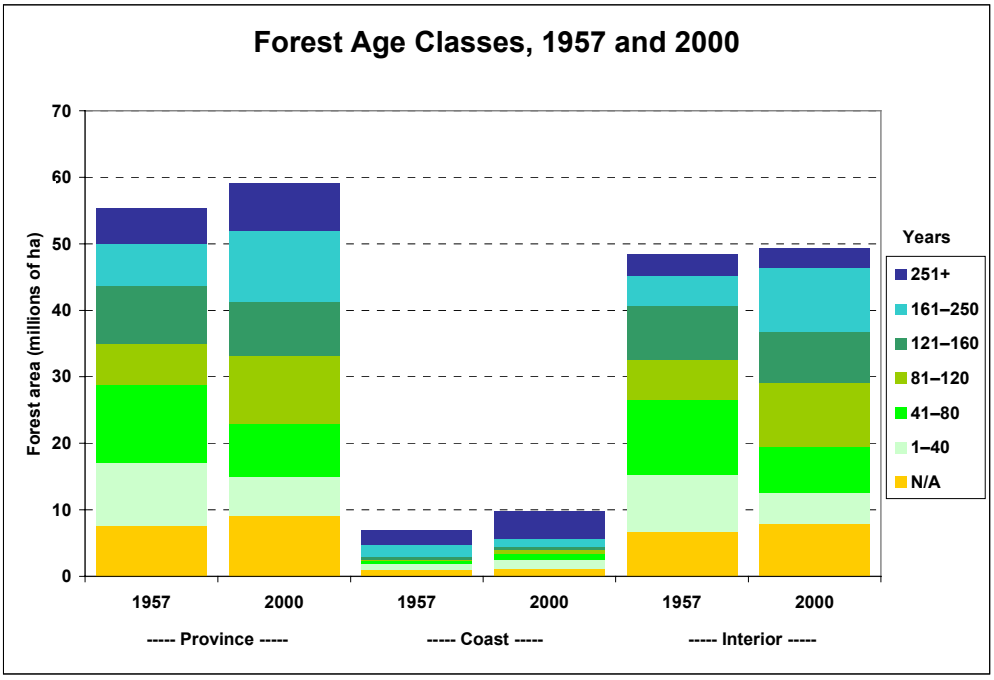
- Detailed forest cover inventories exist for 96% of the province, but many are not current. Updates are current for logging, but not for mountain pine beetle and fire impacts. Current inventories for tree farm licences and private land are mostly not available to government and the public.
- The 1950s inventory and satellite imagery are the only public sources of data for some parks and private land, about 4% of B.C.'s area.

Sources: MSRM's Resource Information, Business Solutions
Related maps: Forest Land, Predominant Tree Species
Detailed information: http://www.for.gov.bc.ca/hfp/sof/

Related international and national indicators:
MP (1999) 1.1.a, 1.1.b
CCFM (1995) 1.1.1, 1.1.2
CCFM (2003) 1.1.1

Indicator 1-3

How have B.C.'s forests changed over the last century?



- Forest area, species composition, age and the distribution pattern of all of these greatly affect ecosystem processes. They change over time due to natural disturbances, logging, land use conversion and other factors.
- Differences between the forest inventories of 1918, 1937 and 1957 are largely due to changes in inventory methods, and do not provide reliable trends of actual changes in the forests in the early 1900s.
- The 1957 and 2000 inventories permit reasonably reliable analysis of changes in age distribution, but not forest area or species composition.
- The area of forests 1 to 80 years old decreased provincially from 38% to 23% of the forest land base, despite extensive logging. The Interior area decreased, while the Coast region area increased from 19% to 24%.
- The area of forests over 80 years old increased provincially from 48% to 61%, primarily due to the increase in the Interior (from 45% to 61%). Railways and settlements led to large areas of forest being burned by accidental fires in the late 1800s. By the 1950s, many of these areas had regrown to become forests under 80 years old and, with effective fire suppression over the past 50 years, are now over 80 years old.

Information

- Inventories available in B.C. make analysis of historical changes in total forest area and areas of predominant species unreliable.
- Analysis of changes in the proportions of forest ages is fairly reliable.

Sources: MSRM's Resource Information, NFI

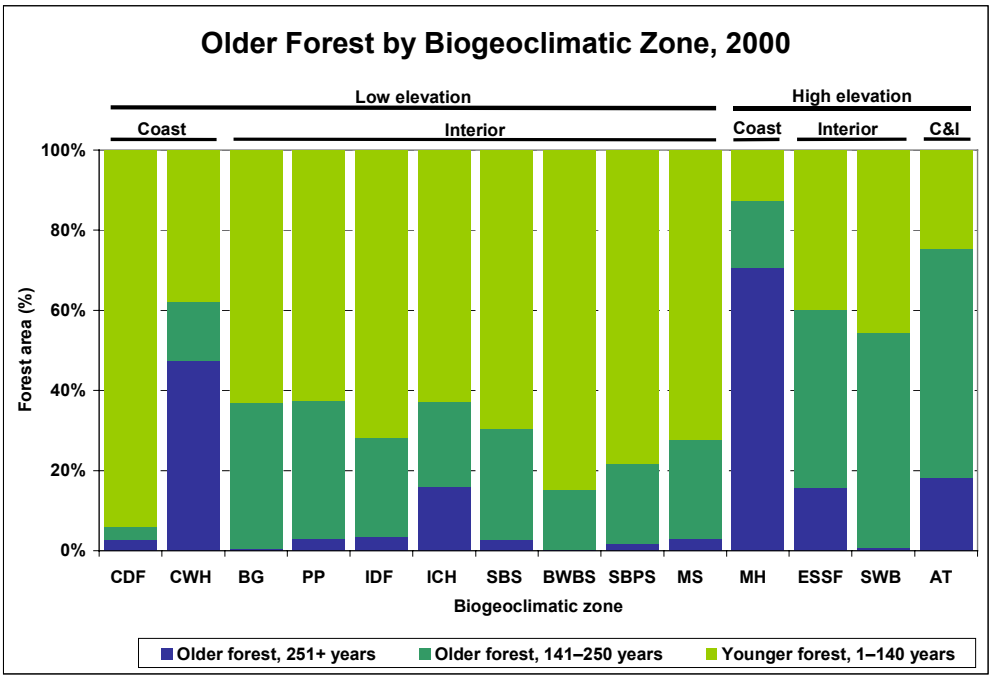
Related maps: Forest Age, Old Growth

Detailed information: http://www.for.gov.bc.ca/hfp/sof/

Related international and national indicators:
MP (1999) 1.1.b
CCFM (1995) 1.1.1, 1.1.2
CCFM (2003) 1.1.1

Indicator 1-4

How much older forest does B.C. have?



- The dry temperate and boreal ecosystems in the Interior have frequent, natural wildfires that limit the proportion of older forests. The wetter ecosystems in the Coast region and along the Interior mountain ranges have fewer wildfires and higher proportions of older forests.
- Forests over 140 years old exist in all 14 biogeoclimatic zones and cover 24 million ha (41% of B.C.'s forests). These include forests over 250 years old that cover 8 million ha (14% of B.C.'s forests).
- Substantial proportions of older forests exist in most biogeoclimatic zones that naturally develop them, with the exception of the Coastal Douglas-fir and Interior Douglas-fir zones. Relatively small areas, 3% or less, of the forests in these two zones are over 250 years old, a result of logging and the development of agriculture and settlements.
- Tree height is often ecologically, economically and culturally important. Trees are over 20 m tall in about 70% of forests over 140 years old and 80% of forests over 250 years old.
- About 25 million ha (42%) of B.C.'s forests are considered old growth. These forests tend to have more large trees and standing dead trees, multi-layered canopies with gaps resulting from the deaths of individual trees, and coarse woody debris on the forest floor.

Related international and national indicators:
MP (1999) 1.1.b
CCFM (1995) 1.1.2
CCFM (2003) 1.1.1

Information

- Information on older forests is incomplete in a few biogeoclimatic zones.
- The age of forests over 250 years old is often inaccurate in the inventory.

Sources: MSRM's Resource Information, MoF's Forest Science
Related maps: Forest Age, Old Growth, Biogeoclimatic Zones
Detailed information: http://www.for.gov.bc.ca/hfp/sof/

Indicator 1 – Ecosystem diversity

What does this indicator tell us about sustainable forest management?

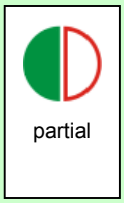
State

B.C.'s varied climates and mountainous terrain have led to expansive forest cover of diverse types and ages – for example, oak parklands, temperate rainforests, dry pine forests and boreal black spruce muskegs. Most of this diversity still exists 150 years after the start of European settlement. Permanent conversion to agriculture, reservoirs, urban and other development has changed 2% of the land base and 3% of former forests.

Trend

Further permanent conversion of forest land will be limited by terrain and climate, but will be mainly in the ecosystems already stressed by development. Fire suppression over the past 50 years has allowed the area of older forests to increase in parts of the Interior. Forest encroachment into grasslands and in-growth of more trees in formerly open forests have also occurred. This partly offsets the conversion of forest land to other uses, but threatens the ecological integrity of grasslands and some forest types. Continuation of these trends will strain the ability of several ecosystems to support B.C.'s rich biological heritage.

Information



The diversity of forest ecosystems in B.C. requires diverse management approaches, which in turn require an extensive knowledge base. Biogeoclimatic ecosystem classification data and 1:250,000 maps are used for forest and range management throughout the province, and larger scale maps of site series are available for almost half the province. A broad ecosystem inventory with 1:250,000 maps is used to assess habitat potential. Threatened plant communities and sensitive ecosystems, including forests, are not well documented. A national forest inventory will provide broad overview and trend information on forest cover. Detailed forest cover inventories on 1:20,000 maps exist for 96% of the province, but many are not current. Current inventories for tree farm licences and private land are mostly not available to government and the public. Forest cover inventories available in B.C. do not enable reliable analysis of trends in forest area and species composition. Forest cover information is incomplete in areas where the highest proportions of former older forests have been converted.

Indicator 2 – Protected forests

Kitlope Heritage Conservancy - John Kelson

Overview

- Protected areas are established for a variety of reasons, including to protect representative examples of diverse ecosystems and to protect key resource values. They provide natural habitats for plants and animals, areas for scientific study and wilderness for recreational, cultural and spiritual pursuits.
- A generally representative 10% of British Columbia's forests are strictly protected.

STATE good **TREND** improving **INFORMATION** partial

Questions about protected forests

2-1 Are B.C.'s protected forests representative of its total forests?
2-2 What are the areas, types and ages of B.C.'s protected forests?
2-3 How has the geographic distribution of protected forests changed?
2-4 How much of B.C.'s older forests is protected?

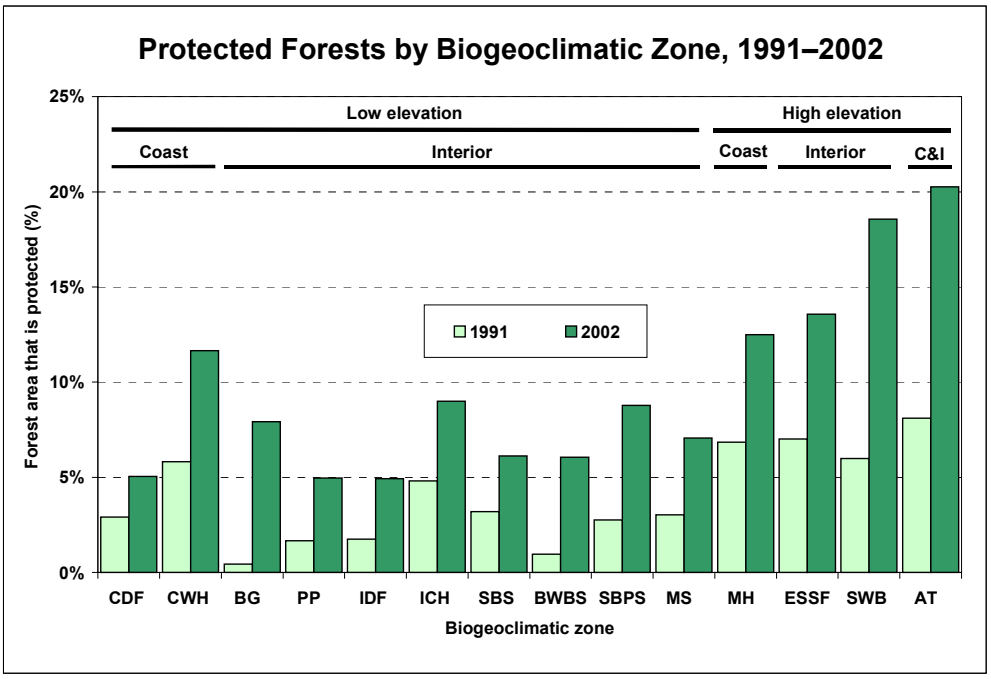
➨ What does this indicator tell us about sustainable forest management?

Related indicators

- Pressures such as logging and environmental activism (see Timber harvest, Public involvement, Law) have influenced the extent and location of protected forests. Their condition is affected by fire, disease, invasive species (see Ecosystem dynamics, Exotic species), climate change and recreational users (see Greenhouse gases, Recreation).
- The state of protected forests influences habitats for wildlife (see Species diversity) and recreational opportunities (see Recreation).
- Management responses include planning, facilities and restoration.

Indicator 2-1

Are B.C.'s protected forests representative of its total forests?



- Protecting representative examples of all forest ecosystems is expected to help maintain the diversity of forest-dependent species.
- B.C.'s protected areas have tripled in area since 1950 and doubled since 1991. The area of protected forests increased 134% from 1991 to 2002; protected areas now include 5.7 million ha (10%) of B.C.'s forests.
- Low-elevation forests, which account for 72% of all forests in B.C., are represented with 8% protected in 2002. High-elevation forests are represented with 15% protected in 2002.
- In 2002, the proportion of protected forest in each biogeoclimatic zone varied from 5% to 20%.
- The Coastal Douglas-fir, Ponderosa Pine and Interior Douglas-fir zones have the lowest representation, each with 5% of forests protected.
- The above figures are based on areas protected by the national and provincial governments. Regional parks, municipal parks and private conservation lands provide limited additional areas.
- Only a few, small changes in areas were made between 2002 and 2004.

Related international and national indicators:
MP (1999) 1.1.c
CCFM (1995) 1.1.3
CCFM (2003) 1.1.2

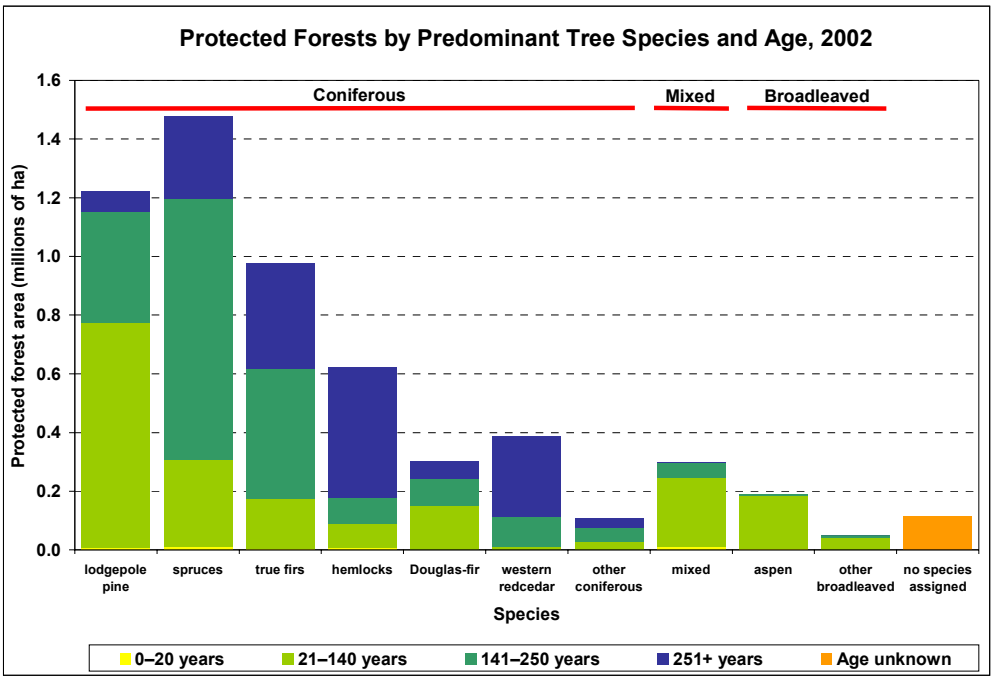
Information

- Estimates of representativeness depend on 1950s inventory data and satellite imagery for about half of the protected forests.
- Representativeness estimates based on forest area are reliable.

Sources: BC Parks, MSRM's Strategic Land Use Planning
Related maps: Protected Areas, Biogeoclimatic Zones
Detailed information: http://www.for.gov.bc.ca/hfp/sof/

Indicator 2-2

What are the areas, types and ages of B.C.'s protected forests?



- Forests may be strictly protected (IUCN categories I to III) or partially protected (IUCN categories IV to VI) by limiting resource development.
- B.C.'s protected forests (IUCN I to III) are mostly coniferous, dominated by lodgepole pine, spruces and true firs, like B.C.'s total forests.
- Older forests are represented well in protected forests. The proportions of protected (and total) forest area over 100 years old are 78% (62%); over 140 years old, 63% (41%); and over 250 years old, 27% (14%).
- In addition, B.C. limits resource development in large special management zones that cover 14 million ha (forest and non-forest) and in many smaller riparian and other sensitive zones. While these areas may not meet all aspects of IUCN definitions for categories IV to VI, their management objectives may be similar to those of one or more IUCN categories. Cumulatively, they provide substantial additional areas that help maintain ecological processes and forest-dependent species.

Information

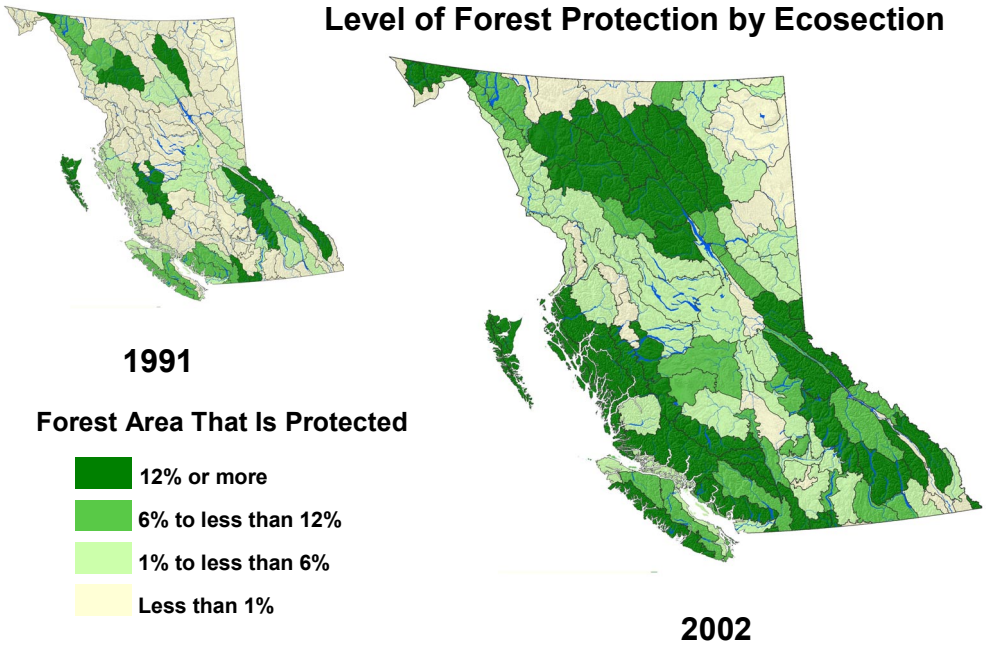
- Analysis of the representativeness of protected forests based on species and age is less reliable than that based on forest area.
- Only satellite imagery is available for a few large parks, and data for several parks existing since the 1950s are old and not reliable.
- More recent forest inventories exist for parks established since 1990.

Sources: BC Parks, MSRM's Strategic Land Use Planning
Related maps: Protected Areas, Special Management Zones
Detailed information: http://www.for.gov.bc.ca/hfp/sof/

Related international and national indicators:
MP (1999) 1.1.c, 1.1.d
CCFM (1995) 1.1.3
CCFM (2003) 1.1.2

Indicator 2-3

How has the geographic distribution of protected forests changed?



- Protecting forests in all parts of the province is important to ensure well-distributed protection of biological diversity. Ecological classification with ecosections based on climate and physiography is used for general conservation and wildlife management. It is better suited for analyzing geographic distribution than biogeoclimatic classification.
- Between 1991 and 2002, the area protected increased in 115 of the 132 terrestrial ecosections. The number with 12% or more of their forest area protected increased from 17 to 43, the number with 6–12% protected increased from 12 to 26, and the number with 1–6% protected increased from 25 to 38. As a result, the number of ecosections with less than 1% of their forests protected decreased from 78 to 25.
- In some parts of the province, protected areas were concentrated in ecosections with high conservation values.
- In other parts of the province, protected areas were intentionally limited in some ecosections with high economic development opportunities.

Information

- Data on the areas of total forests and protected forests by ecosection are reliable.

Sources: BC Parks, Ecoregions of BC

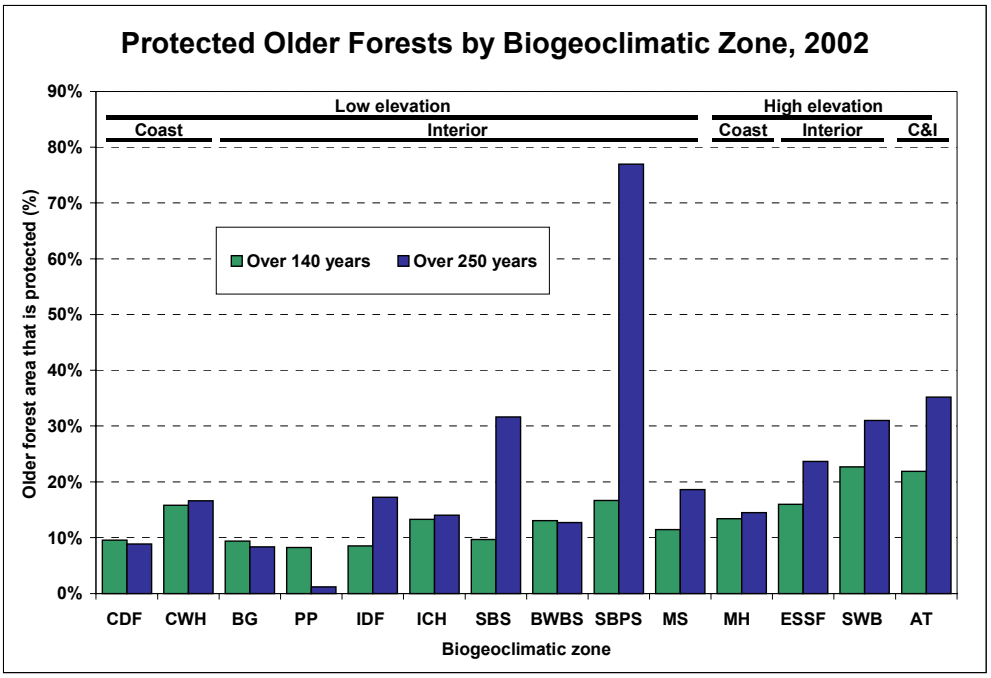
Related maps: Protected Areas, Level of Land Protection by Ecosection

Detailed information: http://www.for.gov.bc.ca/hfp/sof/

Related international and national indicators:
MP (1999) 1.1.c
CCFM (1995) 1.1.3
CCFM (2003) 1.1.2

Indicator 2-4

How much of B.C.'s older forests is protected?



- Older forests provide specialized habitats that play a significant role in maintaining biological diversity. Some are also appreciated for spiritual values. Protecting forests helps prevent the loss of these values for the long time required to grow older forests. Protected older forests are, however, still subject to natural disturbances such as wildfire and pests.
- The area of protected forests over 140 years old has doubled since 1991 to 3.6 million ha (63% of all protected forests). This includes 1.5 million ha over 250 years old (27% of all protected forests). These areas represent 15% and 19%, respectively, of B.C.'s forests of those ages.
- In low-elevation biogeoclimatic zones, 13% of forests over 140 years are protected. In high-elevation zones, 18% are protected.
- Relatively few intact older forests remain in the heavily settled Coastal Douglas-fir, Ponderosa Pine and Interior Douglas-fir zones, but 10%, 8% and 9%, respectively, of the forests over 140 years old are protected.
- The Sub-Boreal Pine–Spruce zone has a small area of forest over 250 years old (see Indicator 1-4), and most of it is within protected areas.
- About 60-65% of the area of protected older forests has trees over 20 m tall. These are often ecologically and culturally important.
- Protected forests considered old growth cover 3.7 million ha (64% of all protected forests). This amounts to 15% of B.C.'s total old growth area.

Related international and national indicators:
MP (1999) 1.1.c, 1.1.d
CCFM (1995) 1.1.3
CCFM (2003) 1.1.2

Information

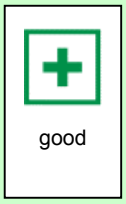
- Age data are not reliable for about half of the protected areas.

Sources: MSRM's Resource Information, MoF's Forest Science
Related maps: Protected Areas, Forest Age, Biogeoclimatic Zones
Detailed information: http://www.for.gov.bc.ca/hfp/sof/

Indicator 2 – Protected forests

What does this indicator tell us about sustainable forest management?

State



Protected areas provide natural habitats for plants and animals, areas for scientific study, and wilderness for a wide variety of recreational, cultural and spiritual pursuits. About 10% of B.C.'s forests are legally protected and meet the standards for IUCN categories I to III. They are reasonably representative of most of the province's forest ecosystems, with a desirable emphasis on older forests. Their geographic distribution reflects intentional balancing of conservation with economic and social priorities. Maintaining ecological processes and natural habitats is also a priority in large areas of forest outside protected areas. While these areas may not qualify as IUCN categories IV to VI, their management objectives may be similar to those of one or more IUCN categories.

Trend

The area of protected forests has more than doubled since 1991, as has the area of protected forests over 140 years old. Representation of most biogeoclimatic zones has improved and the geographic distribution of protected forests among ecosections has also improved. Many forest ecosystems still present a wide range of choices for protecting or developing forests.

Information

Management of currently protected forests and decisions to protect additional areas depend on information about the forests, their conservation values, and expected benefits and costs of ongoing protection. Detailed data and 1:250,000 maps of the biogeoclimatic ecosystem classification are available for the whole province, including protected areas. The broad ecosystem inventory is also available and may be sufficient for some decisions regarding the selection and management of protected forests. Detailed forest cover inventories are available for many protected forests, but only the less reliable 1950s inventory and satellite imagery are available for about half of the protected forests. Furthermore, detailed forest cover inventories primarily address timber values, not conservation values.

Indicator 13 – Timber harvest

Felling – MoF

Yarding – MoF

Loading – MoF

Overview

- Timber harvests supported much of British Columbia's economic development, and continue to be important to the province's economy. (This indicator examines volume; for area and economic importance, see Ecosystem dynamics, Forest products, and Jobs and communities).
- A stable future timber harvest is sustainable provincially, at or above the level of the average volume harvested in the 1990s, although localized increases and decreases in timber supply are forecast.

STATE good **TREND** mixed **INFORMATION** partial

Questions about the timber harvest

13-1 How much timber is harvested annually?

13-2 How does the actual timber harvest compare with the sustainable level?

13-3 What is the provincial timber supply forecast?

13-4 How does the timber supply forecast vary locally?

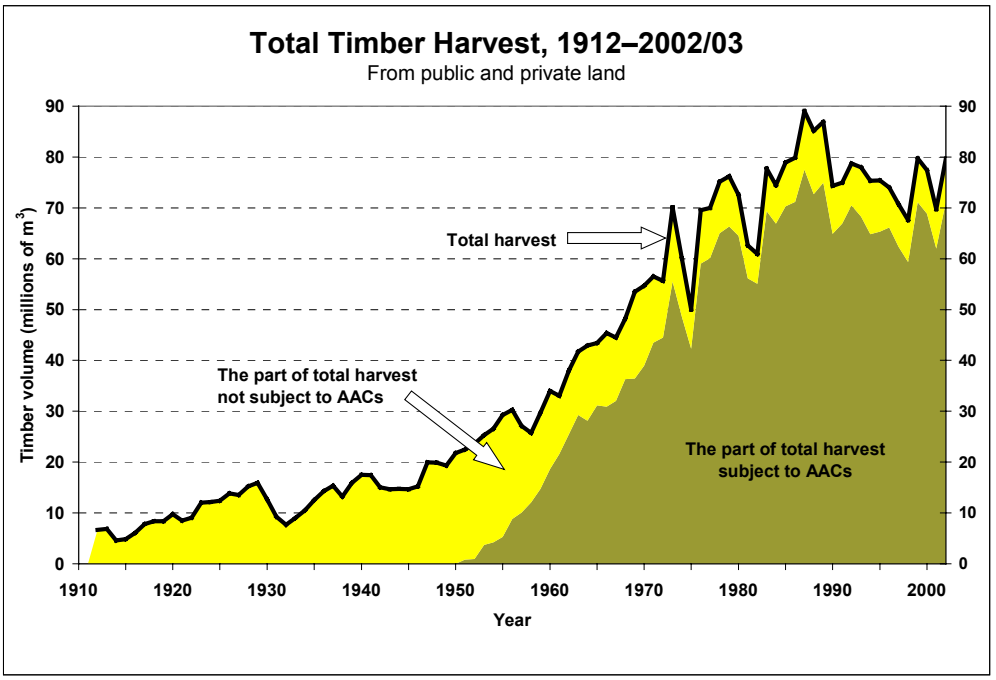
➨ What does this indicator tell us about sustainable forest management?

Related indicators

- Environmental pressures such as wildfires and pest infestations affect planned timber harvest levels (see Ecosystem dynamics).
- The state or level of timber harvests affects the economy (see Forest products, Jobs and communities), ecosystems and perhaps even the climate (see Ecosystem diversity, Species diversity, Greenhouse gases).
- Management responses include planning, appropriate forest practices (see Law) and reforestation (see Silviculture).

Indicator 13-1

How much timber is harvested annually?



- Timber harvests supported a large part of B.C.'s economic development and continue to provide the economic base for many rural communities.
- The annual timber harvest from all public and private land increased 10-fold during the 1900s, and levelled off in the 1990s.
- Concern about the rapid increase led to government regulation of harvest levels to ensure sustainable timber supplies and community stability. Beginning in 1949, government set allowable annual cuts (AACs) to regulate harvest levels on public land and some private land.
- In the 1990s, the average total timber harvest was 75 million m^3 per year, of which 66 million m^3 per year (88%) were subject to AACs.
- The remaining 9 million m^3 per year (12%) were from land with no government-set AACs, primarily private land and some public land.
- Almost all of the harvest subject to AACs is from 37 timber supply areas and 34 tree farm licences, for which the provincial government's chief forester sets AACs. These provided 87% of the total timber harvest over the past 10 years. The government also sets AACs for more than 800 woodlot licences and community forests that provided the remaining 1%.

Information

- Detailed data on timber harvest volumes and areas by land status and species exist for most of the past century, with only a few minor gaps.
- Data are publicly available in the Ministry of Forests' annual reports.

Sources: MoF's Annual reports, Resource Tenures

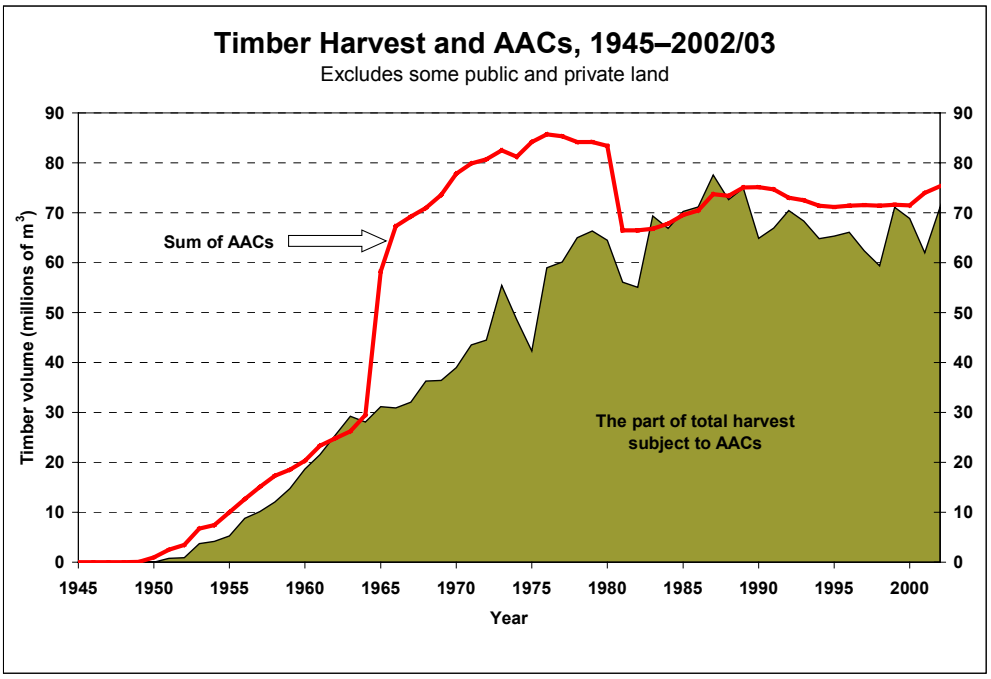
Related maps: Forest Management Units

Detailed information: http://www.for.gov.bc.ca/hfp/sof/

Related international and national indicators:
MP (1999) 2.d
CCFM (1995) 5.1.1
CCFM (2003) 5.3.1

Indicator 13-2

How does the actual timber harvest compare with the sustainable level?



- This comparison can be made for areas subject to government-set AACs. In the 1990s, these accounted for 88% of the total harvest.
- AACs reflect many environmental, economic and social considerations, and provincially represent a sustainable harvest level. AACs are the maximum level of harvests for a five-year period. Harvests may exceed AACs for a short period, compensated by lower subsequent harvests.
- The AACs have changed to reflect new harvesting and milling technologies (increases in the 1960s, 1970s and 1980s), new legislation (the decrease around 1980), and the establishment of new forest practices and parks (the decrease in the early 1990s).
- Over the past 10 years, the average actual harvest from areas subject to AACs was 66 million m^3 per year, or 9% less than the average permitted harvest (sum of AACs) of 72 million m^3 per year. Among the causes for this difference are market fluctuations and delays in forest planning.
- Due to a large outbreak of mountain pine beetle, some AACs have been temporarily increased in the last few years for pest control measures and salvage programs.

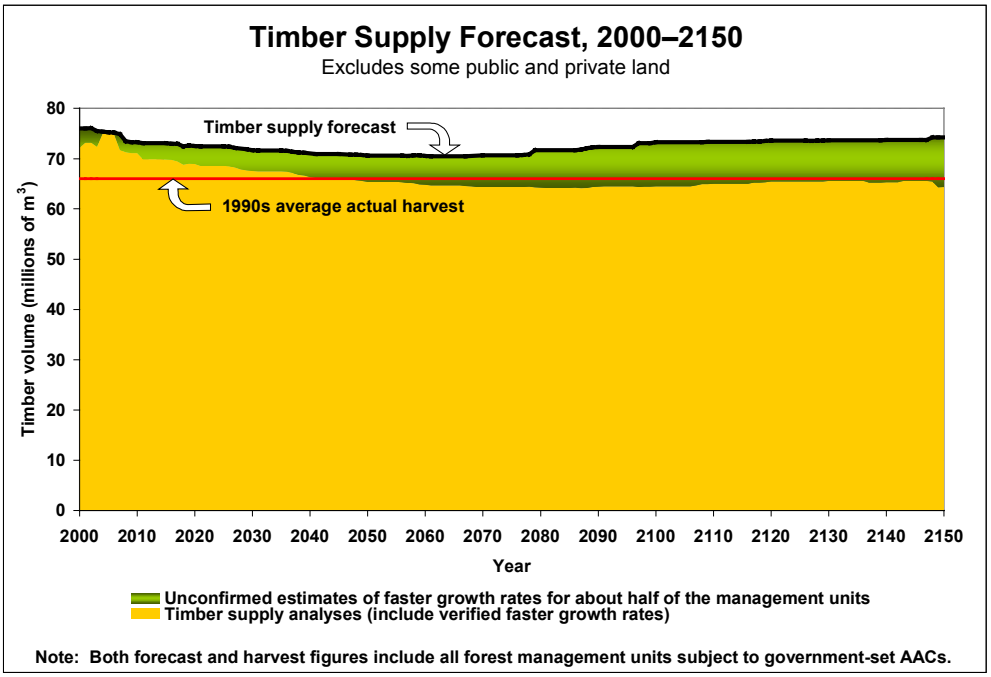
Information

- The AAC rationales and supporting analyses are publicly available for timber supply areas and tree farm licences.
- **Sources:** MoF's Forest Analysis
- **Related maps:** Forest Management Units
- **Detailed information:** http://www.for.gov.bc.ca/hfp/sof/

Related international and national indicators:
MP (1999) 2.d
CCFM (1995) 5.1.1
CCFM (2003) 5.3.1

Indicator 13-3

What is the provincial timber supply forecast?



- Stable future timber supplies are important to B.C.'s economy and to customers who rely on its forest products.
- A detailed forecast is available for forest management units subject to government-set AACs. The sum of the timber supply forecasts decreases from 76 to 70 million m^3 per year over the next six decades; then increases to a steady level of 74 million m^3 per year. This reflects a shift from existing forests to second-growth forests. Harvest levels now sustained by accumulated volume in older forests will in future be sustained by the faster growth of second-growth forests.
- At the lowest point, during the 2050s and 2060s, the timber supply forecast of 70 million m^3 per year is still 7% higher than the 1990s average actual harvest of 66 million m^3 per year.
- The sum of future AACs may be lower or higher than the timber supply forecast due to changes in the harvestable land base, new management practices, catastrophic wildfires, pest epidemics and other factors.

Information

- Timber supply forecasts, including analysis assumptions, are publicly available for timber supply areas and tree farm licences.
- Recent research shows that second-growth forests grow faster than previously estimated. This has been verified by field sampling and included in the timber supply analyses for about half of the management units. Unconfirmed estimates are shown separately for the rest.

Sources: MoF's Forest Analysis, Site Productivity

Related maps: Forest Management Units

Detailed information: http://www.for.gov.bc.ca/hfp/sof/

Related international and national indicators:

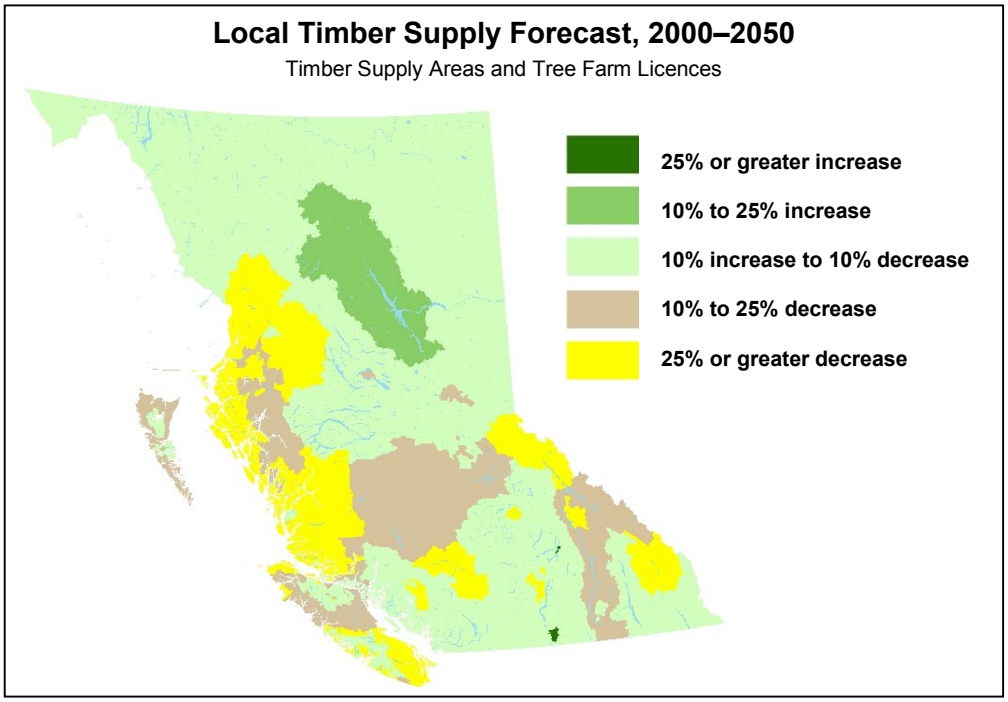
MP (1999) 2.d

CCFM (1995) 5.1.1

CCFM (2003) 5.3.1

Indicator 13-4

How does the timber supply forecast vary locally?



- Stable future timber supplies are important to local economies, especially in rural areas with substantial economic dependency on the forest sector.
- Recent analyses show local variations in timber supply forecasts among the 37 timber supply areas (TSAs) and 34 tree farm licences (TFLs). These provided 87% of the provincial harvest over the past 10 years.
- Increases of 10% or more by 2050 are forecast in 1 TSA and 2 TFLs. Decreases of 10% or more are forecast in 18 TSAs and 14 TFLs.
- Increases and decreases of more than 10% typically occur over several decades. One example of an exception is catastrophic events.
- A temporary AAC increase to control mountain pine beetle infestations is included for 2000 in one unit. The infestation may result in future timber supply decreases not reflected above.
- These forecasts are based on the best available information at the time and do not incorporate unconfirmed estimates of faster growth rates; anticipated changes in harvestable land base and management practices in some areas; and some of the impacts of recent wildfires.

Information

- Timber supply forecasts, including analysis assumptions, are publicly available for TSAs and TFLs.
- Verified higher growth rates were used in forecasts for half of the forest management units. Unconfirmed estimates were not included in the rest.
- Economic/social impact assessments for TSAs are publicly available.

Sources: MoF's Forest Analysis, Site Productivity

Related maps: Forest Management Units

Detailed information: http://www.for.gov.bc.ca/hfp/sof/

Related international and national indicators:

MP (1999) 2.d

CCFM (1995) 5.1.1

CCFM (2003) 5.3.1

Indicator 13 – Timber harvest

What does this indicator tell us about sustainable forest management?

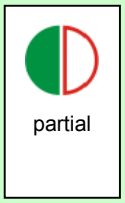
State

British Columbia's early economic development was largely dependent on timber harvests that supported industry and communities throughout most of the province. After increasing rapidly during the 1900s, the total provincial timber harvest stabilized at about 75 million m^3 per year. Government regulation of harvest levels applies to forest management units that provided 88% of the total harvest in the 1990s. In that period, harvest levels in these forests averaged 9% below the sustainable level represented by the provincial sum of AACs.

Trend

Collectively, forests with government-regulated harvest levels are forecast to support future timber harvests that are at least 7% higher than the average timber harvest during the 1990s. These forests will continue to provide an important base for the provincial economy, especially in rural communities. Timber supply forecasts show significant local variation. Large increases are expected in a few units, providing opportunities for new investments in the forest industry. Large decreases are expected over time in several forest management units and will require transitions for workers and communities.

Information



Substantial, detailed information related to timber supply exists for forests with government-regulated harvest levels. Most of this information is publicly available. Recent research shows that many second-growth forests grow faster than previously estimated. As a result, the new projected decrease or "falldown" to 70–74 million m^3 per year in the timber supply forecast for forests with government-regulated harvest levels is smaller than previously estimated. (In 1984 and 1994, the Ministry of Forests published a projected decrease to 50–60 million m^3 per year.) Forests that do not have government-regulated harvest levels (mostly on private land) account for 12% of the provincial timber harvest. The government has little information about these forests and does not know whether the harvests from them are sustainable.

Indicator 19 – First Nations involvement

Ksan totem – Tom Ryan

Consultation – MoF

Overview

- Forests have been economically, culturally and spiritually significant to First Nations people for thousands of years. First Nations people (not including Metis) now make up about 3% of British Columbia's population, and most live in rural communities near the forest land base.
- Involvement by First Nations in the forest sector's economic opportunities has increased over the past 20 years.
- Many First Nations in B.C. have unresolved aboriginal rights and title issues.

STATE mixed **TREND** improving **INFORMATION** adequate

Questions about First Nations involvement

19-1 What timber harvesting opportunities do First Nations have?
19-2 In what ways do First Nations participate in the forest sector?
19-3 How are First Nations interests considered in forest management?
19-4 Are unresolved aboriginal rights and title issues being addressed?

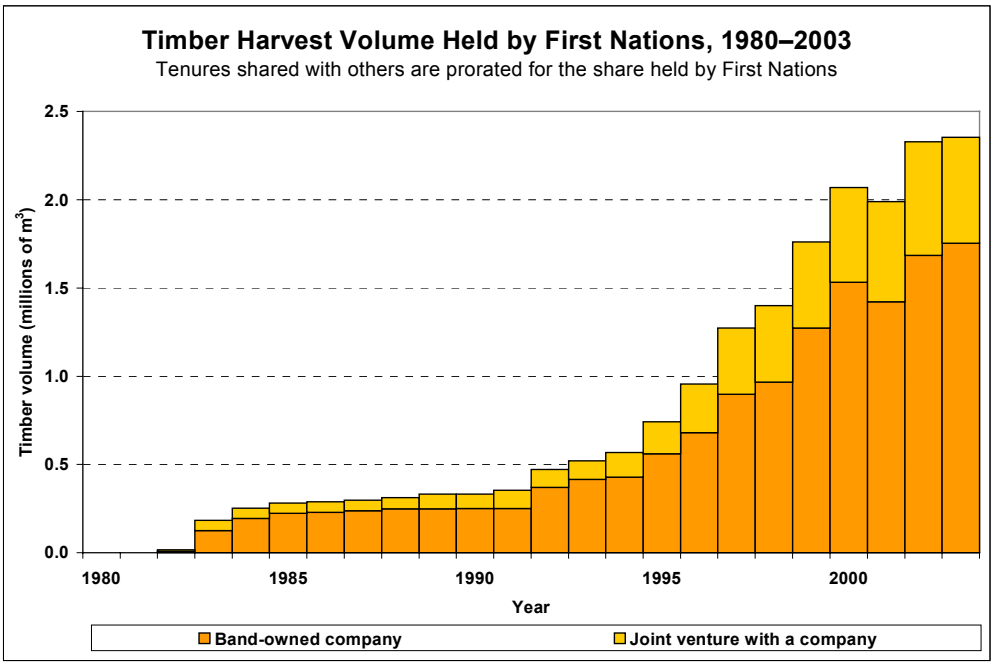
➨ What does this indicator tell us about sustainable forest management?

Related indicators

- Timber harvesting puts pressure on First Nations' traditional cultural uses of the forests, including hunting of wildlife (see Species diversity).
- High rates of unemployment in many First Nations communities create difficult social pressures (see Jobs and communities).
- Management responses include consultation, changes in policy, law, and allocation of forest resources (see Law, Ownership and management), and resolution of aboriginal rights and title issues.

Indicator 19-1

What timber harvesting opportunities do First Nations have?



- Timber harvesting and related milling can provide important economic development opportunities to First Nations.
- The timber harvest volume under tenures held by First Nations increased to 3% of the provincial allowable annual cut (AAC) over the past two decades. The graph shows permitted, not actual, harvests.
- About three-quarters of the timber harvest volume is held by bands or band-owned companies.
- Joint ventures with non-aboriginal companies account for most of the remainder, and provide opportunities for First Nations to develop skills and entrepreneurial capacity.
- Rates of involvement vary around the province, depending on First Nations' interest and capacity and the availability of unallocated timber.
- Recent initiatives enable the sharing of forestry revenues with First Nations, direct awards to First Nations and reallocation of timber from major licensees to First Nations. Over the next few years, First Nations involvement is expected to increase to 8% of the provincial AAC.

Information

- Records of First Nations' timber tenures are reliable for recent years.
- The MoF began systematic gathering of data on First Nations' tenures in 1995. Some minor gaps are known to exist in the data before 1995.

Sources: MoF's Aboriginal Affairs

Related maps: First Nations Bands

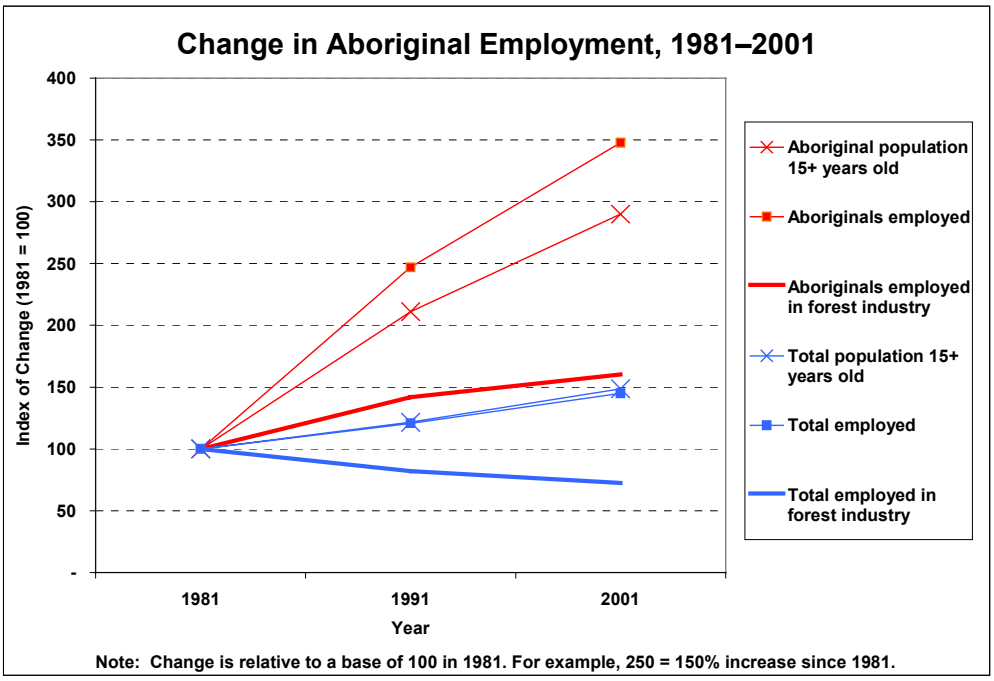
Detailed information: http://www.for.gov.bc.ca/hfp/sof/

Related international and national indicators:

MP (1999) none
CCFM (1995) 6.2.1
CCFM (2003) none

Indicator 19-2

In what ways do First Nations participate in the forest sector?



- First Nations hold timber tenures, work in the forest sector (e.g., logging, milling, fire fighting, tree planting), pursue training in forestry, and consult on forest management. Employment provides direct economic benefits to individuals and communities.
- Census data show that aboriginal direct employment in the forest sector increased 60% between 1981 and 2001, from 3,930 to 6,300, or from 3.5% to 7.7% of total direct employment in the forest sector.
- Aboriginal employment in all sectors increased 248% over these two decades, while total B.C. employment increased 45%.
- With increasing education and training in forestry, First Nations individuals are filling more technical and professional positions.
- First Nations are increasingly participating in opportunities to have their interests considered, primarily through the sharing of information with government and the forest industry.
- Harvesting of fish, wildlife and other non-timber forest products continues to play an important role in First Nations' livelihoods and culture.

Information

- Employment statistics are from the Canada census. The high aboriginal growth rates are partly due to increasing self-identification as aboriginal.
- Information on the use of non-timber forest products is incomplete.

Sources: Statistics Canada

Related maps: First Nations Bands

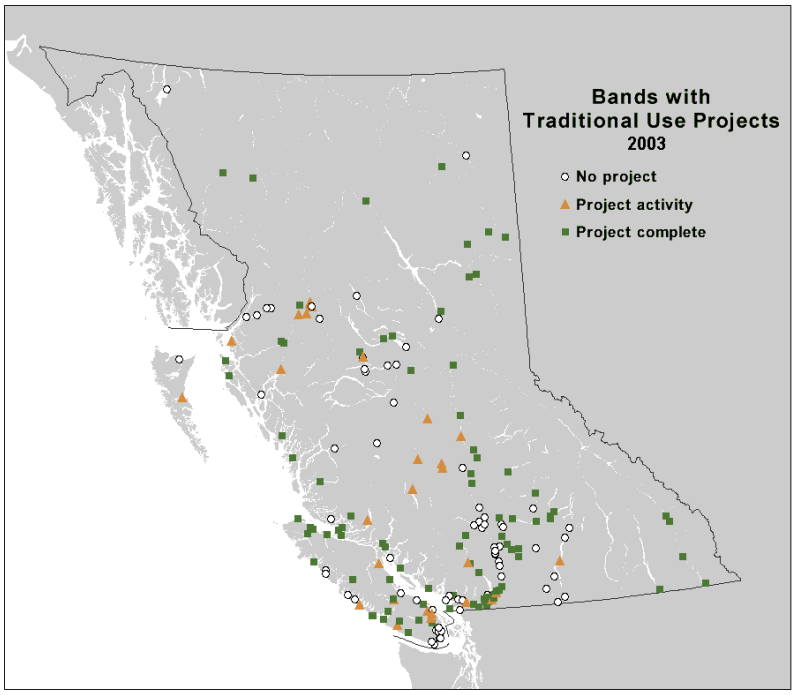
Detailed information: http://www.for.gov.bc.ca/hfp/sof/

Related international and national indicators:

MP (1999) 6.5.a
CCFM (1995) 6.2.1
CCFM (2003) 5.3.5

Indicator 19-3

How are First Nations interests considered in forest management?



- Forest management directly affects the economic, social and legal interests of First Nations.
- The government and the forest industry collect information on aboriginal interests by consulting with First Nations and supporting projects that collect and document information about traditional use.
- Both government and the forest industry have increased their level of consultation with First Nations over time. Court decisions on aboriginal rights issues have prompted development of consultation policies.
- Over the past decade, 55 traditional use projects have documented traditional ecological knowledge and cultural use of land and resources. These projects have involved 126 of 199 bands in the province.
- The government and the forest industry consider information on aboriginal interests in activities such as land use planning and forest management decision-making.

Information

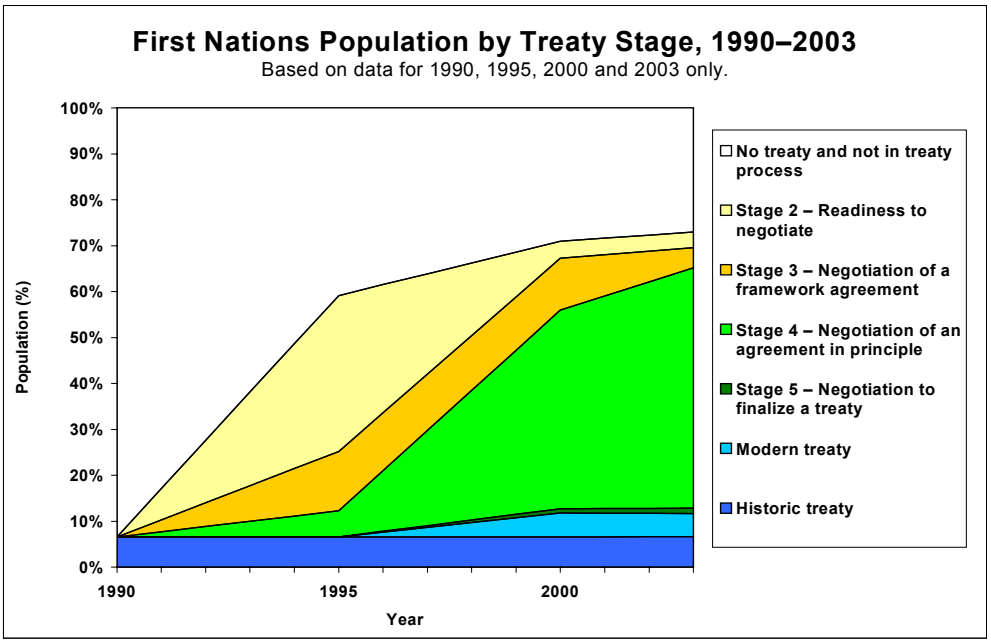
- The quality of information collected in traditional use projects varies.
- Information from the traditional use projects and consultations is available to the involved First Nations and within government.

Sources: MoF's Aboriginal Affairs, MSRM's Business Solutions
Related maps: First Nations Bands
Detailed information: http://www.for.gov.bc.ca/hfp/sof/

Related international and national indicators:
MP (1999) 7.1.a
CCFM (1995) 6.1.1, 6.2.2
CCFM (2003) 6.1.1, 6.2.1

Indicator 19-4

Are unresolved aboriginal rights and title issues being addressed?



- Resolution of aboriginal rights and title issues is expected to increase certainty for land and resource development in B.C. The preferred approach to addressing these issues is through treaty negotiations.
- Historical treaties signed in the 1800s covered 7% of the First Nations population in 1999.
- In 2000, the Nisga'a Treaty and an adhesion to Treaty 8 increased that coverage to 12% of the First Nations population.
- Over 40 First Nations groups, involving more than 60% of the First Nations population, are currently in tripartite negotiations with the provincial and federal governments. Most are in the fourth stage of the six-stage process – negotiation of an agreement in principle.
- These negotiations are overseen and facilitated by the BC Treaty Commission, an independent body established in 1992 by Canada, British Columbia and the First Nations Summit.
- Interim measures agreements are used to address aboriginal rights and title issues while treaty negotiations are under way. They provide interim solutions and economic opportunities such as forest tenures and revenue sharing.

Related international and national indicators:
MP (1999) 7.1.a
CCFM (1995) 6.1.1
CCFM (2003) 6.1.1

Information

- Treaty process information is well documented and readily available.

Sources: BC Treaty Commission, BC Treaty Negotiations Office, Indian and Northern Affairs Canada, MSRM's Business Solutions
Related maps: First Nations Bands
Detailed information: http://www.for.gov.bc.ca/hfp/sof/

Indicator 19 – First Nations involvement

What does this indicator tell us about sustainable forest management?

State

mixed

Forests are economically, culturally and spiritually significant to B.C.'s First Nations, who have depended on them for thousands of years. The timber harvest volume held by First Nations (about 3% of the province's allowable annual cut) is proportional to the First Nations population (about 3% of the province's population). The percentage of First Nations people employed in the forest sector is similar to that of other British Columbians working in the sector. First Nations' interests are considered in forest management decisions. Treaty negotiations currently involve more than 40 First Nations and more than 60% of the First Nations population. The economic situation of many First Nations is not satisfactory. It is expected to improve with treaty settlements and other initiatives, including reallocation of timber rights. These initiatives, however, have also caused considerable short-term uncertainty for the forest industry.

Trend

improving

Over the past two decades, First Nations access to economic opportunities based on timber has increased substantially. Between 1981 and 2001, First Nations employment in the forest sector increased 60%. Consultation on forest management decisions has also increased, and documentation of traditional uses has improved. Several First Nations are close to negotiating modern treaties, and many more are well into the process. Further work is required to resolve many aboriginal rights and title issues. In the long term, these changes are expected to provide greater certainty around forestry and other issues for First Nations, the provincial government, the forest industry and other British Columbians, thereby increasing social and economic sustainability.

Information

adequate

Large amounts of information have been collected and documented to inform forest management decisions, interim measures agreements and treaty negotiations.

Indicator 21 – Law

British Columbia Legislature, Victoria – MoF

Forest practices audit – MoF

Overview

- All forest activities, from timber harvesting to recreation, are governed in varying degrees by law, exercised on the basis of tradition, contractual requirements, administrative policies and legislation.
- British Columbia has a comprehensive framework of law that enables and supports sustainable forest management.

STATE good **TREND** improving **INFORMATION** partial

Questions about law

21-1 How are the elements of sustainable forest management governed?
21-2 Is government assessing compliance with the law?
21-3 What corrective measures are taken?
21-4 Is the law effective in achieving sustainable forest management?

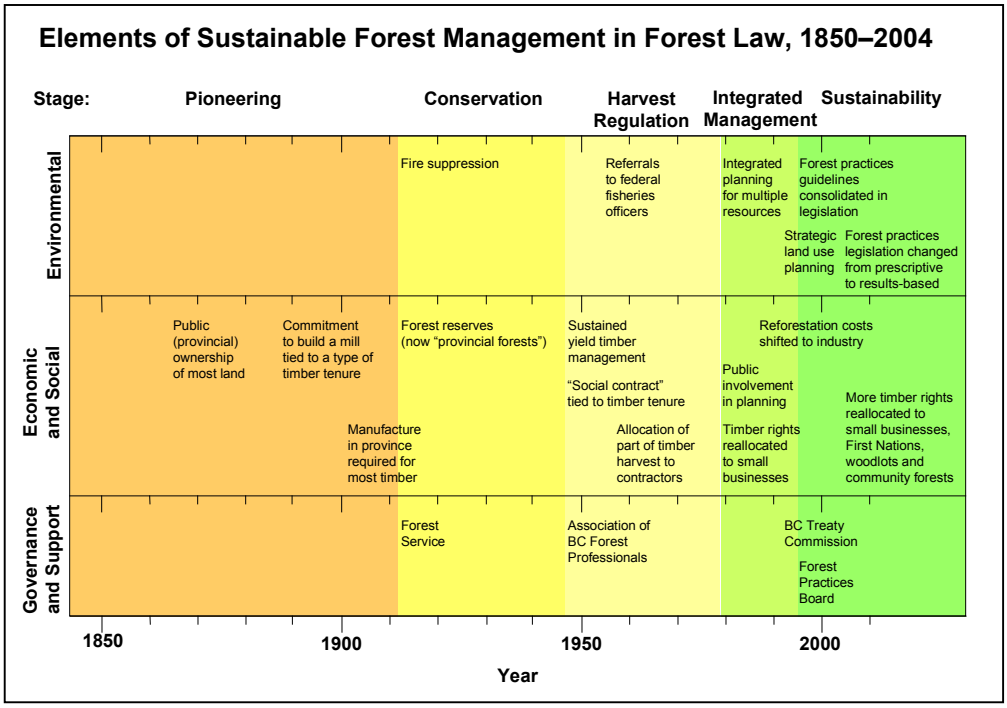
➨ What does this indicator tell us about sustainable forest management?

Related indicators

- Conflicting demands for goods and services from forests create the pressure for government to determine and set in law the rights and obligations of stakeholders (see Forest products, First Nations involvement, Public involvement).
- Governing all aspects of sustainable forest management may create a state of legal complexity that can lead to excessive costs for government and stakeholders (see Jobs and communities).
- One response to excessive costs is delegation of authority (see Ownership and management). Non-state governance (see Certification) may address perceived inadequacies in the law.

Indicator 21-1

How are the elements of sustainable forest management governed?



- Law evolves along with society to protect and balance changing interests in environmental, economic and social values. It authorizes some activities and constrains others, to reduce harm and the risk of harm.
- B.C.'s forest law has evolved over more than a century, to allocate economic opportunities, conserve forests, improve forest planning and forest practices, and establish organizations to support better forestry.
- Administration of timber extraction has been enhanced over time with increasingly comprehensive requirements to ensure a sustainable yield of timber. Early lack of consideration for non-timber values has been replaced by legal requirements for planning, public involvement and explicit objectives to conserve environmental, social and cultural values.
- For most aspects of forestry, initial reliance on contract law and administrative policy was superceded by prescriptive administrative law and, in recent years, by administrative law that enables innovation with a focus on achieving defined objectives. Serious offences continue to be addressed through criminal and quasi-criminal law.
- The legal recognition and roles of the profession of forestry have also evolved, reflecting the increasing breadth and complexity of forestry.

Related international and national indicators:
MP (1999) 7.1.a to 7.1.e
CCFM (1995) 4.4.5
CCFM (2003) 6.5.4

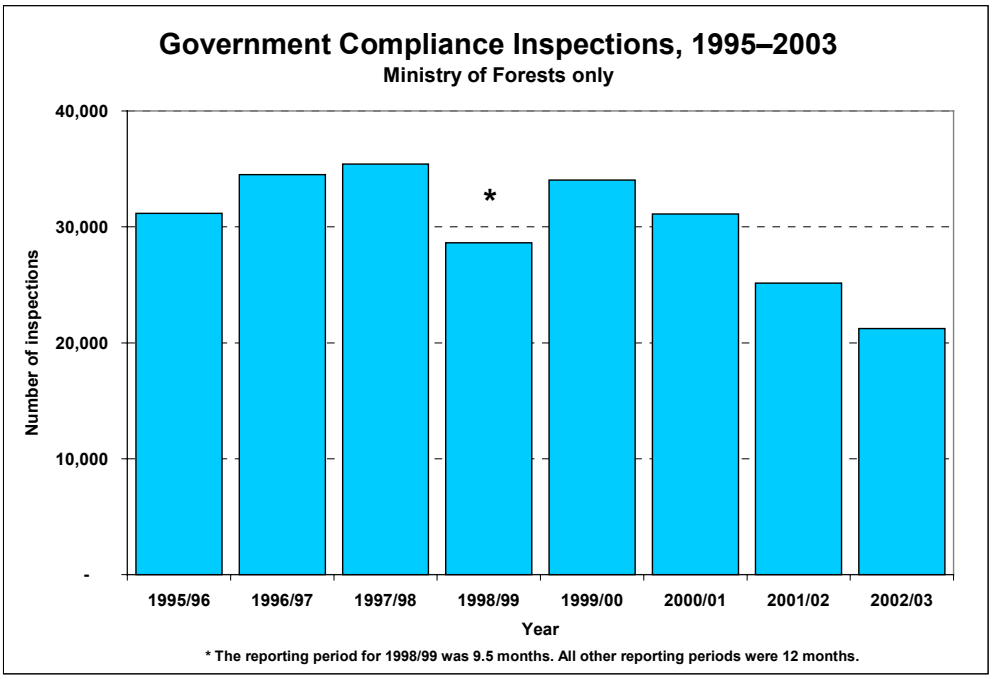
Information

- Various inquiries document the reasons for major changes in the law.

Sources: Forest legislation, ABCFP's guide to legislation
Related maps: none
Detailed information: http://www.for.gov.bc.ca/hfp/sof/

Indicator 21-2

Is government assessing compliance with the law?



- Several government agencies assess compliance with forest law, using site inspections, patrols and office reviews.
- Before 1979, Ministry of Forests compliance checks focused on timber harvesting contracts and unauthorized timber harvests (illegal logging).
- Inspection of forest practices and non-timber values was added in 1979, but was not systematic. Compliance assessments became more systematic to help enforce the *Forest Practices Code Act* of 1995, and their rigour was improved in 2001. The *Forest and Range Practices Act* of 2004 will require further evolution of compliance assessments.
- Inspections have increasingly focused on areas at greatest risk for non-compliance (based on operators' past performance) or environmental impact. Operators with forest certification are usually a lower risk.
- The independent Forest Practices Board, set up in 1995, audits forest practices and the appropriateness of government enforcement. It also investigates complaints and participates in administrative appeals. The board has found that compliance rates are generally high and increasing.
- The Ministry of Water, Land and Air Protection monitors pollution emissions from pulp mills and sawmills, and cooperates with the federal Department of Fisheries and Oceans to protect fish and fish habitat.

Related international and national indicators:
MP (1999) 7.2.e
CCFM (1995) none
CCFM (2003) 3.1, 3.2, 6.4.2

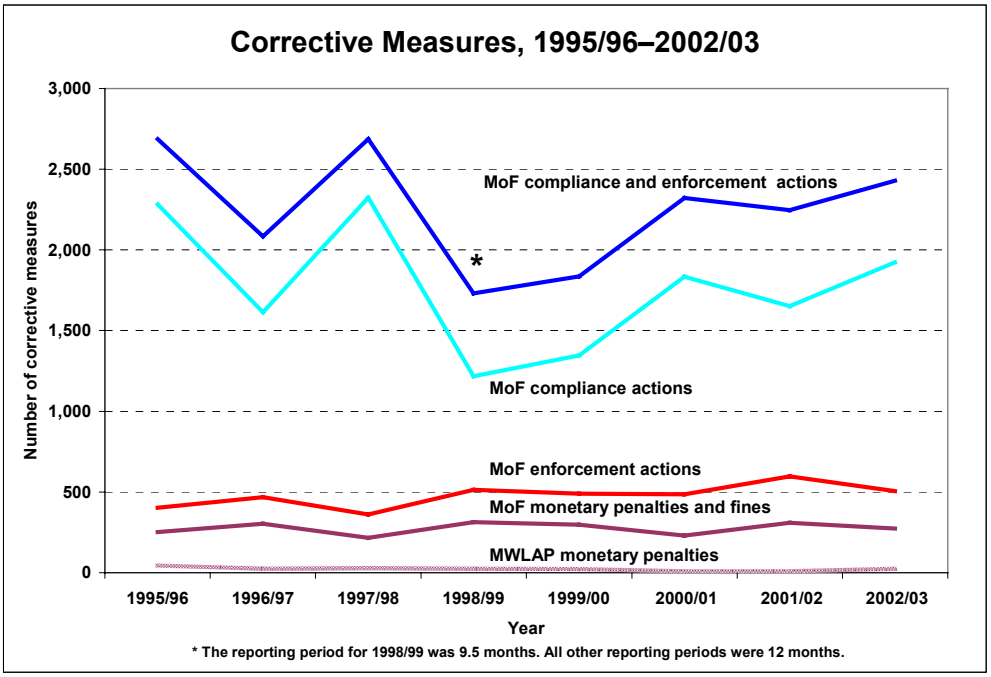
Information

- Statistics are published for MoF inspections and Forest Practices Board audits, but not for MWLAP and DFO inspections.

Sources: MoF's Compliance & Enforcement, Forest Practices Board
Related maps: none
Detailed information: http://www.for.gov.bc.ca/hfp/sof/

Indicator 21-3

What corrective measures are taken?



- Inspections promote compliance with the law, prevent non-compliance and detect non-compliance (leading to compliance actions and enforcement actions).
- Compliance actions, averaging 1,800 per year, mitigate minor problems.
- Enforcement actions, averaging 480 per year, result in formal sanctions. These include administrative measures such as monetary penalties and court-enforced measures such as fines and jail sentences. Their purposes are to remedy harm, compensate for loss, prevent profit from a contravention and deter careless or intentional misconduct.
- Monetary penalties and fines average 275 per year and a total of $0.5 million annually. Over 80% of the monetary penalties are for amounts of $5,000 or less. The largest penalty, for unauthorized timber harvesting, was $235,000 in 1999/00. It included the value of the timber.
- The number of minor contraventions resulting in no enforcement action has increased.
- Courts have ordered about two jail sentences per year.
- Large fines for pollution from mills, especially pulp mills, have decreased in number. The largest single fine was $250,000 in 1990.
- Administrative reviews and appeals are available.

Related international and national indicators:
MP (1999) 7.2.e
CCFM (1995) none
CCFM (2003) 3.1, 3.2, 6.4.2

Information

- The MoF publishes details of its enforcement actions. MWLAP does not.

Sources: MoF's Compliance & Enforcement, Forest Practices Board, Appeals
Related maps: none
Detailed information: http://www.for.gov.bc.ca/hfp/sof/

Indicator 21-4

Is the law effective in achieving sustainable forest management?

Effectiveness Evaluations, 2004
Ministry of Forests

Related indicator in The State of BC's Forests	Specific topic	Developing evaluation indicators	Evaluation indicators drafted	Evaluation indicators field-tested	Effectiveness evaluations started (number)	Effectiveness evaluations completed (number)	Evaluations of effectiveness of the law (+ or +/- or -)
Ecosystem diversity	landscape-level biodiversity	Yes	Yes				
Ecosystem dynamics	upland/riparian function/habitat	Yes	Yes	Yes	8	5	+/- + + + +
	karst features	Yes	Yes				
	cutblock size	Yes	Yes				
	stand-level biodiversity	Yes	Yes				
	wildlife trees	Yes	Yes	Yes	2	1	+/-
Species diversity	post-harvest tree species	Yes					
	wildlife	Yes	Yes				
Exotic species	invasive alien plants	Yes	Yes	Yes	1		
Genetic diversity	post-harvest tree seedlots	Yes					
Soil	soil conservation	Yes	Yes	Yes	1		
Water	drinking water quality	Yes	Yes				
	fish/riparian habitat	Yes	Yes	Yes			
Recreation	recreation sites and trails	Yes	Yes				
	visual quality	Yes	Yes				
First Nations involvement	cultural heritage	Not started					

- Ensuring the law's effectiveness requires responsible innovation, systematic evaluation and continual improvement.
- The MoF has begun monitoring for effectiveness evaluations, to assess whether specific resource values (especially environmental) are being managed sustainably, and to recommend improvements in training, best management practices, policies and legislation.
- Evaluation indicators and monitoring protocols and are rigorously peer-reviewed and field-tested to ensure scientific validity. They are also designed to work at varying levels of intensity.
- Routine, overview monitoring by districts will identify resource value status, trends, implementation issues and areas that require more intensive evaluations by region and headquarters staff.
- The Forest Practices Board cooperated with the MoF in the development and testing of evaluation indicators and has used them to assess the effectiveness of forest practices and to comment on relevant legislation.
- Royal commissions and other inquiries periodically assess the law's effectiveness in protecting and balancing economic and social values. Government staff also have a role in providing timely assessments.

Related international and national indicators:
MP (1999) 7.1.b, 7.1.d
CCFM (1995) 4.4.5
CCFM (2003) 6.5.4

Information

- Evaluation indicators, methods and results are publicly available.

Sources: MoF's FRPA Resource Evaluation, Forest Practices Board
Related maps: none
Detailed information: http://www.for.gov.bc.ca/hfp/sof/

Indicator 21 – Law

What does this indicator tell us about sustainable forest management?

State

British Columbia's legal framework encourages economic development while maintaining environmental requirements, through forest practices regulations that are among the most stringent in the world, and facilitating public involvement to ensure consideration of social values.

The government systematically checks compliance and enforces the law. Practices in the forest, and the compliance and enforcement system itself, are also independently audited.

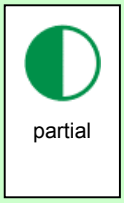
The rate of compliance is high, so the number of corrective measures required and the total amount collected in monetary penalties and fines are relatively low.

Trend

During the 1990s, the increasing complexity of forest law resulted in high costs of operation and administration for both the forest industry and government. Recent adjustments of the legal framework have aimed to reduce these costs, increase the potential for innovation in forest and range practices, and re-direct efforts from a focus on compliance with prescriptive regulations to a focus on achievement of desired objectives.

Over the past eight years, the minor nature of most contraventions and the increasing number of decisions by government to take no further enforcement action reflect an increasing understanding of, and compliance with, the law.

Information



The development of forest law in B.C. is well documented. Data on Ministry of Forests compliance assessments and corrective measures are publicly available, as are the well-documented, independent audits of the Forest Practices Board.

The ultimate effectiveness of the law in achieving specific objectives of sustainable forest management is being rigorously evaluated, but to date only a few results are available.

Indicator 24 – Certification

Lumber bound for international customers - MoF

- Forest certification is a voluntary, market-based instrument that gives buyers of forest products assurance that the products come from well-managed forests. The requirements for certification support sustainability, but certification does not in itself guarantee sustainable forest management.
- British Columbia is a North American leader in forest certification.

STATE good **TREND** mixed **INFORMATION** adequate

Questions about forest certification

24-1 What is the area of B.C.'s certified forest operations?
24-2 How much area is certified under each standard?
24-3 How much of the timber harvest is certified under each standard?
24-4 How much of each tenure type's harvest is certified?

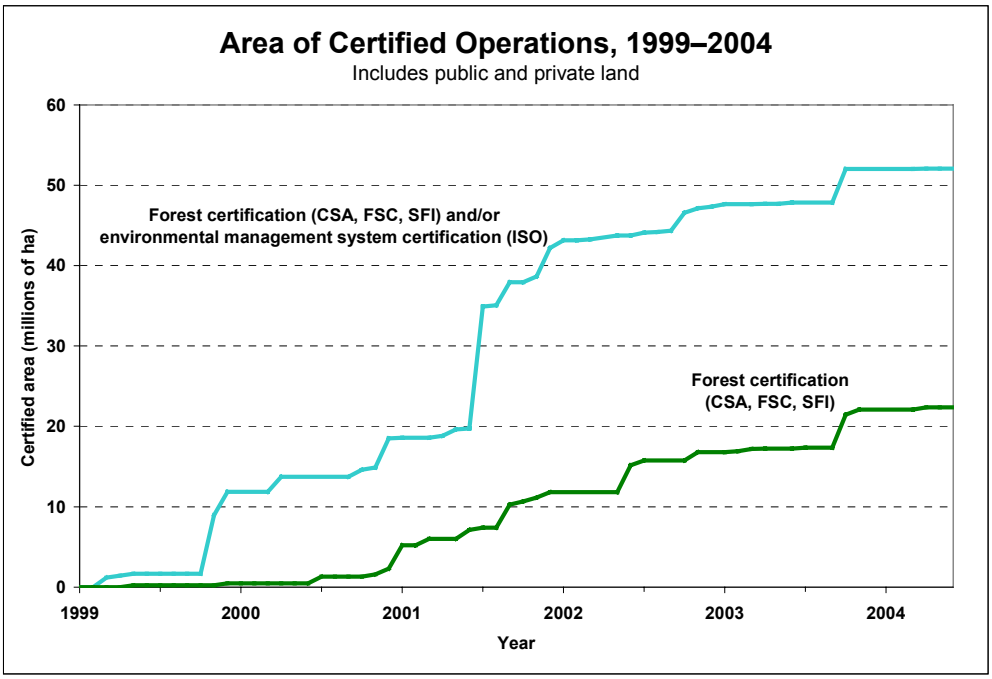
➨ What does this indicator tell us about sustainable forest management?

Related indicators

- Some major customers of the B.C. forest industry (see Forest products) have purchasing policies that favour certified products. This puts pressure on industry to become certified to maintain market access.
- Certification may require changes in forest practices (see Silviculture) and stakeholder involvement (see Public involvement).
- Government and industry may respond to overlap between legal requirements and certification requirements for forest management and auditing by streamlining procedures and sharing costs (see Law).

Indicator 24-1

What is the area of B.C.'s certified forest operations?



- To earn forest certification, a forest operation must receive independent, third-party verification that it is well managed according to a certification standard or set of requirements.
- Three forest certification standards are used in B.C.: CSA, FSC and SFI. They address environmental, economic and social aspects of sustainable forest management (SFM), so they are often referred to as SFM standards or SFM certification.
- In early 1999, no forest operation in B.C. was certified. By June 2004, the area certified under the forest certification standards increased to 22 million ha (28% of the province, excluding protected areas and areas converted for agricultural, urban or other development).
- The ISO standard for certification of environmental management systems, although not specific to forestry and less demanding than forest certification, is often used as a foundation for SFM standards. Including ISO, the area certified by 2004 increased to 52 million ha (65% of the province, excluding protected areas and converted areas).
- In 2004, B.C. accounted for 39% of the area certified in Canada under SFM standards, and 37% of the area certified when ISO is included.

Information

- Certified areas include lakes, alpine areas and other non-forest land within certified forest management units.
- Certified areas are well documented and publicly available.

Sources: Canadian Sustainable Forestry Certification Coalition, MoF

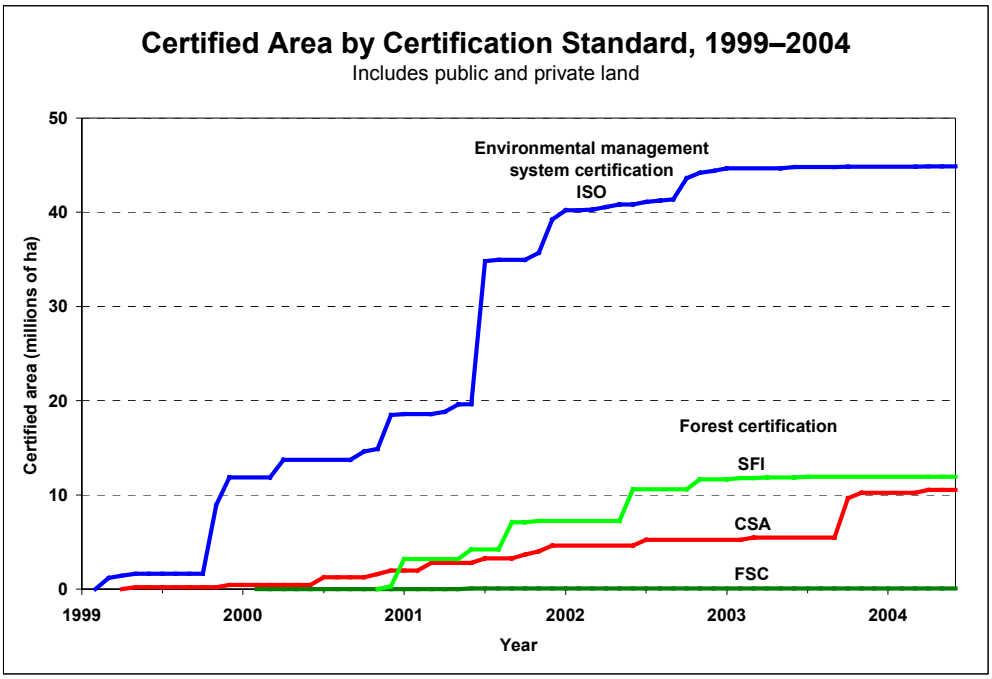
Related maps: none

Detailed information: http://www.for.gov.bc.ca/hfp/sof/

Related international and national indicators:
MP (1999) none
CCFM (1995) none
CCFM (2003) none

Indicator 24-2

How much area is certified under each standard?



- Each certification standard's breadth of influence across the land base is apparent from the area certified under the standard.
- B.C.'s first forest certification was under the SFM standard developed by the Canadian Standards Association (CSA). Almost 11 million ha are now CSA certified. CSA has process requirements consistent with those of ISO, and on-the-ground performance requirements related to national forest values and local objectives established with public participation.
- Next was the international Forest Stewardship Council (FSC) standard that is widely supported by environmental NGOs and First Nations. The preliminary standard for B.C. has detailed process and performance requirements. About 0.1 million ha are now FSC certified.
- The Sustainable Forestry Initiative (SFI) standard developed in the U.S. followed. It also has both process and performance requirements. Almost 12 million ha are now SFI certified.
- About 45 million ha are certified under the International Organization for Standardization (ISO) standard. It requires operators to meet or exceed all environmental regulations and to establish processes to ensure continual improvement. It does not set specific performance criteria.

Information

- Certified areas include lakes, alpine areas and other non-forest land within certified forest management units.
- Certified areas are well documented and publicly available.

Sources: Canadian Sustainable Forestry Certification Coalition, MoF

Related maps: none

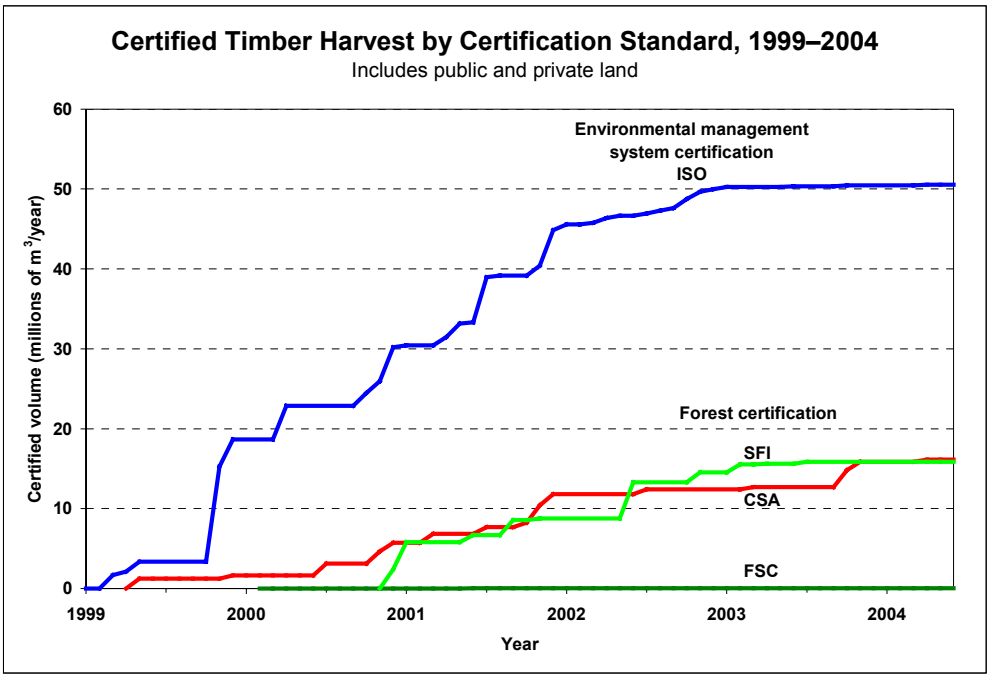
Detailed information: http://www.for.gov.bc.ca/hfp/sof/

Related international and national indicators:

MP (1999) none
CCFM (1995) none
CCFM (2003) none

Indicator 24-3

How much of the timber harvest is certified under each standard?



- Each certification standard's importance to B.C.'s forest products is apparent from the volume of timber harvested under the standard.
- By June 2004, operators with forest certification accounted for 32 million m^3/year, or 38% of the sum of government-set allowable annual cuts (AACs) and the average harvest from private land not subject to AACs.
- The CSA certified volume increased to 16 million m^3/year.
- The FSC certified volume was 0.04 million m^3/year.
- The SFI certified volume increased to 16 million m^3/year.
- Most operators certified under CSA or SFI are also ISO certified. The total volume certified under one or more standards increased to 55 million m^3/year, or 65% of the sum of AACs and private land harvests.
- The ISO certified volume increased to 51 million m^3/year.
- In June 2004, B.C. accounted for 48% of Canada's timber harvest volume certified under SFM standards (CSA, FSC and SFI) and, with ISO included, for 44% of Canada's certified volume.
- Further increases in certification are anticipated under all standards.

Information

- Volumes are based on government-set AACs of forest management units or portions of them, and an estimate for a private land unit.
- Certified volumes are well documented and publicly available.

Sources: Canadian Sustainable Forestry Certification Coalition, MoF

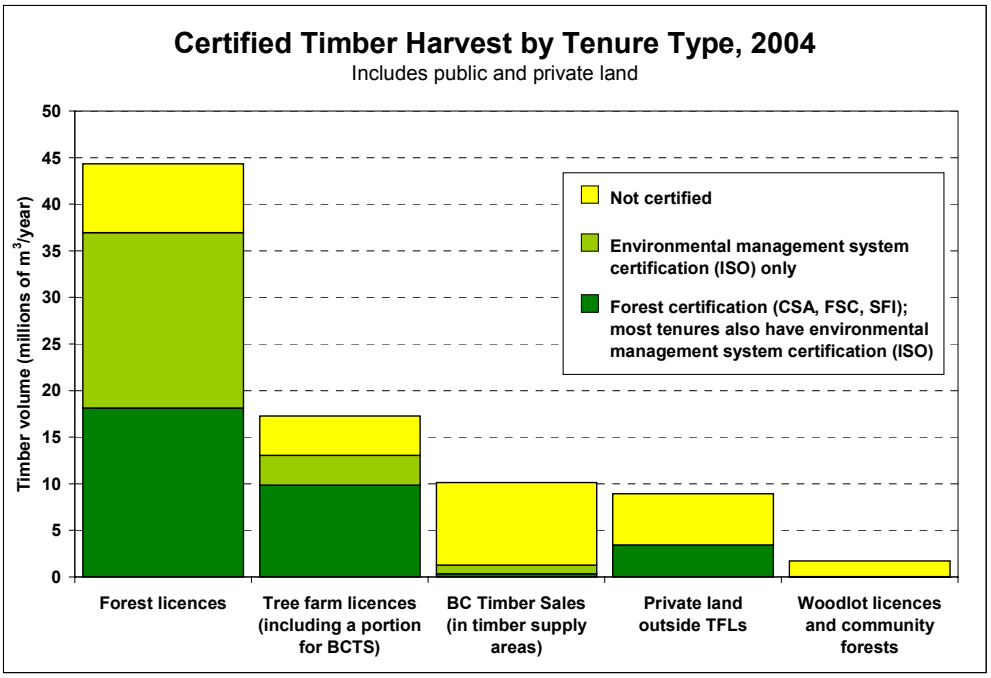
Related maps: none

Detailed information: http://www.for.gov.bc.ca/hfp/sof/

Related international and national indicators:
MP (1999) none
CCFM (1995) none
CCFM (2003) none

Indicator 24-4

How much of each tenure type's harvest is certified?



- Becoming certified is more important to some operators than to others.
- Forest licences (mostly long-term, volume-based tenures), tree farm licences (long-term, area-based tenures) and private land outside TFLs collectively account for over 80% of the provincial timber harvest. They have the highest rates of certification (respectively, 41%, 57% and 38% under SFM standards, and 83%, 76% and 38% when ISO is included). Large operators manage most of the forest under these tenure types. They have a strong incentive to maintain market access by achieving the certification favoured by their buyers. Also, the Forest Products Association of Canada is requiring its members to have all their forest operations certified under an SFM standard by the end of 2006.
- Short-term tenures sold by the government's BC Timber Sales (BCTS) to small operators on public land account for about 13% of the provincial timber harvest. The rate of certification for these tenures in timber supply areas is 3% under SFM standards and 13% when ISO is included.
- The cost of obtaining certification is a significant disincentive for most holders of small woodlot licences and community forest agreements, but certification is a matter of principle to some. These tenures have low rates of certification: 0.4% under SFM standards, 0.7% including ISO.
- Increased certification is anticipated in all tenure types.

Related international and national indicators:
MP (1999) none
CCFM (1995) none
CCFM (2003) none

Information

- Volumes by tenure type can be derived from publicly available data.

Sources: CSFCC, MoF's Certification, Apportionment
Related maps: Forest Management Units
Detailed information: http://www.for.gov.bc.ca/hfp/sof/

Indicator 24 – Certification

What does this indicator tell us about sustainable forest management?

State

Forest certification is a voluntary, market-based instrument that provides buyers with assurance that a forest is well managed and meets the requirements of a certification standard. Some markets now favour forest products from certified forest operations.

Forest certification under the CSA, FSC and SFI standards is evidence of rigorous, systematic efforts to manage forests well, but does not guarantee sustainable forest management. Opinions differ about the merits of these standards, but all operators certified under them are clearly supporting and working towards sustainable forest management.

B.C. is a leader in forest certification in Canada and North America: 28% of the relevant land base and 38% of the total provincial harvest are certified. Including the ISO standard for environmental management systems, 65% of the relevant land base and 65% of the harvest are certified.

Trend

Over the past five years, substantial forest areas and harvest volumes have been certified under two SFM standards (CSA and SFI) and under the ISO standard for environmental management systems. Only a small area and volume were certified under the FSC's SFM standard. Over the next few years, certification of additional areas and volumes is anticipated under all standards.

Rates of certification differ substantially among tenure types. This is in large part due to differences in incentives for, and costs of, certification. It does not necessarily indicate differences in quality of forest management.

Information

The Canadian Sustainable Forestry Certification Coalition monitors certified areas and volumes for all of Canada and publishes its data, including a report for B.C. only. The MoF also monitors certified areas and volumes for B.C. and reports data publicly. Certified areas and volumes by tenure types are not tracked explicitly, but can be derived from publicly available data.

Acknowledgements

The encouragement, ideas, work and cooperation of many people made this report possible. Their input is greatly appreciated.

The contributors and reviewers may not endorse the final wording or hold the views expressed in the report.

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Maps

Numerous aspects of sustainable forest management can be shown well on maps. Many of the indicators in this report therefore provide direct links to relevant maps.

All of the maps used are listed below. Most are available in several formats:

1. HTML (viewed as part of this report)
2. PDF (for printing hard copies and making overheads)
3. Interactive HTML (in the BC Forest Information website)
4. High-quality print (in *British Columbia's Forests: A Geographical Snapshot* – not widely available)

The interactive maps on the BC Forest Information website include a zoom function to allow viewers to see them in greater detail. Several layers can be turned on to show cities and towns, highways, protected areas, private land, agricultural areas and other features. A few layers also have pop-up text for the names of features such as protected areas and ecosections.

The table below shows the availability of maps in the four formats. Click on a coloured Yes to be linked directly to the map.

Map Available?	**HTML**	**PDF** (open with Adobe Reader)	**Interactive HTML**	**High-Quality Print**
Environmental				
Forest Land	Yes	Yes	Yes	Yes
Predominant Tree Species	Yes	Yes	Yes	Yes
Forest Age	Yes	Yes	Yes	Yes
Old Growth	Yes	Yes	Yes	Yes
Biogeoclimatic Zones	Yes	Yes	Yes	Yes
Land Use Conversion	Yes	Yes	Yes	Yes
Protected Areas	Yes	Yes	Yes	Yes
Protected Areas and Special Management Zones	Yes	Yes	Yes	Yes

Map Available?	HTML	PDF (open with Adobe Reader)	Interactive HTML	High-Quality Print
Level of Forest Protection by Ecosection	Yes	Yes	No	No
Level of Land Protection by Ecosection	Yes	Yes	Yes	Yes
Economic and Social				
Forest Management Units	No	Yes	No	No
Local Timber Supply Forecast, 2000–2050	Yes	Yes	No	No
First Nations Bands	No	Yes	No	No
Bands with Traditional Use Projects, 2003	Yes	Yes	No	No

Related Publications

British Columbia's forests and forestry programs were comprehensively summarized in the following Ministry of Forests publications:

Forest, Range and Recreation Resource Analysis, 1994
Forest and Range Resource Analysis, 1984
Forest and Range Resource Analysis, 1979

More recent publications that addressed selected aspects of British Columbia's forests include:

British Columbia's Forests: A Geographical Snapshot, 2003
British Columbia's Forests and Their Management, 2003
Environmental Trends, 2002
Environmental Trends, 2000
Environmental Trends, 1998

A number of commissions over the past century compiled extensive information as part of their examination of forest policy issues in British Columbia. They include:

Ready for Change: Crisis and Opportunity in the Coast Forest Industry, 2001
(Report to the Minister of Forests, Peter H. Pearse)
Shaping Our Future, 2000
(B.C. Forest Policy Review, Garry Wouters)
The Future of Our Forests, 1991
(Forest Resources Commission, A.L. (Sandy) Peel)
Timber Rights and Forest Policy in British Columbia, 1976
(Royal Commission, Peter H. Pearse)
Crown Charges for Early Timber Rights, 1974
(Task Force on Crown Timber Disposal)
The Forest Resources of British Columbia, 1956
(Public Inquiries Act, Gordon McG. Sloan)
The Forest Resources of British Columbia, 1945
(Public Inquiries Act, Gordon McG. Sloan)
Timber and Forestry, 1909–1910
(Royal Commission of Inquiry, Fred J. Fulton)

The following early forest inventories provided summaries of timber resources:

Continuous Forest Inventory of British Columbia, 1957
(H.M. Pogue)
The Forest Resources of British Columbia, 1937
(F.D. Mulholland)
Forests of British Columbia, 1918
(H.N. Whitford and Roland D. Craig)

Acronyms

AAC	Allowable annual cut
ABCFP	Association of British Columbia Forest Professionals
B.C.	British Columbia
BEC	Biogeoclimatic ecosystem classification
BEI	Broad ecosystem inventory
BTM	Baseline thematic mapping
BCTS	BC Timber Sales
CCFM	Canadian Council of Forest Ministers
CDC	Conservation Data Centre
CSA	Canadian Standards Association
CSFCC	Canadian Sustainable Forestry Certification Coalition
DFO	Department of Fisheries and Oceans (Canada)
FRPA	Forest and Range Practices Act
FSC	Forest Stewardship Council
ISO	International Organization for Standardization
IUCN	World Conservation Union
MoF	B.C. Ministry of Forests
MP	The Montréal Process
MSRM	B.C. Ministry of Sustainable Resource Management
MWLAP	B.C. Ministry of Water, Land and Air Protection
NFI	National forest inventory
NGO	non-government organization
SEI	Sensitive ecosystems inventories
SFI	Sustainable Forestry Initiative
SFM	Sustainable forest management
TFL	Tree farm licence
TSA	Timber supply area
UNCED	United Nations Conference on the Environment and Development
U.S.	United States of America

Glossary

Specific definitions used in this report, and their sources, are listed below.

Aboriginal	Relating to all indigenous people of Canada, including Indians (status and non-status), Metis, and Inuit people (as defined in the *Constitution Act* of 1982). (BC Treaty Negotiations Office, Glossary of Treaty-Related Terms. http://www.gov.bc.ca/tno/rpts/glossary/default.htm)
Allowable annual cut (AAC)	The rate of timber harvest permitted each year from a specified area of land. AACs for timber supply areas (TSAs) and tree farm licences (TFLs), which account for most of the provincial harvest, are set by the government's chief forester in accordance with the *Forest Act*. (Adapted from MoF, Glossary of Forestry Terms. http://www.for.gov.bc.ca/hfd/library/documents/glossary/)
Biogeoclimatic zone	A geographic area having similar patterns of energy flow, vegetation and soils as a result of a broadly homogenous macroclimate. (MoF, Glossary of Forestry Terms. http://www.for.gov.bc.ca/hfd/library/documents/glossary/)
Broadleaved	All trees classified botanically as Angiospermae. Also called "hardwoods". Forest areas are classified as broadleaved if trees accounting for more than 75% of the tree volume (or number of stems in young forest) are broadleaved. (Adapted from the definition used for temperate and boreal forest in: United Nations. 2001. The Global Forest Resources Assessment 2000.)
Coarse woody debris	Sound and rotting logs and stumps that provide habitat for plants, animals, and insects and a source of nutrients for soil development. (MoF, Glossary of Forestry Terms. http://www.for.gov.bc.ca/hfd/library/documents/glossary/)
Community forest	A forestry operation managed by a local government, community group, First Nation community-held corporation for the benefit of the entire community. The majority of community forests in B.C. are on Crown land under a timber tenure such as a forest licence, tree farm licence or community forest agreement. (MoF, Community Forest Agreement Program Fact Sheet, June 2003. http://www.for.gov.bc.ca/hth/community/index.htm)

Coniferous	All trees classified botanically as Gymnospermae. Also called “softwoods”. Forest areas are classified as coniferous if trees accounting for more than 75% of the tree volume (or number of stems in young forest) are coniferous. (Adapted from the definition used for temperate and boreal forest in: United Nations. 2001. The Global Forest Resources Assessment 2000.)
Criterion	A category of conditions or processes by which sustainable forest management may be assessed. A criterion is characterized by a set of related indicators that are monitored periodically to assess change. (The Montréal Process. http://www.mpci.org/rep-pub/1995/santiago_e.html#2)
Ecoregion	Major ecosystem, resulting from large-scale predictable patterns of solar radiation and moisture, which in turn affect the kinds of local ecosystems and animals and plants found there. (Bailey, R.G. 1998. Ecoregions: the ecosystem geography of the oceans and continents. Springer-Verlag: New York)
Ecosection	Ecosections are terrestrial or marine areas that are subdivisions of ecoregions, with minor physiographic and macroclimatic or oceanographic variations. The more than 100 ecosections in British Columbia are mapped at 1:250,000 and used for resource emphasis planning. (Adapted from MSRM, Ecoregions of British Columbia. http://srmwww.gov.bc.ca/ecology/ecoregions/index.html)
Ecosystem	A functional unit consisting of all the living organisms (plants, animals, and microbes) in a given area, and all the non-living physical and chemical factors of their environment, linked together through nutrient cycling and energy flow. An ecosystem can be of any size – a log, pond, field, forest, or the earth’s biosphere – but it always functions as a whole unit. Ecosystems are commonly described according to the major type of vegetation, for example, forest ecosystem, old-growth ecosystem, or range ecosystem. (MoF, Glossary of Forestry Terms. http://www.for.gov.bc.ca/hfd/library/documents/glossary/)
First Nation	a. an aboriginal governing body, organized and established by an aboriginal community, or b. the aboriginal community itself. (BC Treaty Negotiations Office, Glossary of Treaty-Related Terms. http://www.gov.bc.ca/tno/rpts/glossary/default.htm)

Forest Forest land Forest cover	Forest refers to one or both of land (forest land) and its associated plant community (forest cover), where the land area exceeds 0.5 ha and 10% of the land area is covered by the crowns of trees able to reach a height of 5 m at maturity. Land that temporarily does not meet these criteria, due to human intervention or natural causes, is considered forest if it is expected to revert to forest. (Adapted from the definition used for temperate and boreal forest in: United Nations. 2001. The Global Forest Resources Assessment 2000.)
Indicator	A quantitative or qualitative variable used to describe a state or condition. When observed periodically, it shows a trend. It provides information that is factual, usually for a specific time and place. (Adapted from the definition used by The Montréal Process. http://www.mpci.org/rep-pub/1995/santiago_e.html#2)
IUCN categories of protected areas	The International Union for Conservation of Nature and Natural Resources (IUCN, known as The World Conservation Union) defines a protected area as "an area of land and/or sea especially dedicated to the protection of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means." It divides them into six categories, depending on their objectives: Category I – **Protected area managed mainly for science or wilderness protection** (Strict Nature Reserve/Wilderness Area); Category II – **Protected area managed mainly for ecosystem protection and recreation** (National Park); Category III – **Protected area managed mainly for conservation of specific natural features** (National Monument); Category IV **– Protected area managed mainly for conservation through management intervention** (Habitat/Species Management Area); Category V – **Protected area managed mainly for landscape/seascape conservation and recreation** (Protected Landscape/Seascape); Category VI – **Protected area managed mainly for the sustainable use of natural ecosystems** (Managed Resource Protected Area).

IUCN categories of protected areas (continued)	The categories reflect a gradient of management intervention. In Categories I–III, strict protection is the rule and natural processes are paramount, Category II and III sites combining this with facilities for visitors. In Category IV, in effect the managed nature reserve, the manager intervenes to conserve or if necessary restore species or habitats. Category V is about protecting cultural, lived-in landscapes, with farms and other forms of land-use. The new Category VI, the sustainable use reserve, is a protected area deliberately set up to allow use of natural resources, mainly for the benefit of local people. (IUCN. 2000. Protected areas: Benefits beyond boundaries – WCPA in action. http://www.iucn.org/themes/wcpa/pubs/other.htm#top)
Mixed forest/other wooded land	Forest/other wooded land on which neither coniferous nor broadleaved trees account for more than 75% of the tree volume (or number of stems in young forest). (Adapted from the definition used for temperate and boreal forest in: United Nations. 2001. The Global Forest Resources Assessment 2000.)
Natural disturbance	A change in forest structure and composition caused by fire, insects, wind, landslides and other natural processes. (Adapted from MoF, Glossary of Forestry Terms. http://www.for.gov.bc.ca/hfd/library/documents/glossary/)
Old growth	Old growth is a forest that contains live and dead trees of various sizes, species, composition, and age class structure. Old-growth forests, as part of a slowly changing but dynamic ecosystem, include climax forests but not sub-climax or mid-seral forests. The age and structure of old growth varies significantly by forest type and from one biogeoclimatic zone to another. (MoF, Glossary of Forestry Terms. http://www.for.gov.bc.ca/hfd/library/documents/glossary/) The following working definition based on location, species and age information available from forest cover inventories is used for quantitative analysis in this and other publications: Old growth is defined as all Coast region forests more than 250 years old, Interior forests dominated by lodgepole pine or deciduous species more than 120 years old, and all other Interior forests more than 140 years old.

Other wooded land	Land with tree crown cover of 5–10% of trees able to reach a height of 5 m at maturity, or with tree crown cover of more than 10% of trees not able to reach a height of 5 m at maturity and shrub or bush cover. (Adapted from the definition used for temperate and boreal forest in: United Nations. 2001. The Global Forest Resources Assessment 2000.)
Predominant species	Tree species or species group with the greatest volume per hectare (or number of stems in young forests).
Protected area	The protected areas network of British Columbia includes national and provincial parks, ecological reserves and other areas designated by statute to protect natural and cultural heritage. Proposed protection areas identified in the preliminary land use plan for the Central Coast are also included. Regional parks, municipal parks, wildlife management areas and private conservation lands are not included. (Adapted from MoF, Glossary of Forestry Terms. http://www.for.gov.bc.ca/hfd/library/documents/glossary/)
Second-growth forest	Relatively young forests that have developed following a disturbance (e.g., wholesale cutting, extensive fire, insect attack) of the previous stand of old-growth forest. Restricted in application to those parts of the world where clearly discernible, old-growth forests still exist or did exist not long ago. (Dunster, J. and Dunster K., 1996. Dictionary of natural resource management. UBC Press: Vancouver)
Special management zone	Zones or areas which are to be managed in such a way as to minimize the risk of undesirable impacts on the important or sensitive resource attributes that are identified for each SMZ. Nearly all of B.C.'s strategic land use plans identify SMZs. (MSRM, Special Management Zone Working Group Project. http://srmwww.gov.bc.ca/rmd/smz/index.htm)
Timber supply area (TSA)	Public (provincial Crown) land designated under the *Forest Act* that is managed for sustainable timber harvest, as determined by an allowable annual cut. (Adapted from MoF, Annual report 2003/04 http://www.bcbudget.gov.bc.ca/annualreports/for/default.htm)

Tree farm licence (TFL)	Land designated under the *Forest Act* that is managed for sustainable timber harvest, as determined by an allowable annual cut. TFLs typically combine public (provincial Crown) land with private land and timber licences. A TFL has a term of 25 years. (Adapted from MoF, Glossary of Forestry Terms. http://www.for.gov.bc.ca/hfd/library/documents/glossary/)
Woodlot licence	Land designated under the *Forest Act*. It is similar to a tree farm licence but on a smaller scale, and has a term of up to 20 years (Adapted from MoF, Glossary of Forestry Terms. Http://www.for.gov.bc.ca/hfd/library/documents/glossary/)

International and National Criteria and Indicators

The Montréal Process

1995 (1999) List of Criteria and Indicators

This list was first published in 1995 in *Criteria and indicators for the conservation and sustainable management of temperate and boreal forests: The Montréal process* (http://mpci.org/rep-pub/1995/santiago_e.html).

New numbering, added in 1999, is used in this report and is shown below.

Criterion 1: Conservation of Biological Diversity

Biological diversity includes the elements of the diversity of ecosystems, the diversity between species, and genetic diversity in species.

1.1 Ecosystem diversity

1.1.a Extent of area by forest type relative to total forest area
1.1.b Extent of area by forest type and by age class or successional stage
1.1.c Extent of area by forest type in protected area categories as defined by IUCN or other classification systems
1.1.d Extent of areas by forest type in protected areas defined by age class or successional stage
1.1.e Fragmentation of forest types

1.2 Species diversity

1.2.a The number of forest dependent species
1.2.b The status (threatened, rare, vulnerable, endangered, or extinct) of forest dependent species at risk of not maintaining viable breeding populations, as determined by legislation or scientific assessment

1.3 Genetic diversity

1.3.a Number of forest dependent species that occupy a small portion of their former range
1.3.b Population levels of representative species from diverse habitats monitored across their range

Criterion 2: Maintenance of Productive Capacity of Forest Ecosystems

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

2.b Total growing stock of both merchantable and non-merchantable tree species on forest land available for timber production

2.c The area and growing stock of plantations of native and exotic species

2.d Annual removal of wood products compared to the volume determined to be sustainable

2.e Annual removal of non-timber forest products (e.g., fur bearers, berries, mushrooms, game), compared to the level determined to be sustainable

Criterion 3: Maintenance of Forest Ecosystem Health and Vitality

3.a Area and percent of forest affected by processes or agents beyond the range of historic variation, e.g., by insects, disease, competition from exotic species, fire, storm, land clearance, permanent flooding, salinisation, and domestic animals

3.b Area and percent of forest land subjected to levels of specific air pollutants (e.g., sulfates, nitrate, ozone) or ultraviolet B that may cause negative impacts on the forest ecosystem

3.c Area and percent of forest land with diminished biological components indicative of changes in fundamental ecological processes (e.g., soil nutrient cycling, seed dispersion, pollination) and/or ecological continuity (monitoring of functionally important species such as fungi, arboreal epiphytes, nematodes, beetles, wasps, etc.)

Criterion 4: Conservation and Maintenance of Soil and Water Resources

This criterion encompasses the conservation of soil and water resources and the protective and productive functions of forests.

4.a Area and percent of forest land with significant soil erosion

4.b Area and percent of forest land managed primarily for protective functions, e.g., watersheds, flood protection, avalanche protection, riparian zones

4.c Percent of stream kilometres in forested catchments in which stream flow and timing has significantly deviated from the historic range of variation

4.d Area and percent of forest land with significantly diminished soil organic matter and/or changes in other soil chemical properties

4.e Area and percent of forest land with significant compaction or change in soil physical properties resulting from human activities

4.f Percent of water bodies in forest areas (e.g., stream kilometres, lake hectares) with significant variance of biological diversity from the historic range of variability

4.g Percent of water bodies in forest areas (e.g., stream kilometres, lake hectares) with significant variation from the historic range of variability in pH, dissolved oxygen, levels of chemicals (electrical conductivity, sedimentation or temperature change

4.h Area and percent of forest land experiencing an accumulation of persistent toxic substances

Criterion 5: Maintenance of Forest Contribution to Global Carbon Cycles

5.a Total forest ecosystem biomass and carbon pool, and if appropriate, by forest type, age class, and successional stages

5.b Contribution of forest ecosystems to the total global carbon budget, including absorption and release of carbon (standing biomass, coarse woody debris, peat and soil carbon)

5.c Contribution of forest products to the global carbon budget

Criterion 6: Maintenance and Enhancement of Long-Term Multiple Socio-Economic Benefits to Meet the Needs of Societies

6.1 Production and consumption

6.1.a Value and volume of wood and wood products production, including value added through downstream processing

6.1.b Value and quantities of production of non-wood forest products

6.1.c Supply and consumption of wood and wood products, including consumption per capita

6.1.d Value of wood and non-wood products production as percentage of GDP

6.1.e Degree of recycling of forest products

6.1.f Supply and consumption/use of non-wood products

6.2 Recreation and tourism

6.2.a Area and percent of forest land managed for general recreation and tourism, in relation to the total area of forest land

6.2.b Number and type of facilities available for general recreation and tourism, in relation to population and forest area

6.2.c Number of visitor days attributed to recreation and tourism, in relation to population and forest area

6.3 Investment in the forest sector

6.3.a Value of investment, including investment in forest growing, forest health and management, planted forests, wood processing, recreation and tourism

6.3.b Level of expenditure on research and development, and education

6.3.c Extension and use of new and improved technologies

6.3.d Rates of return on investment

6.4 Cultural, social and spiritual needs and values

6.4.a Area and percent of forest land managed in relation to the total area of forest land to protect the range of cultural, social and spiritual needs and values

6.4.b Non-consumptive use forest values

6.5 Employment and community needs

6.5a Direct and indirect employment in the forest sector and forest sector employment as a proportion of total employment

6.5.b Average wage rates and injury rates in major employment categories within the forest sector

6.5.c Viability and adaptability to changing economic conditions, of forest dependent communities, including indigenous communities

6.5.c Area and percent of forest land used for subsistence purposes

Criterion 7: Legal, Institutional and Economic Framework for Forest Conservation and Sustainable Management

Criterion 7 and associated indicators relate to the overall policy framework of a country that can facilitate the conservation and sustainable management of forests. Included are the broader societal conditions and processes often external to the forest itself but which may support efforts to conserve, maintain or enhance one or more of the conditions, attributes, functions and benefits captured in criteria 1 – 6. No priority or order is implied in the listing of the indicators.

7.1 Extent to which the *legal framework* (laws, regulations, guidelines) supports the conservation and sustainable management of forests, including the extent to which it:

7.1.a Clarifies property rights, provides for appropriate land tenure arrangements, recognizes customary and traditional rights of indigenous people, and provides means of resolving property disputes by due process

7.1.b Provides for periodic forest-related planning, assessment, and policy review that recognizes the range of forest values, including coordination with relevant sectors

7.1.c Provides opportunities for public participation in public policy and decision-making related to forests and public access to information

7.1.d Encourages best practice codes for forest management

7.1.e Provides for the management of forests to conserve special environmental, cultural, social and/or scientific values

7.2 Extent to which the *institutional framework* supports the conservation and sustainable management of forests, including the capacity to:

7.2.a Provide for public involvement activities and public education, awareness and extension programs, and make available forest-related information

7.2.b Undertake and implement periodic forest-related planning, assessment, and policy review including cross-sectional planning and coordination

7.2.c Develop and maintain human resource skills across relevant disciplines.

7.2.d Develop and maintain efficient physical infrastructure to facilitate the supply of forest products and services and support forest management

7.2.e Enforce laws, regulations and guidelines

7.3 Extent to which the *economic framework* (economic policies and measures) supports the conservation and sustainable management of forests through:

7.3.a Investment and taxation policies and a regulatory environment which recognize the long-term nature of investments and permit the flow of capital in and out of the forest sector in response to market signals, non-market economic valuations, and public policy decisions in order to meet long-term demands for forest products and services

7.3.b Non-discriminatory trade policies for forest products

7.4 Capacity to *measure and monitor* changes in the conservation and sustainable management of forests, including:

7.4.a Availability and extent of up-to-date data, statistics and other information important to measuring or describing indicators associated with criteria 1-7

7.4.b Scope, frequency and statistical reliability of forest inventories, assessments, monitoring and other relevant information

7.4.c Compatibility with other countries in measuring, monitoring and reporting on indicators.

***7.5* Capacity to conduct and apply *research and development* aimed at improving forest management and delivery of forest goods and services, including:**

7.5.a Development of scientific understanding of forest ecosystem characteristics and functions

7.5.b Development of methodologies to measure and integrate environmental and social costs and benefits into markets and public policies, and to reflect forest-related resource depletion or replenishment in national accounting systems

7.5.c New technologies and the capacity to assess the socio-economic consequences associated with the introduction of new technologies

7.5.d Enhancement of ability to predict impacts of human intervention on forests

7.5.e Ability to predict impacts on forests of possible climate change

Canadian Council of Forest Ministers

1995 List of Criteria and Indicators

Taken from *Defining Sustainable Forest Management: A Canadian approach to Criteria and Indicators* (http://www.ccfm.org/ci/framain_e.html).

Criterion 1: Conservation of Biological Diversity

The variability among living organisms from all sources and the ecological complexes of which they are part

1.1 Ecosystem diversity

1.1.1 Percentage and extent, in area, of forest types relative to historical condition and to total forest area

1.1.2 Percentage and extent of area by forest type and age class (ref. 2.2.1)

1.1.3 Area, percentage and representativeness of forest types in protected areas

1.1.4 Level of fragmentation and connectedness of forest ecosystem components

1.2 Species diversity

1.2.1 Number of known forest-dependent species classified as extinct, threatened, endangered, rare or vulnerable relative to total number of known forest-dependent species

1.2.2 Population levels and changes over time of selected species and species guilds

1.2.3 Number of known forest-dependent species that occupy only a small portion of their former range

1.3 Genetic diversity

1.3.1 Implementation of an in situ/ex situ genetic conservation strategy for commercial and endangered forest vegetation species

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

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

2.1 Incidence of disturbance and stress (biotic and abiotic)

2.1.1 Area and severity of insect attack

2.1.2 Area and severity of disease infestation

2.1.3 Area and severity of fire damage

2.1.4 Rates of pollutant deposition

2.1.5 Ozone concentrations in forested regions

2.1.6 Crown transparency in percentage by class

2.1.7 Area and severity of occurrence of exotic species detrimental to forest condition
2.1.8 Climate change as measured by temperature sums

2.2 Ecosystem resilience
2.2.1 Percentage and extent of area by forest type and age class (ref. 1.1.2)
2.2.2 Percentage of area successfully naturally regenerated and artificially regenerated

2.3 Extant biomass (biota)
2.3.1 Mean annual increment by forest type and age class
2.3.2 Frequency of occurrence within selected indicator species (vegetation, birds, mammals, fish).

Criterion 3: Conservation of Soil and Water Resources
The maintenance of soil and water quantity and quality

3.1 Physical environmental factors
3.1.1 Percentage of harvested area having significant soil compaction, displacement, erosion, puddling, loss of organic matter, etc.
3.1.2 Area of forest converted to non-forest land use, for example, urbanization (ref. 4.2.1)
3.1.3 Water quality as measured by water chemistry, turbidity, etc.
3.1.4 Trends and timing of events in stream flows from forest catchments
3.1.5 Changes in distribution and abundance of aquatic fauna

3.2 Policy and protection forest factors
3.2.1 Percentage of forest managed primarily for soil and water protection
3.2.2 Percentage of forest area having road construction and stream crossing guidelines in place
3.2.3 Area, percentage and representativeness of forest types in protected areas (ref. 1.1.4)

Criterion 4: Forest Ecosystem Contributions to Global Ecological Cycles
The impact of the forest and forest activities on global ecosystem functions

4.1 Contributions to global carbon budget
4.1.1 Tree biomass volumes
4.1.2 Vegetation (non-tree) biomass estimates
4.1.3 Percentage of canopy cover
4.1.4 Percentage of biomass volume by general forest type
4.1.5 Soil carbon pools
4.1.6 Soil carbon pool decay rates

4.1.7 Area of forest depletion
4.1.8 Forest wood product life cycles
4.1.9 Forest sector CO2 emissions

4.2 Forest land conversion

4.2.1 Area of forest permanently converted to non-forest land use (for example, urbanization) (ref. 3.1.2)
4.2.2 Semi-permanent or temporary loss or gain of forest ecosystems (for example, grasslands, agriculture)

4.3 Forest sector CO2 conservation

4.3.1 Fossil fuel emissions
4.3.2 Fossil carbon products emissions
4.3.3 Percentage of forest sector energy usage from renewable sources relative to total sector energy requirement

4.4 Forest sector policy factors

4.4.1 Recycling rate of forest wood products manufactured and used in Canada
4.4.2 Participation in the climate change conventions
4.4.3 Economic incentives for bioenergy use
4.4.4 Existence of forest inventories
4.4.5 Existence of laws and regulations on forest land management

4.5 Contributions to hydrological cycles

4.5.1 Surface area of water within forested areas

Criterion 5: Multiple Benefits to Society

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

5.1 Productive capacity

5.1.1 Annual removal of forest products relative to the volume of removals determined to be sustainable
5.1.2 Distribution of, and changes in, the land base available for timber production
5.1.3 Animal population trends for selected species of economic importance
5.1.4 Management and development expenditures
5.1.5 Availability of habitat for selected wildlife species of economic importance

5.2 Competitiveness of resource industries (timber/non-timber related)

5.2.1 Net profitability

5.2.2 Trends in global market share
5.2.3 Trends in research and development expenditures in forest products and processing technologies

5.3 Contribution to the national economy (timber/non-timber sectors)

5.3.1 Contribution to gross domestic product (GDP) of timber and non-timber sectors of the forest economy
5.3.2 Total employment in all forest-related sectors
5.3.3 Utilization of forests for non-market goods and services, including forest land use for subsistence purposes
5.3.4 Economic value of non-market goods and services

5.4 Non-timber values (including option values)

5.4.1 Availability and use of recreational opportunities
5.4.2 Total expenditures by individuals on activities related to non-timber use
5.4.3 Membership and expenditures in forest recreation-oriented organizations and clubs
5.4.4 5.4.4 Area and percentage of protected forest by degree of protection

Criterion 6: Accepting Society's Responsibility for Sustainable Development

Fair, equitable, and effective resource management choices

6.1 Aboriginal and treaty rights

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

6.2 Participation by Aboriginal communities in sustainable forest management

6.2.1 Extent of Aboriginal participation in forest-based economic opportunities
6.2.2 Extent to which forest management planning takes into account the protection of unique or significant Aboriginal social, cultural or spiritual sites
6.2.3 Number of Aboriginal communities with a significant forestry component in the economic base and the diversity of forest use at the community level
6.2.4 Area of forest land available for subsistence purposes
6.2.5 Area of Indian reserve forest lands under integrated management plans

6.3 Sustainability of forest communities

6.3.1 Number of communities with a significant forestry component in the economic base

6.3.2 Index of the diversity of the local industrial base

6.3.3 Diversity of forest use at the community level

6.3.4 Number of communities with stewardship or co-management responsibilities

6.4 Fair and effective decision-making

6.4.1 Degree of public participation in the design of decision-making processes

6.4.2 Degree of public participation in decision-making processes

6.4.3 Degree of public participation in implementation of decisions and monitoring of progress toward sustainable forest management

6.5 Informed decision-making

6.5.1 Percentage of area covered by multi-attribute resource inventories

6.5.2 Investments in forest-based research and development and information

6.5.3 Total effective expenditure on public forestry education

6.5.4 Percentage of forest area under completed management plans/programs/guidelines which have included public participation

6.5.5 Expenditure on international forestry

6.5.6 Mutual learning mechanisms and processes

Canadian Council of Forest Ministers

2003 List of Criteria and Indicators

Taken from *Defining Sustainable Forest Management in Canada: Criteria and Indicators 2003* (found at http://www.ccfm.org/3_e.html#publications).

Criterion 1: Biological Diversity
The variability among living organisms and the ecosystems of which they are part

1.1 Ecosystem diversity

1.1.1 Area of forest, by type and age class, and wetlands in each ecozone. (Core Indicator)

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

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)

1.3 Genetic diversity

1.3.1 Genetic diversity of reforestation seed-lots. (Core Indicator)

1.3.2 Status of *in situ* and *ex situ* conservation efforts for native tree species within each ecozone. (Core Indicator)

Criterion 2: Ecosystem Condition and Productivity
The stability, resilience and rates of biological production in forest ecosystems

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, disease and timber harvest. (Core Indicator)

2.4 Area of forest with impaired function due to ozone and acid rain. (Core Indicator)

2.5 Proportion of timber harvest area successfully regenerated. (Core Indicator)

Criterion 3: Soil and Water

The quantity and quality of soil and water

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. (Supporting Indicator)

Criterion 4: Role in Global Ecological Cycles

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

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)

Criterion 5: Economic and Social Benefits

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

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 and forest-based services to the gross domestic product. (Core Indicator)

5.1.5 Value of unmarketed non-timber forest products and forest-based services. (Supporting Indicator)

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)

5.3 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 harvest of non-timber forest products relative to the levels of harvest 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 Direct, indirect and induced employment. (Core Indicator)
5.3.6 Average income in major employment categories. (Supporting Indicator)

Criterion 6: Society's Responsibility
Fair and effective resource management choices

6.1 Aboriginal and treaty rights
6.1.1 Extent of consultation with Aboriginals in forest management planning and in the development of policies and legislation related to forest management. (Core Indicator)
6.1.2 Area of forest land owned by Aboriginal peoples. (Core Indicator)

6.2 Aboriginal traditional land use and forest-based ecological knowledge
6.2.1 Area of forested Crown land with traditional land use studies. (Core Indicator)

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)

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 and regulations. (Core Indicator)

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 Status of new or updated forest management guidelines and standards related to ecological issues. (Core Indicator).

Reader Comments

We welcome your comments on this report, to help us improve the content and presentation of future editions. Please consider using the questions below as a guide.

Content

- Do you consider the indicators (and questions) addressed in this report to be relevant to sustainable forest management in B.C.?
- Which indicators were the most interesting or useful to you?
- Were some indicators not useful to you? If so, which ones?
- Are there some key indicators or questions that you feel should be added?

Presentation

- Were you able to find the report easily?
- Do you consider the report's format attractive?
- Were you able to navigate easily within the report?
- Did you use some of the links (sources, maps, detailed information)?

Use of the Report

- Will you recommend the report to friends and/or work colleagues?
- Do you intend to use the report in your work? If so, which part: the text? graphs? maps? data?
- Would you like to see more detailed data? (If yes, provide an example.)

Overall

- What would be the most important improvement we could make to the report?

Contact

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