THE STATE OF

British Columbia's Forests

2006

BRITISH COLUMBIA
The Best Place on Earth

Ministry of
Forests and Range

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Cover photo – Location: Quaal River Protected Area, Northern Coastal B.C.
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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, however 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 and Range 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.

New pressures such as climate change and the mountain pine beetle epidemic affect all aspects of our forests and therefore require holistic responses. One example, begun in 2005, is the Future Forest Ecosystems of British Columbia initiative, which aims to maintain and enhance the resilience of the province's forest ecosystems.

This report presents 24 indicators based on international and national frameworks of indicators for assessing sustainable forest management. It emphasizes issues important to British Columbia. The six indicators published in the 2004 edition are repeated, four of them with changes and updated data. New, detailed information is provided for six additional indicators. Overviews are provided for the remaining 12 indicators that will be fully developed in future editions of the report.

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

With two-thirds of British Columbia covered by forests, British Columbians have a real stake in, and many opportunities to contribute to, sustainable forest management. 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 and Range

Acknowledgements

This report was made possible by the ideas, cooperation and hard work of many people.

The names of most individuals who contributed directly, reviewed drafts or gave permission to use their images are provided in the List of Contributors in the back of this report. Some contributors chose not to be listed, and others, regrettably, may have been overlooked in the compilation of the list.

Every effort was made to accurately incorporate the contributors' information and carefully weigh their views. The report's information and assessments may, however, differ from those of individual contributors, and readers should not assume that the report's information and statements about a particular topic are necessarily endorsed by contributors knowledgeable about that topic.

Many others provided guidance, encouragement, contacts, access to files and administrative support. Still more provided ideas and inspiration in the reports they produced for other agencies and jurisdictions.

Elimination of accidental omissions, errors and misrepresentations was a guiding principle for this report. I take full responsibility for any such shortcomings that may have survived the final stages of preparation, and trust that readers will not attribute them to any contributors.

Tom Niemann, RPF
Manager, State of Forests Reporting
Ministry of Forests and Range

Table of Contents

Introduction and Overviews

The Indicators

Note:
The complete framework is listed here. The indicators in **bold** type are presented in full in this report. The others are introduced with a one-page overview, and will be fully addressed in a future edition.

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.

Assessing progress in achieving sustainable forest management is challenging not only because the subject is complex, but also because of the varying opinions and viewpoints people bring to the topic. An understanding of current conditions and trends, and of the adequacy of information to assess them, provides a basis for informed decisions.

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

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

Detailed information and assessments are provided for 12 of 24 indicators grouped into three broad categories: environmental, economic and social, and governance and support. Not all data are current to the year 2006 – the date of data varies from the year 2000 for some indicators to 2006 for several. Overviews are provided for the remaining 12 indicators that will be fully developed in future editions.

Environmental Indicators

Information and the ministry's assessments are provided for 5 of 10 environmental indicators: Ecosystem diversity, Protected forests, Ecosystem dynamics, Species diversity, and Genetic diversity. The assessments are summarized in Figure 1.

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 in protected areas. These and other forest areas provide large tracts of natural habitat, undeveloped areas for scientific study and wilderness for recreation. Some forest types are threatened by development.

Since 1950, the dynamics of B.C.'s forest ecosystems have changed with increasing wildfire suppression, timber harvests and climate change. These changes may reduce ecosystem stability and resilience, and disrupt future

economic activity. The unprecedented magnitude of the current mountain pine beetle epidemic demonstrates the potential impact of such changes.

British Columbia has a rich diversity of species, and most forest-associated species have healthy populations. Populations and ranges of some species have expanded, while declining habitat quantity and quality has reduced populations of other species, in some cases putting them at risk. Management responses have increased over the past two decades.

A wide range of environmental conditions has led to great genetic diversity in the more than 40 tree species found in B.C. Genetic gains in timber growth and pest resistance are increasingly included in reforestation. Insects, fires and climate change are expected to damage some genetic reserves and installations.

Ministry's partial assessment based on these five indicators

Despite concerns about changes in ecosystem dynamics and continuing pressure on threatened and endangered species, the prospects for environmental sustainability in British Columbia's forests are positive.

Substantial databases have been assembled for these five indicators. Available information is only partially adequate for assessing sustainable forest management for four of the five indicators.

Environmental Indicators	State	Trend	Information
1. Ecosystem diversity	 good	 mixed	 partial
2. Protected forests	 good	 improving	 partial
3. Ecosystem dynamics	 mixed	 deteriorating	 partial
4. Species diversity	 mixed	 deteriorating	 partial
6. Genetic diversity	 good	 mixed	 adequate

FIGURE 1. Ministry of Forests and Range assessments of environmental indicators.

Economic and Social Indicators

Information and the ministry's assessments are provided for 5 of 10 economic and social indicators: Ownership and management, Timber harvest, Silviculture, Jobs and communities, and First Nations involvement. The assessments are summarized in Figure 2.

Most of British Columbia's forests are owned by the provincial government on behalf of all British Columbians. First Nations claim aboriginal rights and title to many areas of the province. Operational management of timber harvests and other uses is delegated to tenure holders with a variety of rights and obligations.

Much of B.C.'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.

With B.C.'s high level of public ownership, most silvicultural activities such as reforestation have depended on government policies or funding. Silvicultural practices have evolved over the past 30 years, improving conservation of biological diversity, reforestation, and the volume and value of future timber supplies.

Employment in the forest sector has remained fairly stable while the province's economy grew and diversified. Provincial dependence on the forest sector has therefore decreased, but many rural communities are still highly dependent. They are also vulnerable to downturns in timber product markets and the impacts of the current mountain pine beetle epidemic.

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.

Ministry's partial assessment based on these five 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.

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

Economic and Social Indicators	State	Trend	Information
11. Ownership and management	 mixed	 mixed	 adequate
13. Timber harvest	 good	 mixed	 partial
14. Silviculture	 good	 mixed	 partial
18. Jobs and communities	 mixed	 mixed	 adequate
19. First Nations involvement	 mixed	 improving	 adequate

FIGURE 2. Ministry of Forests and Range assessments of economic and social indicators.

Indicators of Governance and Support

Information and the ministry's assessments are provided for two of four governance and support indicators: Law and Certification. The assessments are summarized in Figure 3.

British Columbia's forest law is designed to support sustainable forest management. The province's legal framework includes compliance and enforcement activities, public reporting by the independent Forest Practices Board, and systematic monitoring and assessment of the law's effectiveness.

Forest certification led by non-government organizations complements the governance provided by B.C.'s legal framework. British Columbia's forest industry has pursued forest certification to maintain access to markets and demonstrate the province's high quality of forest management.

Ministry's partial assessment based on these two indicators
British Columbia's forest law and progress on forest certification support sustainable forest management.

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

Governance and Support Indicators	State	Trend	Information
21. Law	 good	 improving	 partial
24. Certification	 good	 improving	 adequate

FIGURE 3. Ministry of Forests and Range assessments of governance and support indicators.

Conclusion

The information presented in this report enables a partial assessment of British Columbia's progress towards sustainable forest management.

The Ministry of Forests and Range assessed the state of 7 of 12 indicators as "good." Five indicators were assessed as "mixed," or having some good and some poor conditions.

Trends for 4 of 12 indicators were assessed as "improving." Six indicators were assessed as "mixed," or having some improving and some deteriorating trends. Two indicators were assessed as "deteriorating."

Information for 5 of 12 indicators was considered "adequate" for assessing the indicators' state and trend. Seven indicators were deemed to have only partially adequate information, typically because one or more important pieces of information are not available.

The Ministry of Forests and Range's assessment identifies many positive attributes of the resource base and substantive accomplishments. It also shows that there are some significant challenges ahead to ensure sustainable forest management in British Columbia.

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 the province's progress in achieving sustainable forest management.
- To provide the Ministry of Forests and Range' assessment of that progress.

Content

The four parts following "About This Report" provide an overview of British Columbia's forests and society, an overview of forest management in the province, and discussions of sustainable forest management and indicators.

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

Information and assessments are provided for 12 of 24 indicators. Overviews are provided for the remaining 12 indicators that will be fully developed in future editions of the report.

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 and Range's assessment of the indicator.

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 and Range's 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 for assessing the state and trend at the provincial level.

The symbols used to summarize the assessment are shown in Figure 4.

This report does not describe or assess the Ministry of Forests and Range's 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.

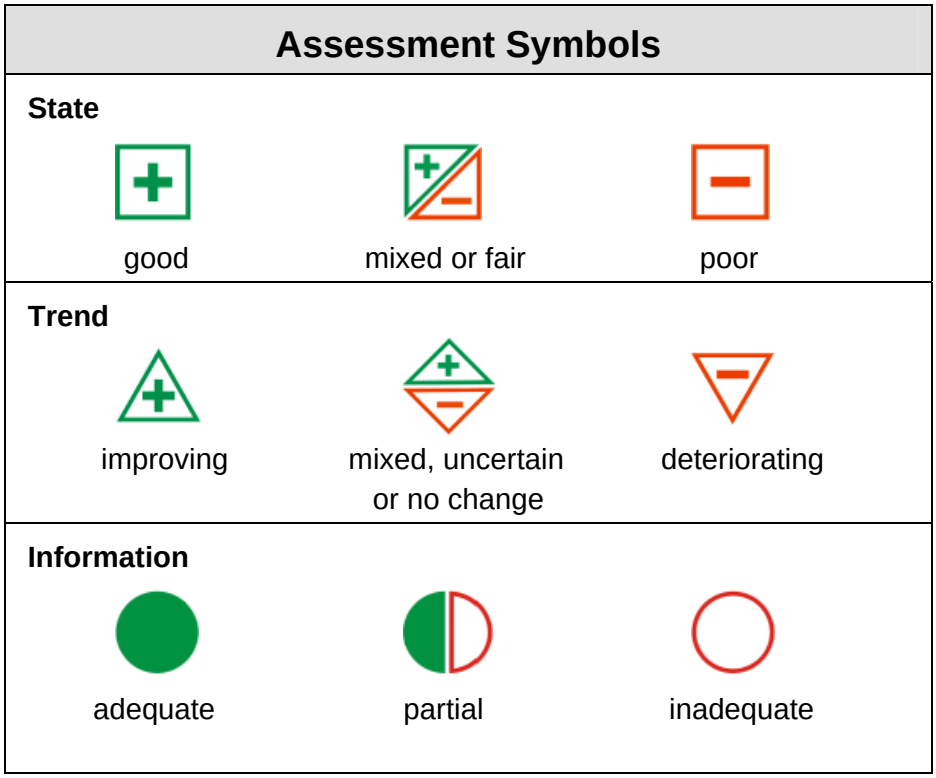


FIGURE 4. Assessment symbols used in this report.

Changes and Updates from the 2004 Edition

Reader feedback about the 2004 edition led to improvements in this 2006 edition. Endnotes provide more detailed explanations for technically inclined readers. Sources and notes about the data for each indicator are included in the back matter of the report.

Data were updated for several indicators published in the 2004 edition: Timber harvest (13-1, 13-2, 13-3, 13-4), First Nations involvement (19-1, 19-3), Law (21-2, 21-3, 21-4) and Certification (24-1, 24-2, 24-3, 24-4).

The date of data varies from the year 2000 for some indicators to 2006 for others. Readers are urged to note the years for which data are presented.

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 contact on the copyright page.

Maps, graphs and data tables are available online at www.for.gov.bc.ca/hfp/sof/.

Terms such as “forest” that have a technical meaning specific to this report are listed in the appendix Glossary. They are underlined the first time they occur within each indicator.

All links to other internet websites worked at the time of publication. The complete URL and a description including the organization are provided to assist readers in finding related websites if the linked websites are changed.

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 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.

Readers are encouraged to take action in two ways:

- provide feedback to help improve the content, presentation and overall usefulness of future editions of the report (please see contact information on the inside front cover), and
- engage in informed, constructive discussion about the future management of British Columbia’s forests.

Actions that support progress in achieving sustainable forest management will benefit all British Columbians.

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 5. This makes the province, on a global scale, as important as many forest nations.

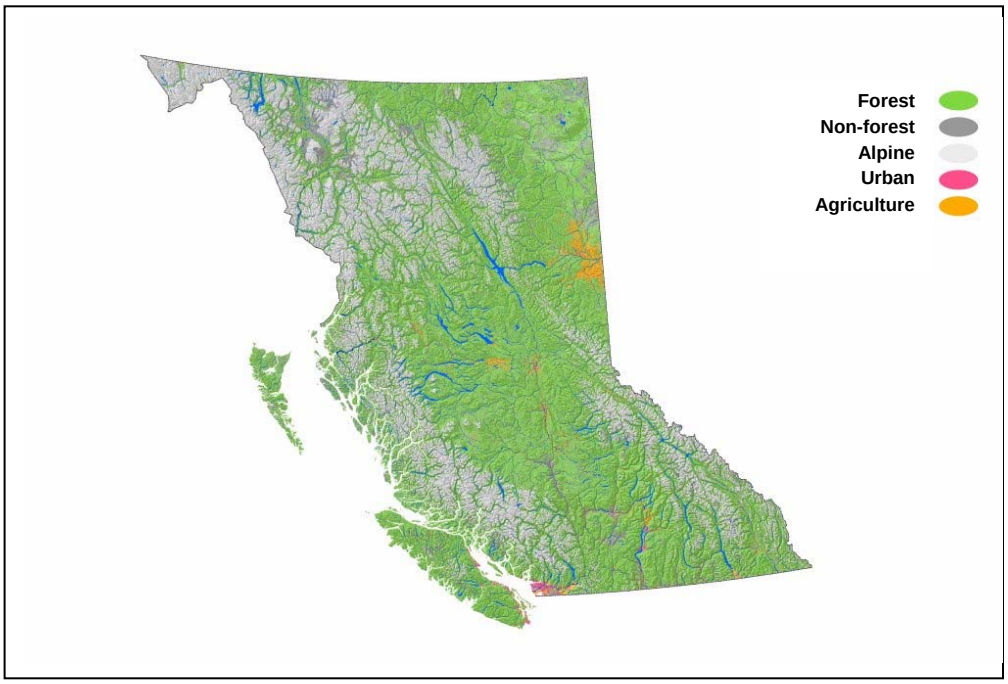


FIGURE 5. Forest land of British Columbia, 2000.

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 4.3 million in 2006 (see Figure 6). 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.

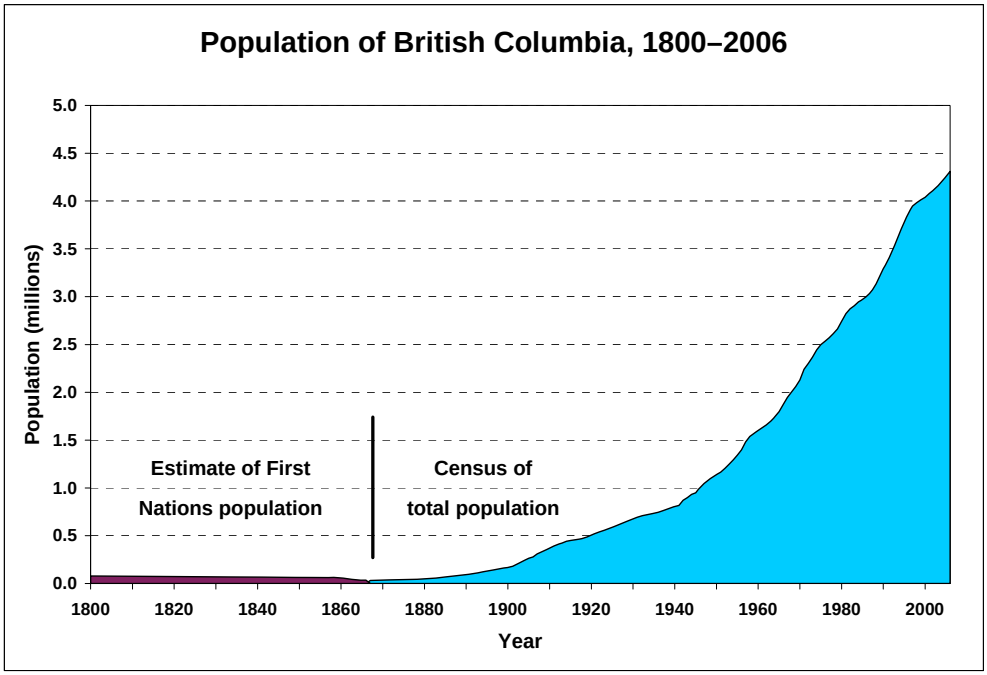


FIGURE 6. Population of British Columbia, 1800–2006.

The growing population has exerted considerable pressure on British Columbia's natural resources, including timber, 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.

Forestry is the province's most important industry

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.

Timber-based industries, generally referred to as the forest sector, continue to be the foundation of British Columbia's economy, accounting for 7% 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, balancing many 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, the Forestry Revitalization Plan, and the requirements of the *Forest and Range Practices Act* are just a few of the major initiatives during the past decade 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.

Forest Management in British Columbia: An Overview

Let us think how long is ninety years. What has happened to stable countries in the last ninety years? ... Human habits have changed equally drastically. Wireless communication, the internal-combustion engine, the aeroplane, atomic fission and fusion, plastics and man-made fibres have been invented. … The per capita use of lumber has dropped by over 50 per cent. Who shall say what further changes will affect the value of the crop by the end of the rotation the Licensee is now starting?

– H. R. MacMillan
(First chief forester of the British Columbia Forest Service and prominent forest industrialist. 1956 Sloan Commission[1])

Sections:

The Concept

Forest management can be described as ongoing iterations of five activities:

1. Define and understand the forest
2. Set goals
3. Plan activities
4. Implement activities
5. Assess results

Forest Management in British Columbia

The five activities provide a useful framework for describing the main elements and evolution of forest management in British Columbia.

Define and Understand the Forest

This includes basic rules of ownership and practices, inventory and research.

The British Columbia Forest Service (BCFS) is the main government agency responsible for stewardship of about 50 of the province's 59 million hectares of forest. The province relies on private sector investment to develop B.C.'s forests, creating jobs and revenue, while retaining public ownership to enable conservation measures consistent with public expectations.

The issuance of timber tenures under the *Forest Act* to private forest operators is the key vehicle that establishes rights to forest development and the generation of public revenues through the payment of stumpage. The two main types of long-term tenures issued are area-based tree farm licences (TFLs) and volume-based forest licences (FLs). In addition, short-term timber sale licences (TSLs) facilitate market-based pricing and value-added opportunities. Tenure holders must be compliant with the planning and practices requirements established by the provincial government.

The BCFS manages the forest inventory program for the province's publicly owned forests. The tenure holders are responsible for undertaking the forest inventories. The BCFS, tenure holders and other agencies also undertake inventories of non-timber values to support forest management.

The BCFS's research program contributes to the scientific basis for many aspects of forest management, including silviculture, growth and yield of managed forests, and conservation of soil, water and wildlife. The Canadian Forest Service and several universities also play major roles in research. The forest industry often collaborates on research with partners.

Set Goals

The goals of forest management, and the processes for setting goals, have evolved over the past century in British Columbia. The main goals highlighted below in **bold** include desired future forest conditions for values including timber, biodiversity and cultural heritage resources.

As the forest industry rapidly grew at the beginning of the 20th century, concerns were raised that future timber supplies could be depleted. A royal commission on timber and forestry made recommendations in 1910 that led to the introduction of new timber tenures in the *Forest Act* of 1912 and the establishment of the BCFS **to protect forests** and **regulate their use**.

By 1940, annual rates of harvest had increased substantially, much of the best timber had been allocated, and natural reforestation was not keeping pace with harvesting. A second royal commission recommended in 1945 that the province ensure a **sustained yield of timber**. The *Forest Act* was amended in 1947 to regulate harvests with allowable annual cuts (AACs) and help ensure an orderly transition from harvesting old-growth timber to long-term management of second-growth forests. Area-based tenures, later named TFLs, were granted in exchange for private sector commitments to invest in manufacturing facilities and provide long-term forest management, thereby supporting the province's goal of **economic development**.

Improved access and technological advancements led to increasing AACs as the land base economically suitable for forestry expanded, particularly in

the province's Interior. The increasing scope of industrial forestry in turn led to concerns about other forest values and uses, such as recreation, water, wildlife and fish. In 1976, another royal commission recommended an overhaul of timber tenures and policies, and led to the 1979 *Forest Act* and a new *Ministry of Forests Act.* To ensure **integrated resource management** that provides diverse public benefits, the BCFS now had to explicitly consider non-timber values in its decisions. A new planning process was introduced, new forest management units called timber supply areas (TSAs) were formed, a new process for determining AACs was established, and a strategic management system was initiated that included periodic publication of provincial information in forest and range resource analyses.

Many forest issues arose as public expectations increased in the 1980s. This led to yet another commission that made recommendations in 1991 on many issues including land use conflicts, AACs, and forest planning and practices.

In 1992, government initiated consensus-based land use planning processes, involving diverse public interests, **to reduce land use conflicts**. Today, land use plans have been approved or are nearing approval for 85% of British Columbia, providing long-term management goals and objectives for public lands. The plans also helped deliver the province's goal established in the early 1990s **to double protected areas to 12% by the year 2000**.

Also in the early 1990s, the province re-emphasized the goal of a sustained yield of timber with a new goal of **timely determinations of AACs**. The province's chief forester was legally required to make AAC determinations for TFLs and TSAs every 5 years, taking into account current understanding of the forests, current forest practices and any approved land use plans.

In response to widespread demands **to improve forest practices**, the *Forest Practices Code of British Columbia Act* came into force in 1995. The Code collected hundreds of varied requirements into one consistent legal framework for planning and practices that applied across the province. This resulted in improvements that were widely noted. However, its complex planning requirements and highly prescriptive approach to forest management led to significant increases in costs to both tenure holders and government.

In 2004, the results-based *Forest and Range Practices Act* (FRPA) replaced the Code. Among its several goals are **to encourage innovation** by reducing the prescriptive aspects of the Code, and **to reduce regulatory costs** by streamlining the planning process and other requirements while **maintaining high environmental standards**. Along with FRPA, legislation governing various resource professionals was amended or introduced **to increase reliance on the judgment of professionals** by clarifying standards of accountability.

Plan Activities

Forest planning typically includes identification of key issues, information and objectives; development and evaluation of scenarios; and selection of a preferred scenario that is fleshed out to make "the plan." The evolution of forest planning in British Columbia reflected its goal-setting history.

Timber was the predominant forest value up to the mid-1970s, so most forest plans focused on timber harvesting. The 1947 *Forest Act* set the stage for long-term area-based tenures, now called TFLs, and a requirement for TFL tenure holders to prepare five-year management plans that address long-term timber supply, a 20-year spatial harvesting plan and investments in forestry activities. These apply to less than 10% of the province's forests.

Following the 1979 *Forest Act*, TFL management plans and a variety of other plans for local areas and specific sites evolved to provide integrated resource management of timber and other forest values, and opportunities for public review and comment.

Beginning in the 1990s, some plans have included more explicit efforts to balance environmental, economic and social goals to achieve sustainable forest management. Most TFL holders now prepare sustainable forest management plans (SFMPs) to support their application for forest certification, using indicators for resource values and targets to describe desired future forest conditions. These SFMPs are generally also submitted to the BCFS for approval to meet most of their management plan requirements.

Most of the province's forests are in TSAs, for which a timber supply analysis every 5 years has been legally required since the early 1990s. The analysis provides a forecast for 200 years or more, taking into account existing land use goals and objectives. There is no legal requirement for long-term plans that address forestry activities and investments needed to achieve desired future forest conditions. That said, many forest tenure holders in TSAs now also voluntarily develop long-term SFMPs in support of forest certification, similar to TFL holders.

On private forest land, which accounts for about 5% of the province's forests, planning is the owner's responsibility. A management commitment is required for some of these lands to maintain a favourable tax classification.

The *Forest Practices Code of British Columbia Act* of 1995 required six levels of forestry plans. Among these, the 5-year forest development plan (FDP) was required to be consistent with legal objectives stemming from land use plans. Prescriptive content requirements, including the need to show the location of intended cutblocks and roads, hampered innovation and responsiveness to changing markets. The subjective approval test "that forest resources be adequately managed and conserved" led to disputes that

delayed approval and implementation of plans. FDPs were updated every one or two years, leading to significant transaction costs between industry and government as well as a short planning horizon. Although streamlining changes were made with respect to the number of required types of plans, the Code's overall approach to forest planning was viewed as too cumbersome and costly.

For major forest tenure holders, the *Forest and Range Practices Act* of 2004 requires two levels of plans, of which one – the forest stewardship plan (FSP) – is submitted for approval by the BCFS. The FSP identifies forest development units within which development can occur, and must provide measurable results or verifiable strategies consistent with government objectives for various forest values. Government objectives stem from a variety of sources. Some come from land use plans, others are provided or enabled in regulations, and others are grandparented from the Code. The FSP has a 5-year term that may be extended to 10 years. Other requirements include consultation with First Nations and providing an opportunity for review and comment by the public and other resource users. Tenure holders must also prepare site plans that identify intended roads, cutblocks and FSP strategies for the site. The site plans are not approved by government but must be available to the public on request.

Implement Activities

Forestry activities today, such as road building, timber harvesting, reforestation, silvicultural treatments and forest protection, have long-term implications for future forest conditions, often well beyond the next 50 or 100 years. Forestry activities need to be carried out by tenure holders and government in a manner that is consistent with completed plans, including land use plans, SFMPs, FSPs and site plans.

Under the *Forest Act,* the BCFS is responsible for issuing tenures, including long-term licence documents such as TFLs and shorter-term road permits and cutting permits, and for determining the stumpage price and other charges that tenure holders must pay. Most forest activities are implemented by tenure holders and contractors working for them. Fire suppression and management of insects and diseases have been the responsibility of the BCFS in partnership with tenure holders.

Before 1987, reforestation of harvested areas on public land was mostly funded by government and carried out by the BCFS and some tenure holders. Reforestation efforts lagged under this arrangement, so in 1987 reforestation was made a legal obligation to be funded and carried out by major tenure holders. The BCFS (now through BC Timber Sales) is legally required to reforest areas harvested under TSLs. Areas of public land where timber was burned by wildfire or killed by insects may be reforested by the BCFS, based on each situation's merits as an investment of public funds.

Similarly, other silvicultural treatments such as juvenile spacing, fertilizing, pruning and commercial thinning are based on their merits as an investment of public funds, and may be carried out by the BCFS or tenure holders.

Assess Results

Monitoring and assessing forest conditions relative to the desired future forest, and evaluating the effectiveness of management activities in achieving goals, supports a cycle of continuous improvement.

Each of the above activities can be assessed and adjusted based on the assessments. For example:

- Is available information adequate? Are tenure obligations clear?
- Are the goals clear and comprehensive?
- Are plans realistic and adequate for realizing the goals?
- Did implementation follow the plan and legal requirements?

Continuous improvement is a fundamental component of modern forest management. Government processes that contribute to continuous improvement include this report, the Ministry of Forests and Range's service plans, the Forest and Range Practices Advisory Council, the Forest and Range Evaluation Program, various adaptive management projects, the investigations and audits by the Forest Practices Board, and the BCFS compliance and enforcement program.

As discussed, many forest tenure holders in British Columbia either have or are actively pursuing independent third-party forest certification. This involves use of indicators, targets, monitoring and reporting on attainment of those targets. The tenure holder's performance is also periodically assessed through independent third-party audits.

Professional associations and academia, often in partnership with government and industry, provide numerous continuing education opportunities to help ensure that resource professionals are aware of their professional obligations, are appropriately qualified to perform key tasks, learn from actions taken and adapt to change.

Long-term forest management requires inter-generational learning and adaptation to broad changes such as changes in society's values regarding forest resources, changes in global demand for forest products and, increasingly, climate change.

About Sustainable Forest Management

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

– Fred Bunnell
(Professor, University of British Columbia)

Sections:

The Concept

Sustainable forest management is a widely supported goal. Forest practices have addressed aspects of sustainability for centuries, but “sustainable forest management” is a relatively recent concept that explicitly encompasses environmental, economic and social dimensions. It is more comprehensive than earlier concepts such as “sustained yield of timber.”

Sustainable forest management can be viewed as a sector-specific subset of the broader concept of sustainable development, which was first given prominence by the World Commission on Environment and Development, commonly known as the Brundtland Commission. In its 1987 report, “Our Common Future,” the commission emphasized the interdependence of environmental integrity, economic development and social security. Specifically, the commission stated:

> *Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.*

The concepts of sustainable development and sustainable forest management have gained wide acceptance, even though their exact meaning and the methods for their implementation are often disputed. A variety of graphic models, such as three overlapping circles representing the environment, the economy and society, are used to illustrate the concepts.

Numerous efforts that support sustainable development and sustainable forest management are being implemented in a variety of ways by governments, communities and industries.

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. 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 – 2006*, cross-references relevant indicators of the Montréal Process (1999) 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 practice 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. 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.

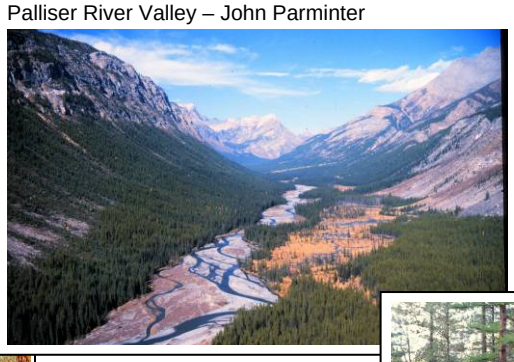
Reference values – for instance, historical baselines, technical or scientific thresholds and desired targets – provide a context for assessment of states and trends.

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.

Environmental Indicator 1

Ecosystem diversity


Coastal forest – Alex Inselberg


Palliser River Valley – John Parminter


Dry open forest – Don Gayton

Why is this important?

Diverse, well-functioning ecosystems are essential for environmental, economic and social sustainability. Many British Columbians are concerned about land use and preservation of old growth forests.

Overview

- Ecosystem diversity refers to the variety of ecosystems, their organisms and the interactions of those with their environment.
- British Columbia is the most biologically diverse province in Canada, and includes parts of 6 of the world's 30 terrestrial ecoregions.
- 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?

➡ Ministry of Forests and Range's assessment

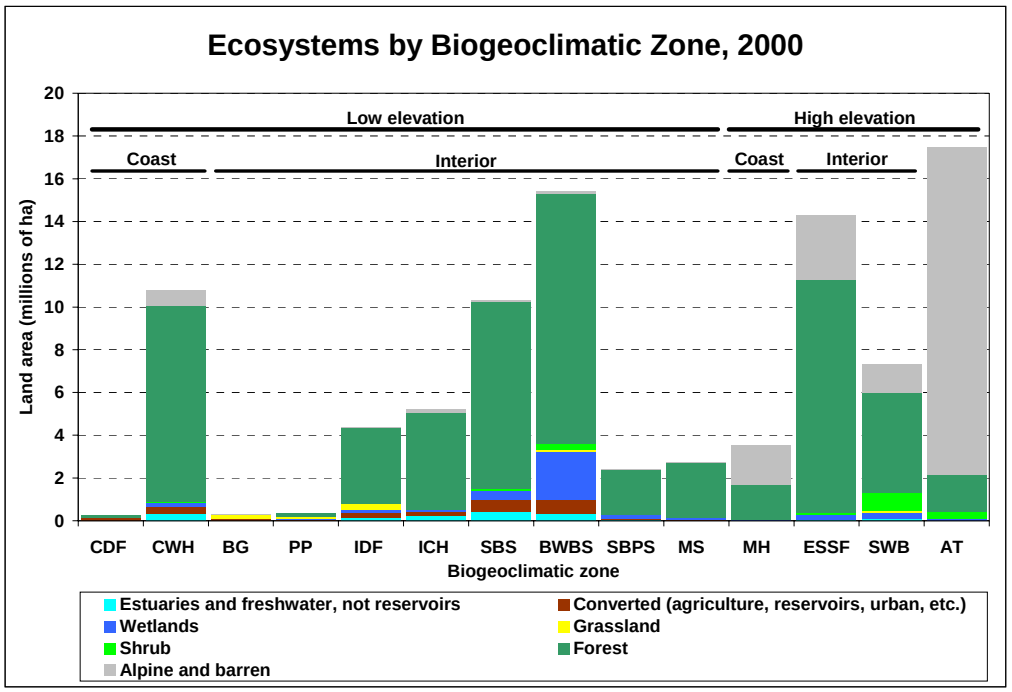
Related indicators

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

For data tables, see:
www.for.gov.bc.ca/hfp/sof/

Environmental Indicator 1-1

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



Why is this important?

Human settlement and resource development change the diversity and extent of ecosystems.

State and Trend

- 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 (CDF) 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.
- **Maps:** Biogeoclimatic Zones, Land Use Conversion

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.
- **References:** MFR's BEC, NFI, VRI; MoE's BEI, CDC, SEI; MAL's BTM

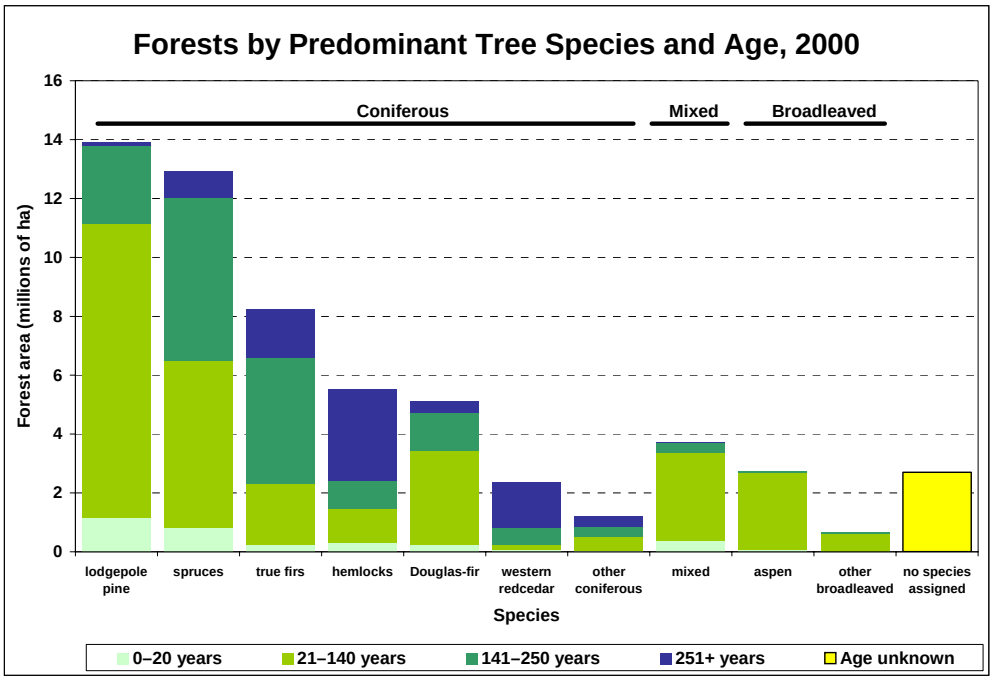
Related international and national indicators:

MP 3.a

CCFM 2.2

Environmental Indicator 1-2

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



Why is this important?

Different forest types and ages provide specialized habitats for plants, animals and fungi, and support a variety of human activities and livelihoods.

State and Trend

- Forests 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.
- **Maps:** Forest Land, Predominant Tree Species

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.
- **References:** MFR's VRI; MAL's LRDW

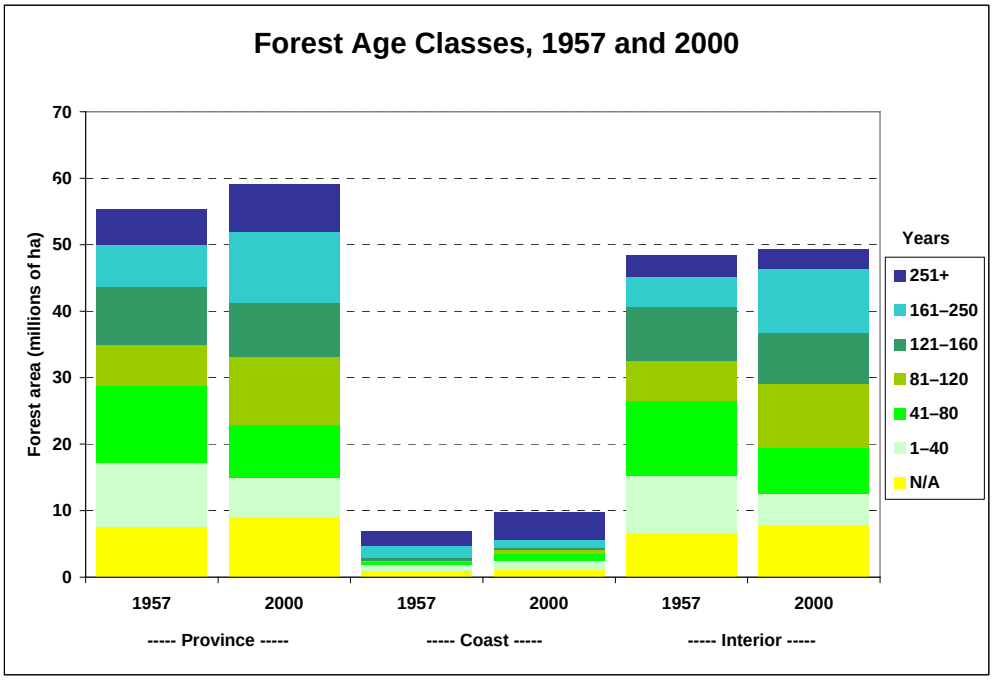
Related international and national indicators:

MP 1.1.a, 1.1.b

CCFM 1.1.1

Environmental Indicator 1-3

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



Why is this important?

Natural disturbances, logging, and land use conversion affect ecosystem processes.

State and Trend

- Ecosystem processes in forests are largely dependent on the area and distribution of forests, tree species composition and age.
- The area of forests recorded in forest inventories increased from 1957 to 2000, but it is not known how much of this is due to changes in inventory methods and how much is due to changes in actual forests.
- Similarly, apparent changes in predominant species may be due to methods more than changes in the forests.
- 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.
- **Maps:** Forest Age, Old Growth

Information

- 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 changes in forest area, species or age in the early 1900s.
- The 1957 and 2000 inventories permit reasonably reliable analysis of changes in age distribution, but do not support reliable analysis of changes in forest area or species composition[2].
- **References:** MFR's NFI, VRI

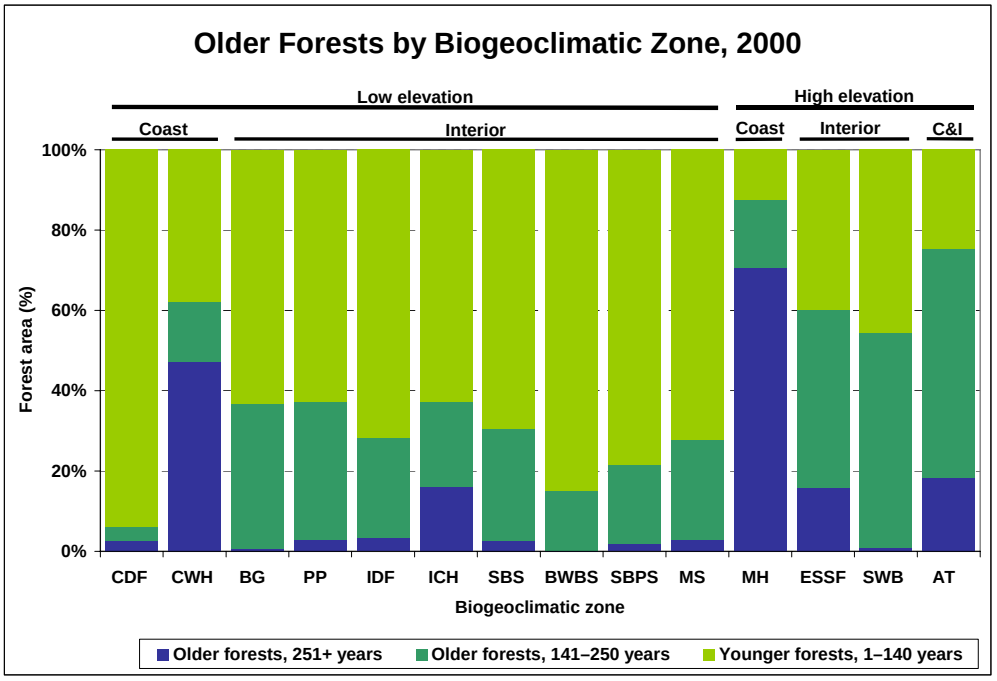
Related international and national indicators:

MP 1.1.b

CCFM 1.1.1

Environmental Indicator 1-4

How much older forest does B.C. have?



Why is this important?

Older forests provide specialized habitats not found in younger forests.

State and Trend

- 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.
- **Maps:** Forest Age, Old Growth, Biogeoclimatic Zones

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.
- **References:** MFR's VRI, Forest Science

Related international and national indicators:

MP 1.1.b

CCFM 1.1.1

Ecosystem diversity

Ministry of Forests and Range's assessment

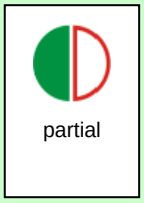
State

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 has 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.

Environmental Indicator 2

Protected forests

Kitlope Heritage Conservancy - John Kelson

Why is this important?

Protected forests provide natural habitats for plants and animals, areas for scientific study, and wilderness for recreational, cultural and spiritual pursuits.

Overview

- Protected forests are forests in strictly protected areas in which development is largely prohibited by law.
- In B.C., forests are strictly protected in provincial parks, ecological reserves and recreation areas, and in national parks.
- 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 What is the geographic distribution of protected forests?
2-4 How much of B.C.'s older forests is protected?

➡ Ministry of Forests and Range's assessment

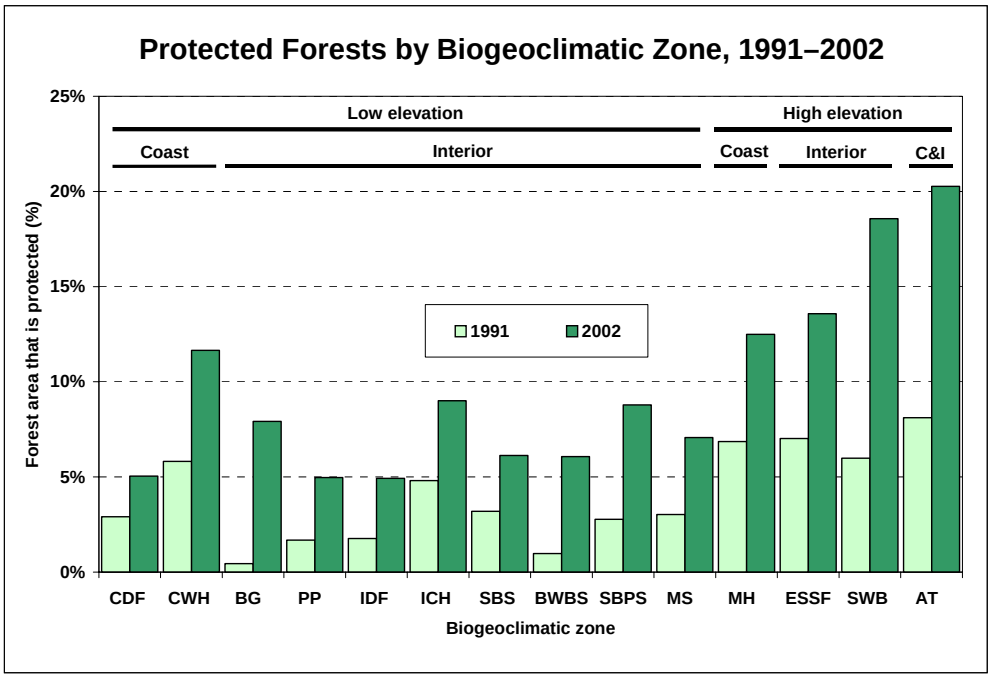
Related indicators

- 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 types and condition of protected forests influence habitats for wildlife (see Species diversity) and recreational opportunities (see Recreation).
- Management responses include planning, facilities and restoration.

For data tables, see:
www.for.gov.bc.ca/hfp/sof/

Environmental Indicator 2-1

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



Why is this important?

Protection of representative examples of forest ecosystems helps maintain ecological processes and species diversity.

State and Trend

- 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. These zones are the warmest and driest of the forested biogeoclimatic zones; consequent human settlement has limited availability of natural forests for protection.
- Only a few, small changes in areas were made between 2002 and 2005.
- **Maps:** Protected Areas, Biogeoclimatic Zones

Information

- 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.
- 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.
- **References:** MoE's BC Parks; Parks Canada

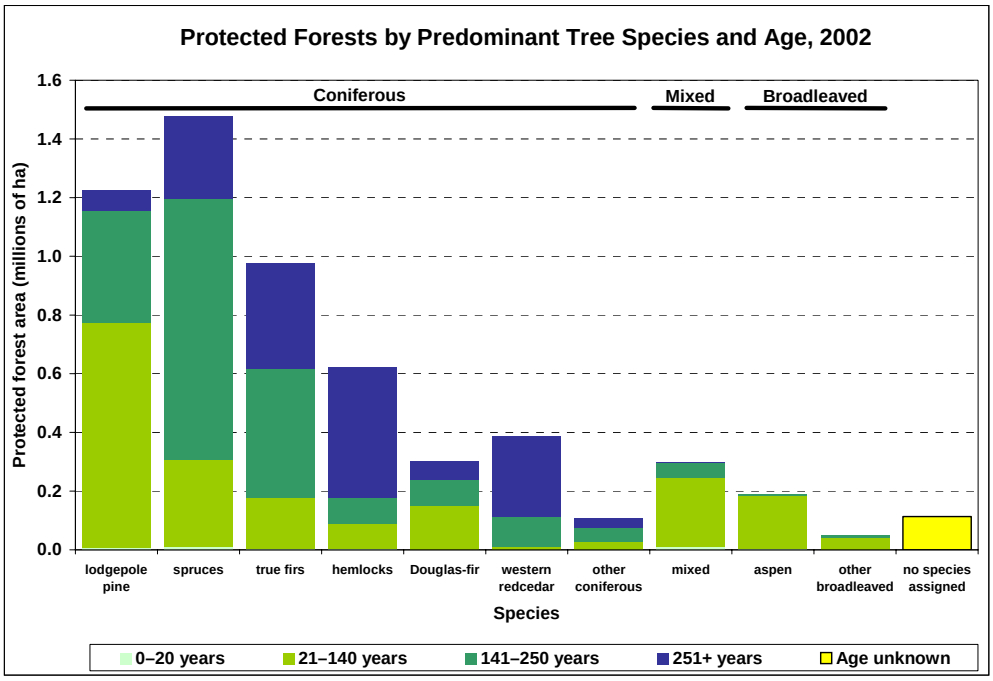
Related international and national indicators:

MP 1.1.c

CCFM 1.1.2

Environmental Indicator 2-2

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



Why is this important?

The many specialized habitats of forest-associated species occur in forests of different types and ages.

State and Trend

- B.C.'s protected forests are strictly protected (IUCN categories I to III).
- Like B.C.'s total forests; B.C.'s protected forests are mostly coniferous, dominated by lodgepole pine, spruces and true firs.
- Older forests are well-represented 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%).
- Areas can also be partially protected (IUCN categories IV to VI) by limiting resource development. In B.C., large special management zones cover 14 million ha (forest and non-forest) and many smaller riparian and other sensitive zones cover additional areas. 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.
- **Maps:** Protected Areas, Special Management Zones

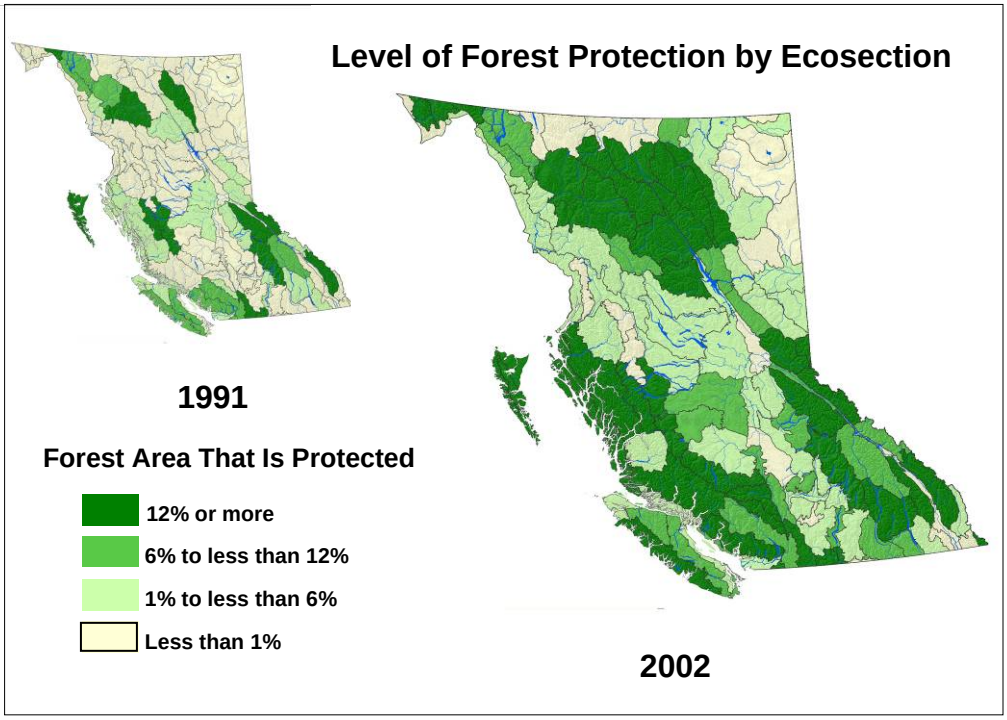
Information

- Only satellite imagery is available for a few large parks, and data for several parks existing since the 1950s are old and not reliable. Analysis of the representativeness of protected forests based on species and age is therefore less reliable than that based on forest area.
- More recent forest inventories exist for parks established since 1990.
- **References:** MoE's BC Parks; Parks Canada; MAL's Strategic Land Use Planning, LRDW; MFR's VRI

Related international and national indicators:
MP 1.1.c, 1.1.d
CCFM 1.1.2

Environmental Indicator 2-3

What is the geographic distribution of protected forests?



Why is this important?

The geographic distribution of protected areas reflects society's choices to balance conservation values with economic development opportunities.

State and Trend

- Ecological classification into ecosections based on climate and physiography is used for general conservation and wildlife management.
- 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, especially along the coast, protected areas were concentrated in ecosections with high conservation values.
- In other parts of the province, such as the northeast, protected areas were intentionally limited in some ecosections with high economic development opportunities.
- **Maps:** Protected Areas, Level of Land Protection by Ecosection

Information

- Ecosections are better suited for analyzing geographic distribution than biogeoclimatic zones.
- Existing data on the areas of total forests and protected forests by ecosection are reliable.
- **References:** MoE's BC Parks, Ecoregions of B.C.

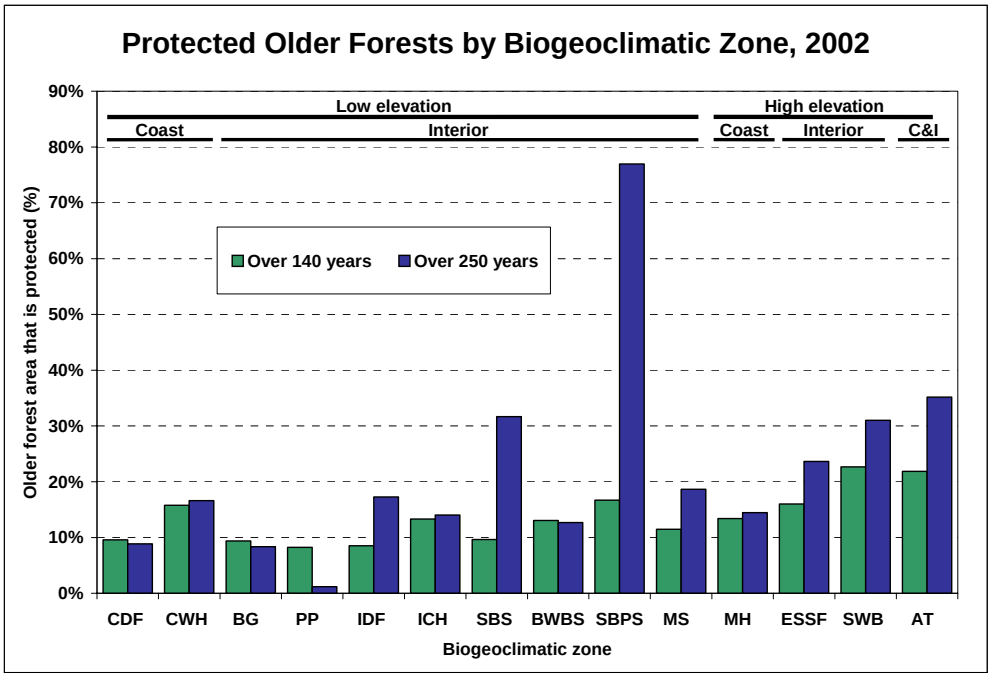
Related international and national indicators:

MP 1.1.c

CCFM 1.1.2

Environmental Indicator 2-4

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



Why is this important?

Protection of older forests helps ensure the survival of dependent species, and the preservation of their other special values. Protection of B.C.'s old growth forests is a high profile public issue.

State and Trend

- Older forests that take hundreds of years to develop provide specialized habitats and numerous economic, social and spiritual values.
- The area of protected forests over 140 years old doubled between1991 and 2002, 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).
- Protected forests include 15% of the province's forests over 140 years old and 19% of forests over 250 years old.
- 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. Tall trees provide important ecological niches, and are appreciated for their aesthetic and spiritual values.
- 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.
- **Maps:** Protected Areas, Forest Age, Biogeoclimatic Zones

Information

- Age data are not reliable for about half of the protected areas.
- **References:** MFR's VRI, Forest Science

Related international and national indicators:

MP 1.1.c, 1.1.d

CCFM 1.1.2

Protected forests

Ministry of Forests and Range's assessment

State

good

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

improving

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. Due to historical development patterns, choices are limited in the smaller biogeoclimatic zones.

Information

partial

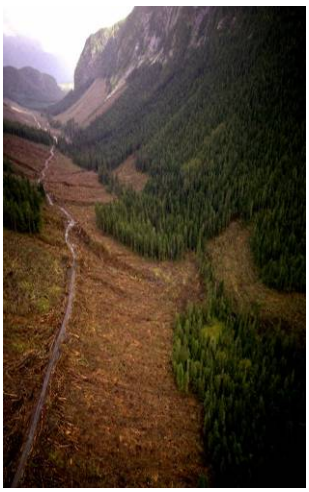
Management of currently protected forests and decisions to protect additional areas depend on information about the forests, their conservation values, and expected benefits and costs of ongoing protection. Detailed biogeoclimatic data and 1:250,000 maps are available for the whole province, including 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 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 inventories primarily address timber values, not conservation values.

Environmental Indicator 3

Ecosystem dynamics

Wildfire – MFR

Mountain pine beetle – Lorraine Maclauchlan



Timber harvest – MFR

Why is this important?

Altering the dynamics of forest ecosystems may reduce environmental stability and resilience, leading to detrimental economic and social impacts.

Overview

- Ecosystems are dynamic – their non-living elements change, and their living elements grow and die. Despite dramatic changes in individual elements, ecosystems can be resilient and stable.
- Since 1950, the dynamics of British Columbia's forest ecosystems have been subject to climate change, wildfire suppression and increased timber harvests.
- Changes in the dynamics of B.C.'s forest ecosystems appear to be reducing ecosystem stability and resilience.

STATE mixed **TREND** deteriorating **INFORMATION** partial

Questions about ecosystem diversity

3-1 What are the main dynamics in B.C.'s forests?
3-2 How are the main dynamics changing forest age?
3-3 How are the main dynamics changing forest biomass?
3-4 How fragmented are B.C.'s forest ecosystems?

➡ Ministry of Forests and Range's assessment

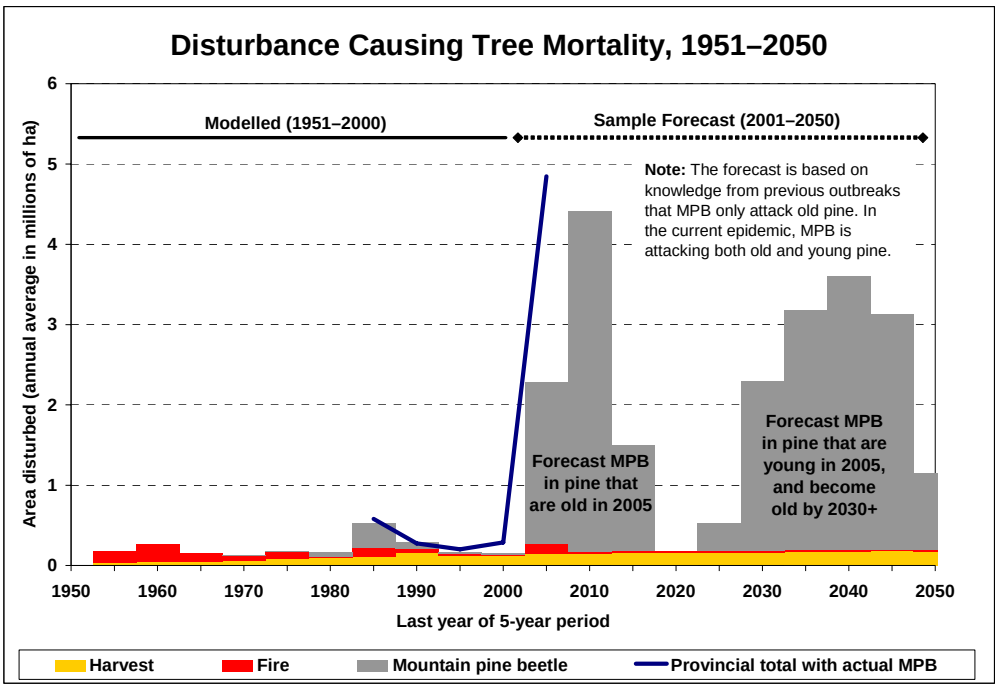
Related indicators

- Pressures that affect ecosystem dynamics include fire management, logging, reforestation, invasive plants and animals, and climate change (see Timber harvest, Silviculture, Exotic species, Greenhouse gases).
- Altering ecosystem dynamics can disrupt wildlife habitat and economic activity (see Species diversity, Forest products, Jobs and communities).
- Management responses include protected areas (see Protected forests), research to improve understanding (see Management capacity), ecosystem restoration and prescribed fires.

For data tables, see:
www.for.gov.bc.ca/hfp/sof/

Environmental Indicator 3-1

What are the main dynamics in B.C.'s forests?



Why is this important?

Managing the combined effects of established and new ecosystem dynamics requires understanding their relative importance and their interactions.

State and Trend

- Fires, insects and diseases that kill trees are part of the natural dynamics of ecosystems. Humans reduce some disturbances (e.g., fire suppression) and add other disturbances (e.g., timber harvests).
- From 1950 to 2000, fire suppression reduced the area disturbed by fires, while the area disturbed by timber harvests increased. Their combined area averaged 170,000 ha per year. This is forecast to increase to 190,000 ha annually in 2001–2050.
- The current mountain pine beetle epidemic, enabled by climate change[3], is forecast to disturb an average 2,000,000 ha per year in 2001–2050 (an area may be disturbed more than once). This is 40 times the 1951–2000 average and 10 times the forecast area of fire and harvest disturbance. The actual area disturbed in 2005 was 8,700,000 ha, and the actual average for 2001–2005 is twice the forecast level.
- Other insects primarily reduce growth rates. They affected 340,000 ha per year in 1951–2000, and generally had lesser impacts.
- Diseases attack tree roots, stems and foliage. They cause both growth loss and mortality. An introduced stem disease, white pine blister rust, has greatly reduced the occurrence of mature western white pine. Climate change triggered an epidemic of an endemic foliage disease[4].
- Disease impacts are widely dispersed and difficult to reduce.
- **Maps:** Pine Volume Killed (2004 Observed, 2011 Projection)

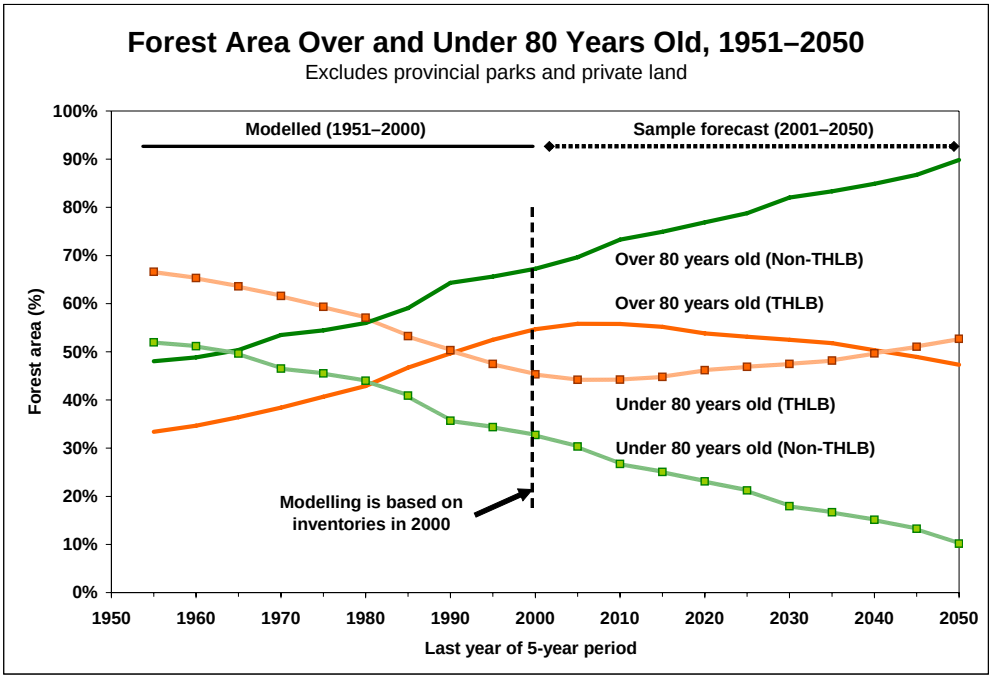
Related international and national indicators:
MP 3.a
CCFM 2.3

Information

- Past assumptions about mountain pine beetles have proven wrong.
- The effects of climate change are new, complex and hard to predict.
- **References:** MFR's MPB; CFS's Disturbances, MPB Initiative

Environmental Indicator 3-2

How are the main dynamics changing forest age?



Why is this important?

Maintaining a mix of forest ages over time supports a variety of habitats for plants and animals, and the capacity of ecosystems to recover from disturbances.

State and Trend

- Wildfire, insect and disease disturbances affect forest age across the province, but timber harvests affect the age of forests primarily on the timber harvest land base (THLB).
- From 1951 to 2000, the proportion of forests over 80 years old increased on the THLB and the non-THLB (non-commercial and explicitly reserved forests). Effective suppression of wildfires allowed the aging of large forest areas burned in the late 1800s (see Indicator 1-3).
- Over the next 50 years, a decrease in the proportion of forests over 80 years old is forecast on the THLB, caused by increased areas harvested.
- In contrast, ongoing aging is forecast for forests on the non-THLB until 2050, when about 90% of these forests will be over 80 years old. As a result, fuel for wildfires and food for insects will increase.
- Wildfires now account for a small proportion of total disturbances, so doubling the average area burned by 2050 changes the forecast little. However, the severe 2003 fire season increased the average for 2001–2005 six-fold.
- **Maps:** Forest Age

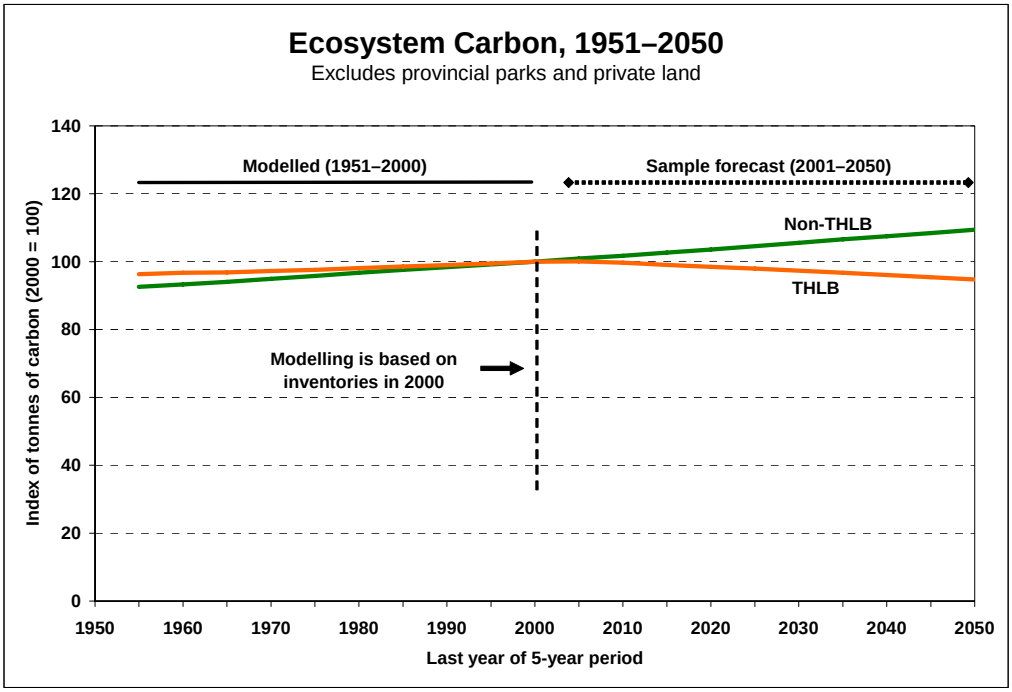
Information

- Past and future forest ages were modelled with the federal government's national carbon budget model, using forest inventories for 2000.
- The model treated all insect disturbances as partial disturbances – forests with a mix of tree species continue to age after mountain pine beetle kills all the pine. This modelling is inaccurate for pure pine forests if all trees are killed.
- **References:** MFR's VRI; CFS's CBM-CFS2

Related international and national indicators:
MP 1.1.b, 2.a
CCFM 1.1.1

Environmental Indicator 3-3

How are the main dynamics changing forest biomass?



Why is this important?

Changes in forest biomass imply changes in ecosystem functions, stability and resilience.

State and Trend

- The quantity of living organisms in an ecosystem can be measured as the amount of carbon in above-ground and below-ground biomass. The quantity of dead organisms or dead organic matter is also important.
- In B.C.'s forests, biomass amounts to less than one third of total ecosystem carbon. Merchantable parts of trees amount to about 10%.
- Total ecosystem carbon in B.C.'s forest ecosystems increased from 1951 to 2050 in the scenario used for Indicators 3-1 and 3-2.
- On the non-THLB, assuming no harvesting and minor natural disturbances, total ecosystem carbon increases 18% from 1951 to 2050.
- On the THLB, total ecosystem carbon is relatively stable over the 100 years. A decrease of about 5% from 2000 to 2050 is caused by ongoing timber harvests replacing older forests with second-growth forests.
- Wildfires and timber harvests decrease total ecosystem carbon by directly removing carbon from forest ecosystems. Harvests have the biggest impact on total ecosystem carbon.
- Mountain pine beetle, and other insects and diseases, affect total ecosystem carbon indirectly. They change biomass to dead organic matter, with no immediate effect on total ecosystem carbon. This leads to increased carbon release from decomposition, and decreases carbon absorption from the atmosphere.
- **Maps:** Forest Land

Related international and national indicators:

MP 2.b, 5.a

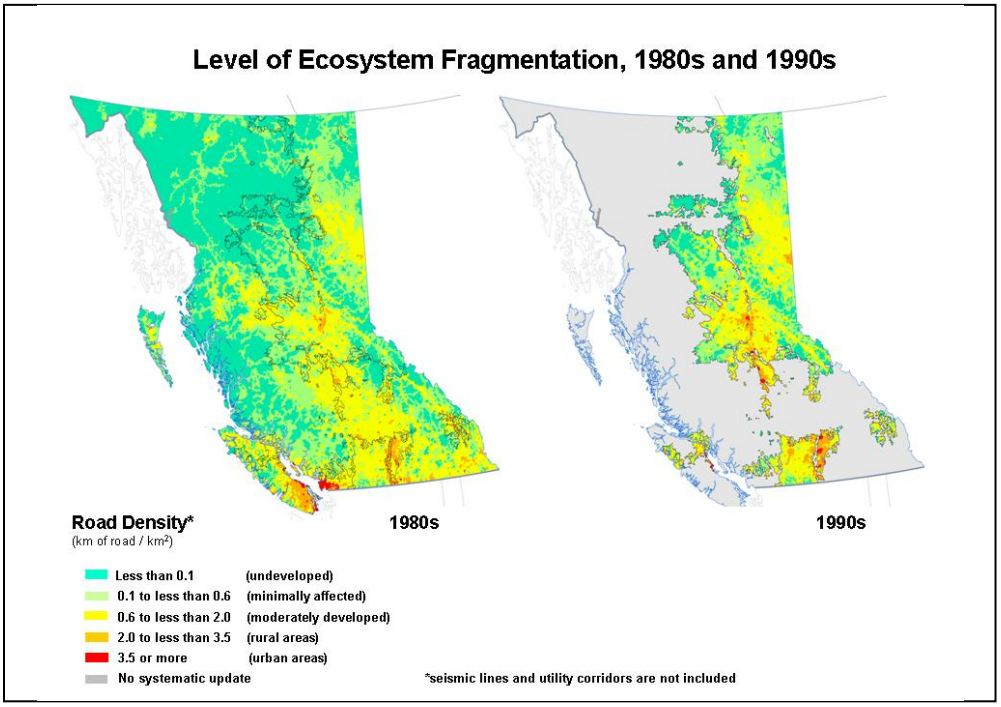
CCFM 2.1, 4.1.2

Information

- The model may be overestimating carbon increases before 2000[5].
- Information on the impacts of diseases is limited.
- **References:** MFR's VRI; CFS's CBM-CFS2

Environmental Indicator 3-4

How fragmented are B.C.'s forest ecosystems?



Why is this important?

Fragmentation of forests disrupts ecosystem functions, reduces habitat quantity and quality, and reduces populations of some species.

State and Trend

- Road density is a common indicator of fragmentation and related human activities. Roads can cause a direct loss of habitat, degrade habitat quality, reduce the size of habitat patches, create barriers that isolate populations, reduce habitat use because animals avoid related noise and activity, decrease populations through road kills and increased legal and illegal hunting, and help disperse predators and invasive species.
- The road density categories shown represent areas that are 1) undeveloped, without roads, 2) minimally affected by few roads, 3) unsuitable for some large carnivores such as grizzly bear and wolves, 4) rural areas unsuitable for all large carnivores, and 5) urban areas.
- Undeveloped watersheds covered 44% of B.C. in the 1980s, an estimated 26% in 2005, and are expected to cover 18% in the long term.
- Undeveloped and minimally affected watersheds combined covered 73% of B.C. in the 1980s and an estimated 61% in 2005.
- Other developments, such as seismic lines for oil and gas exploration, cause additional fragmentation, especially in north-eastern B.C.[6]
- Large areas away from all developments (regardless of watershed locations), called intact areas, are important habitat for large wildlife.
- **Maps:** Intact Areas

Information

- Province-wide road data were systematically collected by government in the 1980s, and updated for about 34% of the province during the 1990s. Since then, voluntary contributions from industry have provided updates, but it is not known where road information is complete or incomplete.
- **References:** MAL's LRDW

Related international and national indicators:

MP 1.1.e

CCFM (none)

Ecosystem dynamics

Ministry of Forests and Range's assessment

State


mixed

B.C.'s varied forest ecosystems have evolved with periodic disturbance by fire, insects and diseases. Forest management over the last 50 years has suppressed some of these disturbances and introduced increasing levels of disturbance from timber harvests. On balance, the amount of forest over 80 years old is greater now, as is the total ecosystem carbon. The current epidemic of mountain pine beetle has, however, created an unprecedented level of disturbance that is threatening numerous aspects of environmental, economic and social sustainability. Ecosystem fragmentation has increased, but substantial areas still exist that are undeveloped or only minimally affected by roads.

Trend


deteriorating

Fire suppression, timber harvests and climate change are changing ecosystem dynamics across the province. Their combined effects are not easy to anticipate and, as in the case of mountain pine beetles, can have catastrophic impacts. The changing proportions and geographic distribution of forests over and under 80 years old can be expected to have various known, uncertain and currently unknown impacts on ecosystem functions. In combination with climate change, this is changing susceptibility to wildfires, insects, diseases and invasive species. Increasing impacts from these agents can be expected. Ecosystem fragmentation is also expected to increase.

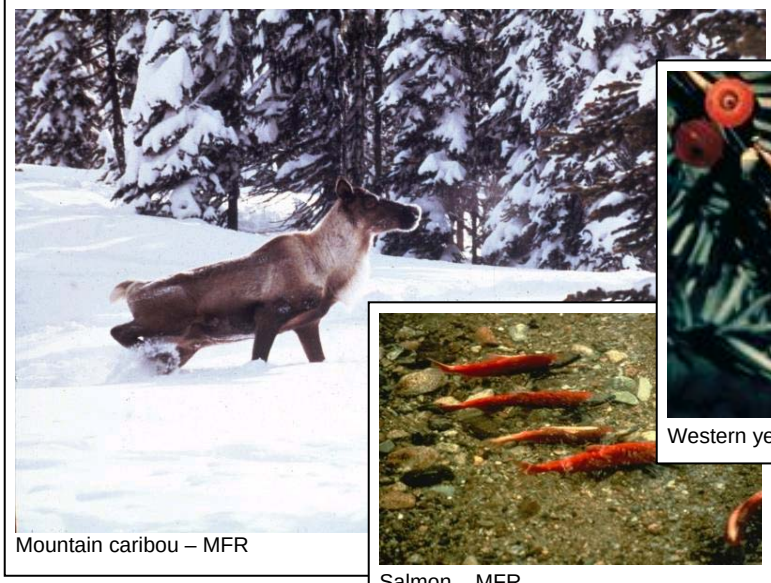
Information


partial

Locations of historical wildfires and many insect outbreaks are well documented. Their impacts on timber volumes are less well known, as are the locations and impacts of tree diseases. A detailed and complex model of provincial-level forest ecosystem dynamics is available, and while some input data and assumptions are not accurate, the model and data are constantly being improved. Systematic, province-wide inventories of roads are not being maintained, so monitoring of ecosystem fragmentation will need to rely on satellite imagery. Climate change is known to be occurring in B.C., but the nature of the change is variable and its likely impact on forest ecosystem dynamics is hard to predict.

Environmental Indicator 4

Species diversity



Mountain caribou – MFR

Salmon – MFR

Western yew – MFR

Why is this important?

Changes in species diversity can affect ecosystem productivity and stability. Species at risk, especially culturally important species, have a high public profile.

Overview

- Species diversity encompasses the number of species (species richness) and the distribution of their populations and individuals.
- British Columbia has high species diversity, with more vascular plants than neighbouring provinces and states, and more than 70% of Canada's bird species.
- Most of B.C.'s forest-associated species have healthy populations. Some populations and distributions are changing, and some are at risk.

STATE mixed **TREND** deteriorating **INFORMATION** partial

Questions about species diversity

4-1 How many species are forest-associated?
4-2 How many forest-associated species are at risk?
4-3 Are populations of selected forest-associated species changing?
4-4 Are tree species before and after timber harvests similar?

➡ Ministry of Forests and Range's assessment

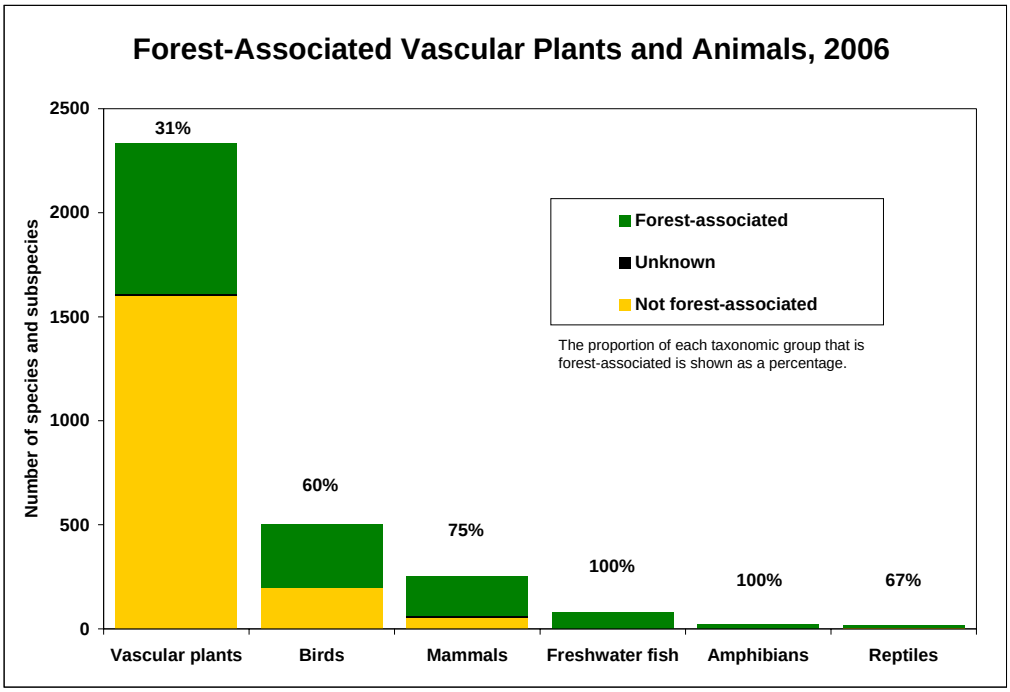
Related indicators

- Pressures on species diversity include land use changes, invasive species, fires and fire suppression, logging, human access and climate change (see Ecosystem diversity, Exotic species, Ecosystem dynamics, Timber harvest, Recreation and Greenhouse gases).
- Changes in species diversity may affect ecosystem services, economic opportunities, enjoyment of nature and cultural traditions (see Ecosystem dynamics, Forest products, Recreation, First Nations involvement).
- Management responses include protected areas (see Protected forests), other habitat protection, recovery programs and ecosystem restoration.

For data tables, see:
www.for.gov.bc.ca/hfp/sof/

Environmental Indicator 4-1

How many species are forest-associated?



Why is this important?

Forest management changes the habitats that forest-associated species depend on.

State and Trend

- B.C.'s forest ecosystems provide habitats for many plants, vertebrates, invertebrates, lichens and fungi. A forest-associated species is known to either depend on, or make some use of, forest ecosystems.
- Among B.C.'s 3,201 vascular plant and terrestrial vertebrate species, 1,324 (41%) are forest-associated, including 721 vascular plants, 303 birds, 189 mammals, 81 freshwater fish, 20 amphibians and 10 reptiles.
- Of these forest-associated species, 473 (36%) are known to be associated with old growth forests.
- Standing or fallen, dead or dying trees (wildlife trees, coarse woody debris) are used for food, nesting habitat or shelter by 83 birds, 58 mammals, 12 amphibians and one reptile.
- Many streams that support freshwater fish species depend on forested riparian areas and large organic debris in stream channels for channel stability, erosion control and temperature modification.
- **Maps:** See Indicator 4-3 for range maps of selected species.

Information

- Extensive information is readily available for some taxonomic groups.
- Information is available but incomplete for non-vascular plants, invertebrates, lichens and fungi.
- The Resource Information Standards Committee (RISC) develops standards for field inventory of plants and animals in British Columbia.
- Relatively few species are regularly and systematically inventoried.
- **References:** MoE's SEE, IWMS, RISC, CDC; MFR's WTC; UBC's E-Flora BC; NatureServe; Wild BC

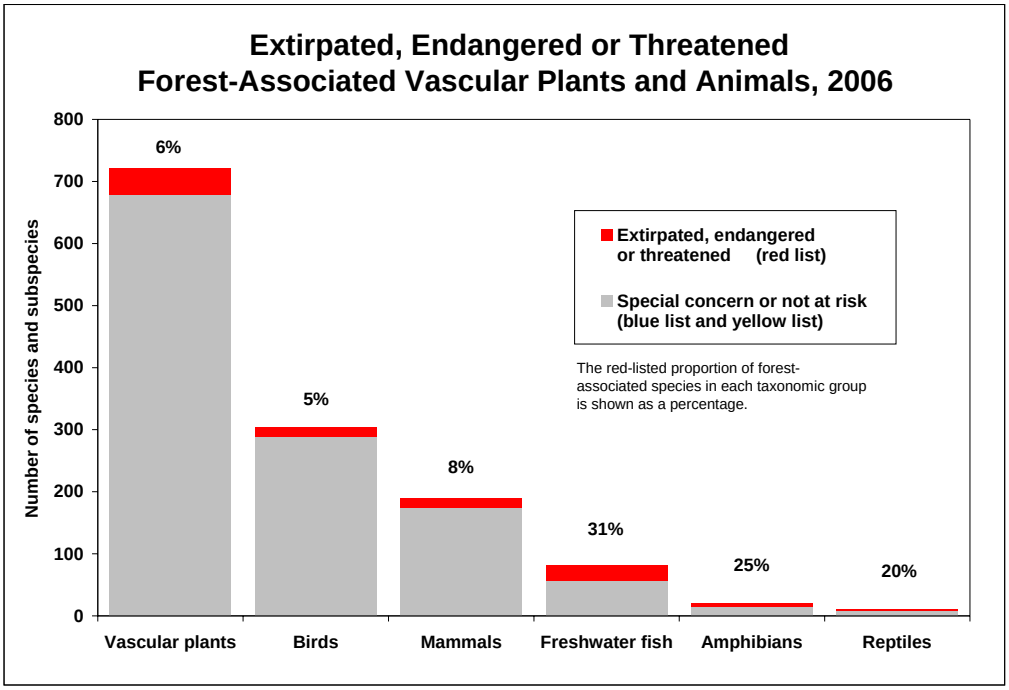
Related international and national indicators:

MP 1.2.a

CCFM (none)

Environmental Indicator 4-2

How many forest-associated species are at risk?



Why is this important?

Local extirpation of species can affect ecosystem processes and economic opportunities. Global extinction of species is irreversible.

State and Trend

- Ranking the risk of extinction helps to guide conservation efforts. Various provincial, national and international lists of species are based on increasing degrees of scientific scrutiny and data to confirm status.
- The B.C. Conservation Data Centre's red list includes 400 (12%) vascular plant and terrestrial vertebrate species that are extirpated, endangered or threatened. A further 5 species are extinct.
- Some red-listed species are naturally rare. Some are at the limits of their natural range and rare in B.C., but more abundant outside B.C.
- Further investigation is required after a species is red listed. This may or may not lead to formal designation and explicit management measures.
- Forest-associated species include 106 (27%) of the red-listed species, with the largest numbers in the CWH (42), CDF (30) and IDF (26) biogeoclimatic zones. Timber harvesting is a major threat to 33 or more of these, including coastal giant salamander and spotted owl.
- The provincial *Forest and Range Practices Act* provides specific habitat protection for "identified wildlife" – 70 species and 15 plant communities.
- The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) lists 91 of B.C.'s forest-associated species as endangered or threatened, and protection is provided for 76 under federal law.
- **Maps:** See Indicator 4-3 for range maps of selected species.

Information

- Changes in number of species listed and in rankings (greater or lesser risk) do not reliably indicate trends, due to factors other than risk status.
- **References:** MoE's CDC, SEE, IWMS, Recovery Planning; MFR's BEC; Government of Canada's COSEWIC, SAR; NatureServe; IUCN

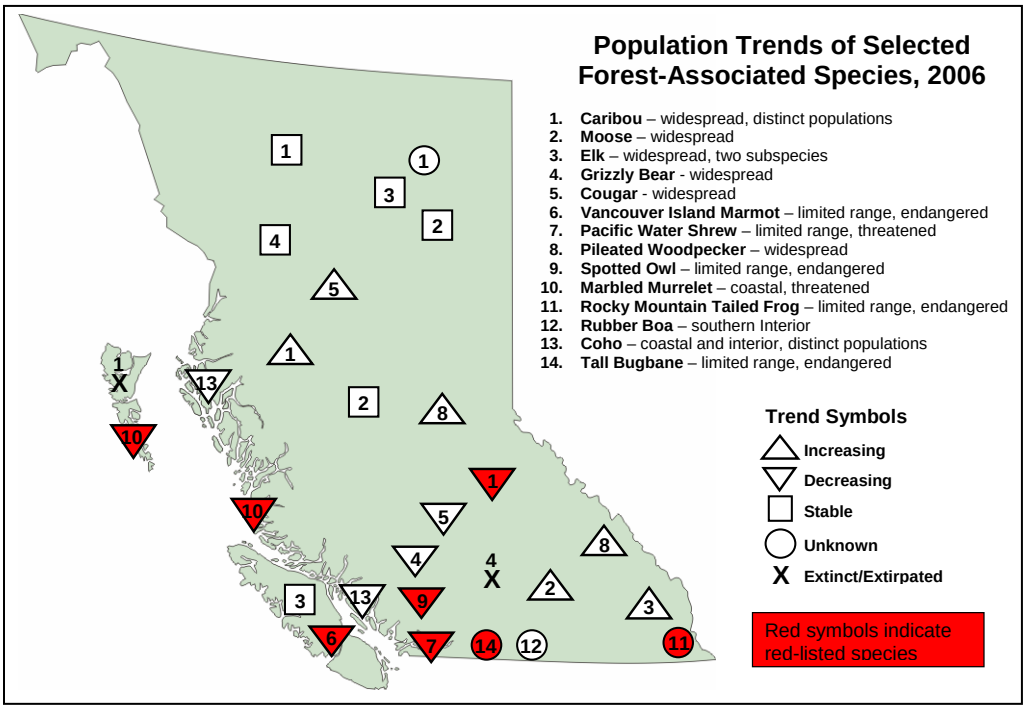
Related international and national indicators:

MP 1.2.b

CCFM 1.2.1

Environmental Indicator 4-3

Are populations of selected forest-associated species changing?



Why is this important?

Changes in populations and ranges may reflect evolutionary change or ecological dysfunction, and can affect economic uses and social traditions.

State and Trend

- From a list of 105 species selected for their ecological, economic or social significance, and to represent a variety of taxonomic groups, 14 species are presented here to illustrate the variety of population trends.
- Among widespread species, caribou, moose, elk, grizzly bear and cougar have locally varying population trends. Some local populations are increasing, or have expanding ranges; others are stable, declining or at risk, and a few have been extirpated.
- Pileated woodpeckers appear to be increasing. The tree cavities created by this keystone species are used by other species for nesting, shelter and feeding.
- Along the coast, all stocks of coho salmon have declining spawning abundance, due to changes in forest and marine conditions.
- Among rare species with limited ranges, Vancouver Island marmot and spotted owl are endangered and populations are decreasing.
- Although few or no population trend data exist for many species such as Pacific water shrew, marbled murrelet, Rocky Mountain tailed frog, rubber boa and tall bugbane, their habitat is known to be declining in quantity and quality due to logging, urbanization and agriculture.
- **Maps:** Range maps and notes for the above species are in Maps annex.

Information

- Population trends are known for relatively few species. Most vascular plant and vertebrate species have not been systematically inventoried.
- **References:** MoE's SEE, IWMS, CDC, Recovery Planning; Government of Canada's COSEWIC; NatureServe; BBS

Related international and national indicators:

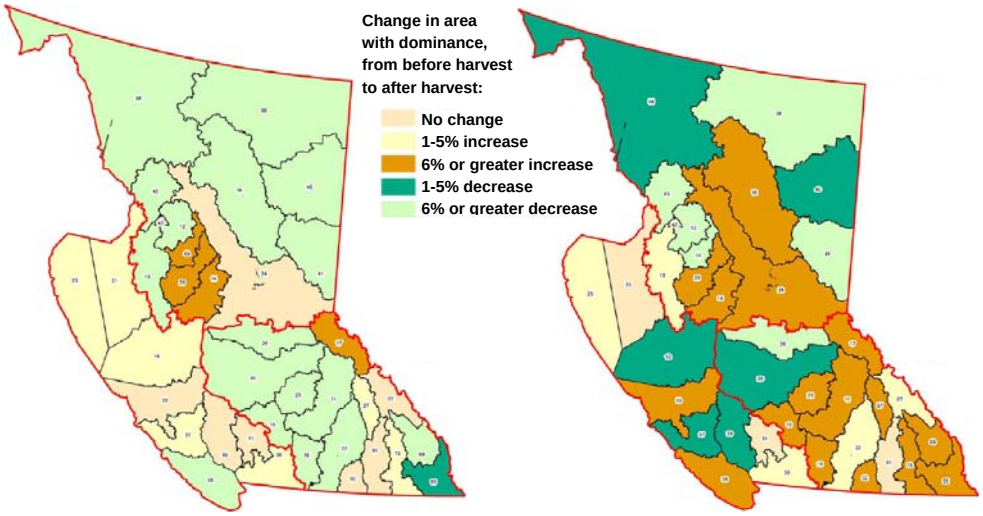
MP 1.3.a, 1.3.b

CCFM 1.2.2, 1.2.3

Environmental Indicator 4-4

Are tree species before and after timber harvests similar?

Change in Area with Dominance of a Single Tree Species, in Areas Harvested Up to and After 1987



Areas harvested up to 1987 **Areas harvested after 1987**

Why is this important?

Reducing the number of tree species (or changing the species) may decrease biological diversity and ecosystem resilience. Future economic value of forests may be increased or inadvertently decreased.

State and Trend

- Most of B.C.'s forests have a mixture of two or more tree species. About one quarter to one third are dominated by a single tree species that accounts for more than 80% of timber volume before harvest.
- The area dominated by one species before timber harvests can change after harvests and reforestation[7]. The extent of dominance changed after 1987, when the government assigned greater responsibility for reforestation, including selection of tree species, to the forest industry.
- In areas harvested up to 1987, coniferous forests with one dominant tree species decreased from 33% before harvest to 25% after harvest. Broadleaved forests increased from 0% before harvest to 5% after.
- In areas harvested after 1987, coniferous forests with one dominant tree species increased from 25% before harvest to 34% after harvest. Broadleaved forests increased from 1% before harvest to 4% after.
- Tree species after harvest may differ from those before harvest due to natural seeding, or planting species with better success rates and costs.
- Changes in area of predominant species before and after harvest (both time periods combined) include lodgepole pine (35% to 33%), spruces (29% to 23%), true firs (3% to 9%), hemlock (6% to 4%), Douglas-fir (16% to 16%), western redcedar (3% to 2%) and aspen (0% to 2%).
- **Maps:** Predominant Tree Species

Related international and national indicators:
MP (none)
CCFM (none)

Information

- Species data before and after harvest are available for only 57% and 11%, respectively, of the areas harvested 1970–1987 and after 1987.
- **References:** MFR's RESULTS

Species diversity

Ministry of Forests and Range's assessment

State

British Columbia has exceptional species diversity, much of it forest-associated. Among the 1,324 forest-associated vascular plant and terrestrial vertebrate species, 106 (8%) are red-listed (extirpated, endangered or threatened). Timber harvesting is a major threat to 33 or more of these. Management of older forests in and outside protected areas is expected to address concerns about species associated with old growth forests. Reforestation is maintaining a mix of tree species, which helps maintain ecosystem processes and diverse habitats.

Trend

Populations and ranges of some opportunistic species have expanded, while declining habitat quantity and quality has reduced populations of other species, in some cases putting them at risk. The extinction of five species to date was not related to forestry. Forest management is, however, implicated (along with climate change, urbanization and activities relying on road access) in the critical status of a few endangered species. To halt the trend, management responses increased over the past two decades, and include species recovery plans, breeding programs, protected forests (5.7 million ha), protection of other forest habitats (3.4 million ha) and establishment of old growth management areas. Partial data (for 11% of areas harvested) indicate that since 1987 reforestation may be increasing the extent of forests dominated by a single tree species. In some areas, this has been stopped due to concern about ecosystem health and resilience.

Information

Taxonomic cataloguing and description of B.C.'s species and their life cycles is extensive for vascular plants and vertebrate species; less so for non-vascular plants, invertebrates, lichens and fungi. Populations and population trends are known only for the relatively few species that are regularly and systematically inventoried. Inventories of mosses and lichens are generally lacking. Several sources rank the conservation status of B.C.'s species. Changes in conservation status may be due to changes in knowledge, procedures and taxonomy, rather than a species' actual condition, so trends in the number of species at risk can be misleading.

Environmental Indicator 5

Exotic Species

Orange Hawkweed – MFR

Gypsy moth – MFR

Hybrid Poplar – MFR

Why is this important?

Some exotic species pose significant environmental and economic threats. A few may provide important economic benefits.

Note: This indicator will be addressed fully, with detailed information and an assessment, in a future edition of the report.

Overview

- Exotic species are non-indigenous plants, animals and pathogens.
- Some exotic species are invasive. They spread rapidly and can disrupt indigenous species, nutrient cycling and water flow. This can reduce biological diversity, tree growth and agricultural yields. They could also result in export restrictions on B.C.'s forest products.
- The economic impacts of invasive species can amount to millions of dollars annually.
- Some fast-growing, non-indigenous tree species may offer benefits such as greater timber production than indigenous species and better adaptation to climate change. Some risk exists, however, that exotic species could become invasive or hybridize with closely related indigenous species, leading to disruption of ecosystem processes.
- Effective control strategies of exotic insects and diseases are impeded by a lack of knowledge about their behaviour in their new environment.

Related indicators

- Forest and range activities (see Timber harvest, Silviculture and Range) can contribute to the spread of invasive exotic plants, insects and pathogens.
- The presence of exotic species in B.C.'s forest products could lead to restrictions on exports (see Forest products).
- Effective control requires an enabling regulatory framework (see Law) and sound understanding of the behaviour of exotic insects and diseases in their new environment (see Knowledge, Management capacity).

Related international and national indicators:

MP 2.c, 3.a

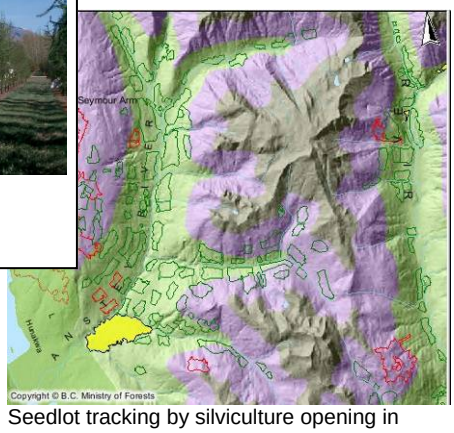
CCFM 1.2.4

Environmental Indicator 6

Genetic diversity

Grand fir (*Abies grandis) in situ* reserve – Alvin Yanchuk

Pollen isolation bags used in tree breeding and orchard management – Alvin Yanchuk



Seedlot tracking by silviculture opening in SeedMap – MFR

Why is this important?

Genetic diversity, a fundamental component of biological diversity, is required for adaptation and evolution.

Overview

- Genetic diversity refers to genetic variation within individual organisms, within populations and among populations of a species.
- British Columbia's forests are genetically diverse, with over 40 native tree species that grow in a wide range of environmental conditions.
- Most of this natural genetic diversity is intact for B.C.'s tree species. Management of protected areas and sound reforestation practices ensure genetically adapted, healthy and ecologically resilient forests.

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

Questions about genetic diversity

6-1 How well conserved are the genetic resources of trees?
6-2 What genetic variation exists in unmanaged and managed forests?
6-3 What proportion of reforestation uses select seed?
6-4 Where is select seed planted?

➡ Ministry of Forests and Range's assessment

Related indicators

- Agricultural and urban development, logging, planting and climate change are changing the genetic diversity of tree species (see Ecosystem diversity, Timber harvest, Silviculture, Greenhouse gases).
- Seed use strategies may help mitigate the effects of climate change (see Greenhouse gases) and increase benefits from investments in reforestation (see Silviculture).
- Management responses include reserves (see Protected forests, Timber production forests), forest genetics research, tree breeding, seed use regulation, and monitoring of genetic gain (see Silviculture) and the effectiveness of regulations for ensuring genetic diversity (see Law).

For data tables, see:
www.for.gov.bc.ca/hfp/sof/

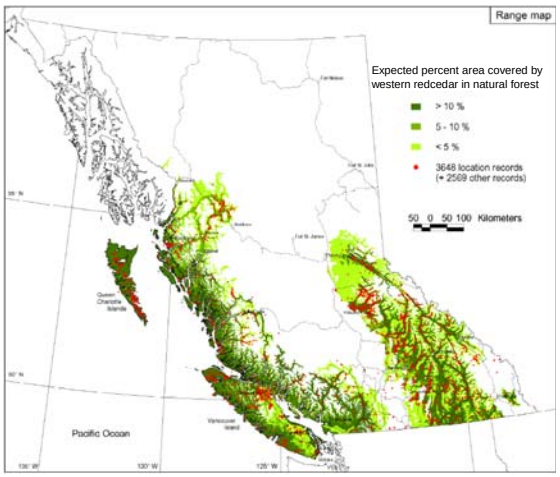
Environmental Indicator 6-1

How well conserved are the genetic resources of trees?

***In Situ* Protection of Western Redcedar *(Thuja plicata)*, 2001**
(Species Range and Proportion Protected, by Biogeoclimatic Zone)

BEC Zone	Species range (ha)	Protected (%)
CDF	250,162	2.7
CWH	10,476,016	9.9
ICH	4,889,831	10.1
IDF	1,301,659	6.4

Species Range of Western Redcedar



Why is this important?

Conservation of genetic resources maintains the capacity for local adaptation, and the rare but potentially important genes for disease and pest resistance.

State and Trend

- Protected areas provide *in situ* reserves that conserve genetic resources. All of B.C.'s commercial tree species are represented in protected forests. Representation varies by species, biogeoclimatic zone, seed planning unit, and the number and size of reserves.
- For example, western redcedar, the province's official tree, is protected in all four of its biogeoclimatic zones. By zone, the portion of its range that is protected is 10% (CWH and ICH), 6% (IDF) and 3% (CDF).
- Currently, no commercial tree species lacks protection in any of its seed planning units. Since 1991, the area protected in the 10 least protected seed planning units increased by a factor of 22. More *in situ* reserves are considered desirable in a small number of seed planning units.
- *Ex situ* genetic conservation consists of trees planted in installations for genetic research and tree breeding, and seed collections.
- B.C. has six genetic resource archives and hundreds of provenance and progeny test sites around the province, providing *ex situ* conservation for 19 commercial and 3 non-commercial species.
- Seed collections for commercial use, genetic archives and research exist for most species, with over 8,000 seedlots in long-term storage.
- **Maps:** Predominant Tree Species, Protected Areas, Biogeoclimatic Zones, Natural Stand Seed Planning Zones

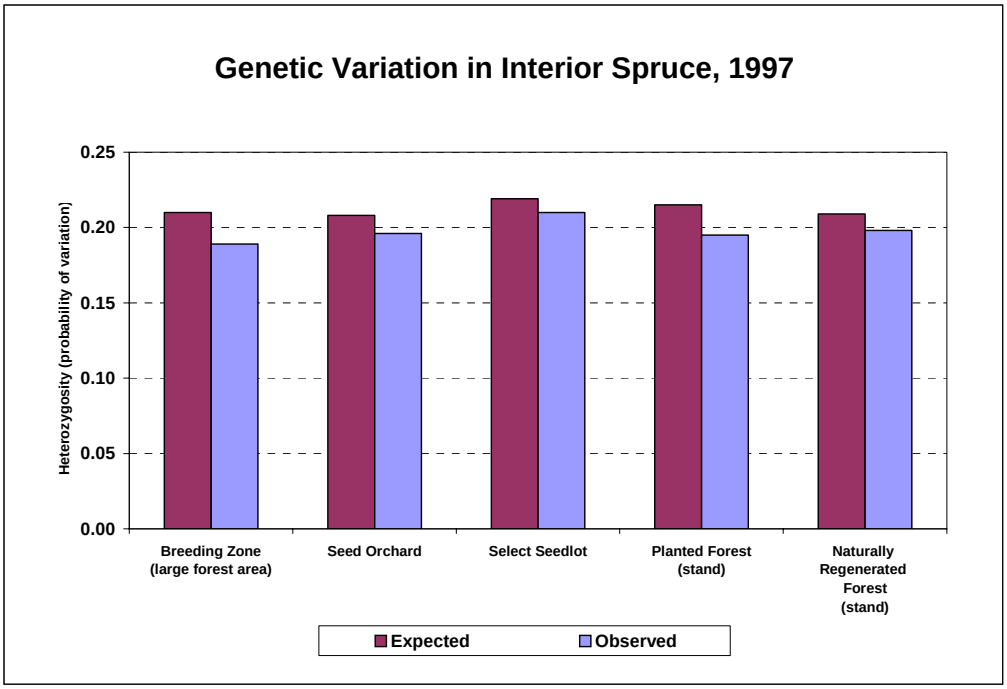
Information

- Maps and statistics of *in situ* reserves are published for 49 species.
- Spatial data relevant to genetic resources are available from the land resource data warehouse (LRDW).
- **References**: Range maps, LRDW, BC Parks

Related international and national indicators:
MP (none)
CCFM 1.3.2

Environmental Indicator 6-2

What genetic variation exists in unmanaged and managed forests?



Why is this important?

A planted forest should be at no greater genetic risk than a naturally regenerated forest.

State and Trend

- After fire or harvest, reforestation occurs by natural regeneration (from roots or naturally available seed), or by planting. Seed used for planting may be from natural forests or from seed orchards.
- The genetic variation among trees in reforested areas depends on the number of, and variation among, parent trees.
- Analysis of spruce in B.C.'s Interior shows that expected and observed genetic variation, as measured by heterozygosity, is similar in planted and naturally regenerated forests.
- Unmanaged (naturally regenerated) forests can be expected to have similar genetic variation as the original forest. Planted forests grown with select seed from seed orchards can be as or more genetically variable due to mixing of diverse individuals and overcoming inbreeding.
- In B.C., minimum genetic diversity standards, as measured by effective population size, must be met in order to register seed from natural and seed orchard sources for use in reforestation on public land.
- **Maps:** Natural Stand Seed Planning Zones

Information

- Genetic diversity information (seed source, number of seed source trees, effective population size) are stored in the Seed Planning and Registration system (SPAR).
- Standards established to maintain genetic diversity and productivity are published in the Chief Forester's Standards for Seed Use.
- **References:** SPAR, Chief Forester's Standards for Seed Use

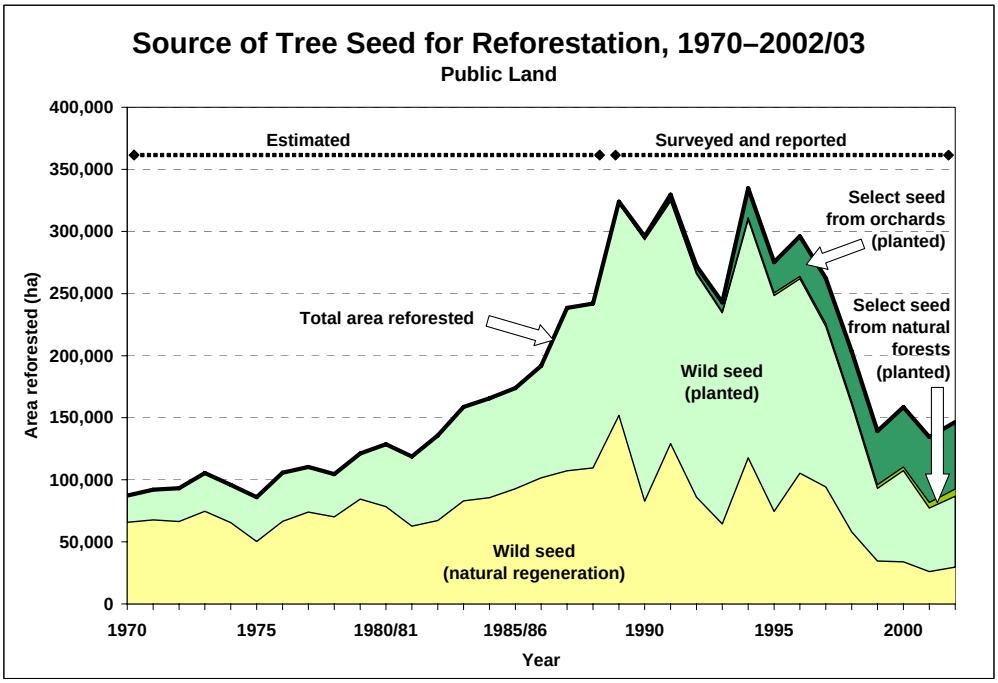
Related international and national indicators:

MP (none)

CCFM 1.3.1

Environmental Indicator 6-3

What proportion of reforestation uses select seed?



Why is this important?

Use of select seed is expected to yield substantial ecological, forest health and economic benefits over the long term.

State and Trend

- Reforestation is achieved with natural regeneration and tree planting.
- Wild seed from natural forests is used for natural regeneration and planting. Select seed from seed orchards and natural forests with superior genetic traits is increasingly used for planting.
- Between 1985 and 2000, reforestation by planting was increased to reduce accumulated not satisfactorily restocked areas.
- The proportional area reforested by planting increased from an estimated 28% in 1970–1974 to over 77% in 1998/99–2002/03.
- Operational use of select seed, particularly orchard seed, began in the 1980s. Legislation requiring use of the best genetic material increased the use of select seed from 10% of the area reforested in 1995/96 to 41% in 2002/03.
- The average genetic gain in select seed increased from 3% in 1994/95 to 11% in 2005/06. Further gains are expected. Gains in some species are substantially higher (e.g., 32% in western larch). By 2002/03, seed with genetic gain of 5% or more was planted on 18% of the area reforested.
- **Maps:** Natural Stand Seed Planning Zones

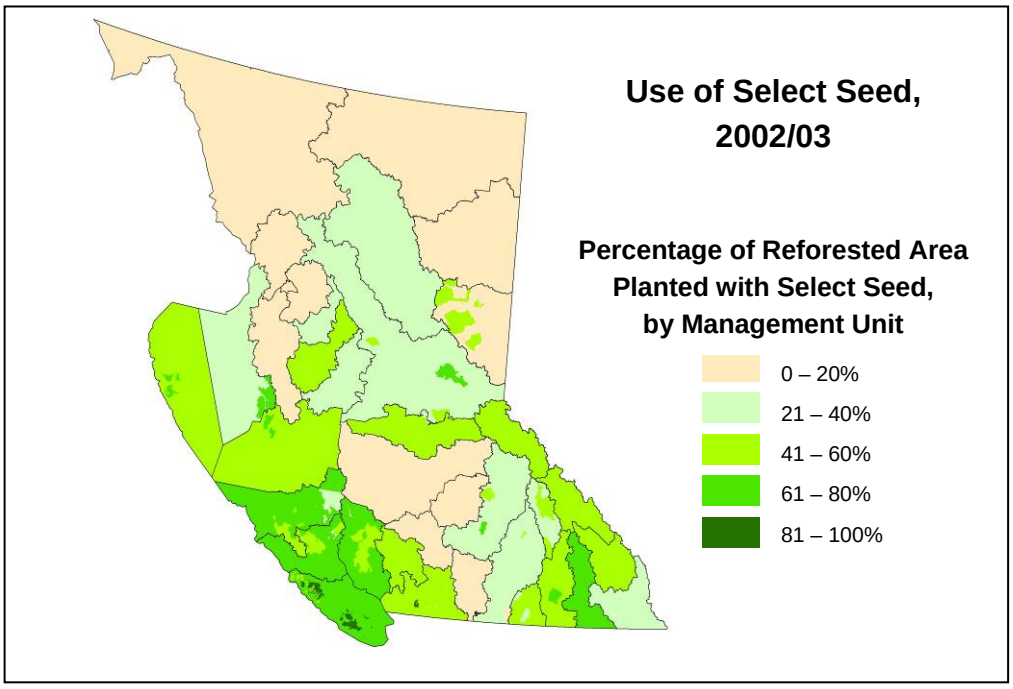
Information

- Silvicultural information about area planted and associated genetic source (species, seedlot) is available in the provincial Reporting Silviculture Updates and Landstatus Tracking System (RESULTS).
- Information about the seeds' genetic source, genetic gain and areas of use is stored in the Seed Planning and Registry system (SPAR).
- Spatial seed use reports are available in the SeedMap system.
- **References:** MFR's Annual Reports, SPAR, RESULTS, SeedMap

Related international and national indicators:
MP (none)
CCFM 1.3.1

Environmental Indicator 6-4

Where is select seed planted?



Why is this important?

Areas reforested with select seed are expected to have improved productivity and forest health.

State and Trend

- Select seed, where available, may help mitigate timber supply shortfalls and impacts of climate change, and provide a satisfactory return on investment.
- The use of select seed aims to increase growth potential, and improve disease and pest resistance, tree form and wood quality. Faster growth rates allow increased harvest levels and lower minimum ages for harvesting. Disease and pest resistance reduces growth losses and loss of ecosystem functions. Improved tree form and wood quality increase the value of wood products.
- The select seed used operationally comes from seed orchards based on breeding programs (10 species) and selected provenances (2 species), and from natural forests of superior provenances (4 species).
- The area reforested with select seed in 2002/03 was about 16,000 ha in tree farm licence areas and 42,000 ha in timber supply areas, or 33% of the 178,000 ha reforested in the two main types of forest management units. Reforestation with select seed was proportionally higher in tree farm licences (57%) than in timber supply areas (28%).
- **Maps:** Natural Stand Seed Planning Zones, Forest Management Units

Information

- Planting and associated genetic source information (species, seedlot, selection and transfer) are available in RESULTS, SPAR and SeedMap.
- At the time of analysis, 2002/03 was the most recent year for which all reforestation data had been entered in the RESULTS database.
- **References:** MFR's Annual Reports, SPAR, RESULTS, SeedMap

Related international and national indicators:

MP (none)

CCFM (none)

Genetic Diversity

Ministry of Forests and Range's assessment

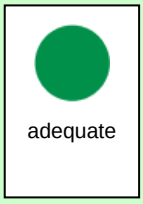
State

The maintenance of genetic diversity is critical to the continued productivity, adaptation and evolution of forest tree populations. With the systematic expansion of the protected areas in the 1990s, forest tree genetic resources are currently well represented in protected areas. Standards for minimum genetic diversity of seedlots ensure adaptation and productivity on public land. Tracking systems for seed use are in place. Forest genetics research and tree breeding are well established, and gene conservation issues are being addressed. Related climate change issues are being actively considered, and a provincial strategy for the management of the province's genetic resources is being developed.

Trend

The area reforested by planting, the number of species and total area planted with select seed, and the genetic gains in those seeds have all increased. Seed production and genetic gain forecasts will continue to be considered for decision-making in silviculture planning and timber supply analyses. Advanced-generation breeding programs will continue for the major commercial species, and selection will factor in more tolerance to climatic changes, diseases and pests. Some *in situ* reserves and forest genetics installations have been damaged by insects and fires, and more losses are anticipated due to climate change.

Information



B.C.'s forest tree genetic resources have been catalogued by the Ministry of Forests and Range and the University of British Columbia's Centre for Forest Gene Conservation. The SPAR system is a provincial genetic resource registry for tree seeds and their sources. It is also a fully integrated seed and seedling request management and reporting system. Integration of data from SPAR with silvicultural data from RESULTS enables seedlot and genetic gain tracking from seed collection to planting. Stakeholder input in the provincial gene resource management program is supported by the Forest Genetics Council of British Columbia.

Environmental Indicator 7

Soil

Assessing soil – Mike Curran

Why is this important?

Soil is the foundation on which forest and range ecosystems develop.

Note: This indicator will be addressed fully, with detailed information and an assessment, in a future edition of the report.

Overview

- Soil holds much of the nutrients and biological mass of forest and range lands. It consists of inorganic material, decaying organic matter, air, water and many microbial and larger organisms.
- Soil provides two important ecological functions that depend on complex interactions of its components. These functions are productivity (capacity to support plant growth) and regulation of water flow.
- Forest practices, range practices and recreational activities (construction of access roads, timber harvesting, site preparation for planting trees, cattle grazing and use of all-terrain vehicles) can have negative and, in some cases, positive impacts on soil's ecological functions.
- Concern about the nature and extent of forest soil degradation prompted government to develop, in the early 1970s, forest practice guidelines to limit negative impacts on soils. These guidelines have been updated over time based on scientific research into the long-term effects of forest and range practices on soil productivity.
- Soil conservation requires detailed consideration of site conditions, season and equipment used in forest and range management.

Related indicators

- Environmental pressures such as wildfires (see Ecosystem dynamics) may affect soil productivity. Economic and social pressures may lead to soil degradation (see Timber harvest, Recreation) or soil conservation (see Law, Public involvement).
- Soil conservation measures help maintain water quality, aquatic and riparian habitats (see Water), ecosystem productivity and future economic benefits (see Timber harvest, Jobs and communities).
- Management responses include development and enforcement of better forest practices based on research (see Knowledge, Law, Silviculture).

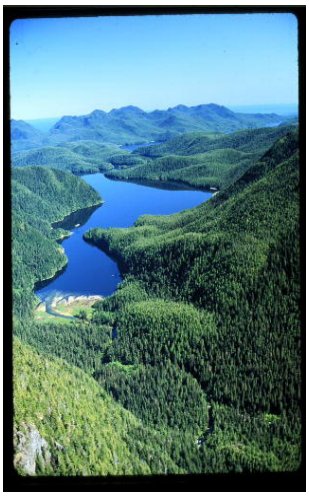
Related international and national indicators:

MP 4.a, 4.d, 4.e, 4.h

CCFM 3.1, 3.2

Environmental Indicator 8

Water



Vancouver Island Watershed – Ian McDougall

Coastal BC – Candace Kenyon

City of Cranbrook Community Watershed study – MFR

Why is this important?

Water is essential for sustaining forests, other ecosystems and a wide range of human activities. Forestry can affect water quantity and quality.

Note: This indicator will be addressed fully, with detailed information and an assessment, in a future edition of the report.

Overview

- Freshwater resources sustain human, animal and plant populations. They supply water for drinking and other domestic and industrial needs.
- British Columbia has abundant sources of fresh water, but supply in some areas is limited. In the future, competition for fresh water is expected to increase as demand outstrips readily available supply.
- Forest soil stores and filters fresh water. Forest vegetation plays a vital role in protecting the quantity, quality and timing of water flows.
- Forest and range activities such as road construction and maintenance, log hauling, use of herbicides, fertilizing and cattle grazing can decrease water quality with sedimentation and pollution. Extensive clearcutting within a watershed can change water levels. These activities can also modify aquatic habitats, affecting populations of fish and other species. Careful management and monitoring can minimize these impacts.

Related indicators

- Timber harvesting, fires and the current mountain pine beetle epidemic affect water quantity and quality (see Ecosystem dynamics, and Timber harvest).
- Water quantity and quality, and the timing of water flows, can affect ecosystem functions (see Ecosystem diversity, Species diversity and Soil).
- Better understanding of watershed function and forest ecosystems enables forest managers to minimize impacts on water (see Knowledge).

Related international and national indicators:

MP 4.b, 4.c, 4.f, 4.g

CCFM 3.2, 3.3

Environmental Indicator 9

Air


Wildfire smoke – MFR


Bee hive burner, Bulkley Valley – MoE

Why is this important?

Air quality and climatic conditions affect human and forest health, and forests and forest practices can affect air quality.

Note: This indicator will be addressed fully, with detailed information and an assessment, in a future edition of the report.

Overview

- Forest health is affected by climatic conditions including air temperature and moisture. Wind can uproot trees and occasionally large expanses of forest. Air pollutants contaminate soil and water, and can severely reduce tree growth and overall forest health.
- Common air contaminants of greatest concern in British Columbia include sulphur dioxide and ozone. These contaminants can significantly damage and reduce growth of forest and range vegetation.
- Air quality is in turn affected by forests, both positively and negatively.
- Forests can moderate micro-climatic temperature and moisture.
- Forests release volatile organic compounds such as terpenes. They are considered atmospheric pollutants, and create a haze on warm days.
- Forest-related air pollution is caused by wildfires, prescribed fires and wood milling activities. Along with ecological and economic benefits, these activities produce smoke and other contaminants that cause respiratory and cardiovascular problems and impair visibility.
- Fire suppression to protect timber, property and lives reduces smoke emissions in the short term, but causes fuel build-up that can eventually lead to catastrophic fires.

Related indicators

- Some forest practices and forest-related industrial activities reduce air quality (see Silviculture, Forest products).
- Air quality directly affects soil productivity, water quality (see Soil, Water) and growth of trees, which may have implications for future timber supplies (see Timber harvest).
- Management responses to forest-related air quality issues include adjustment of forest practices and regulation of industrial activities that pollute the air (see Law).

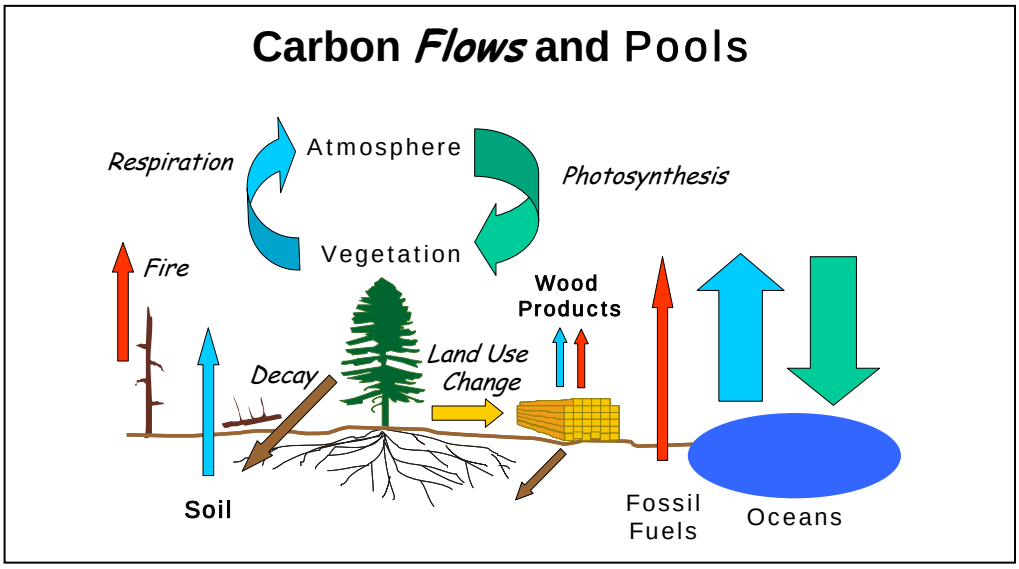
Related international and national indicators:

MP 3.b

CCFM (none)

Environmental Indicator 10

Greenhouse gases



Why is this important?

Rising concentrations of atmospheric greenhouse gases have been linked to climate changes that affect ecosystems and have impacts on communities and businesses.

Note: This indicator will be addressed fully, with detailed information and an assessment, in a future edition of the report.

Related international and national indicators:
MP 5.a, 5.b, 5.c
CCFM 4.1.1 to 4.1.4

Overview

- Greenhouse gases help the atmosphere retain heat from the sun. Human activities, including the burning of fossil fuels and land clearing, are linked to rising concentrations of these gases in the atmosphere, and in turn have been linked to global warming and other climate changes.
- Forest vegetation and the accompanying debris and soil can be "sources" of the greenhouse gases carbon dioxide (CO_2) and methane (CH_4) when they burn or decompose. They also store vast amounts of carbon and can be net "sinks" of these gases. Boreal peatlands can also be important sinks or sources of greenhouse gases, notably methane.
- Concern about increases in atmospheric greenhouse gases over the past century led to an international agreement, known as the Kyoto Protocol, to reduce emissions. Canada has signed the protocol, and decided in 2006 not to account for forest management in its official accounting of national greenhouse gas emissions.
- Climate change linked to greenhouse gas emissions may increase forest fires and outbreaks of insects and diseases, shift forest/grassland boundaries, and lead to impacts on the forest and range industries.
- The forest industry can limit its greenhouse gas emissions by improving energy efficiency and switching to renewable fuels (wood residues).

Related indicators

- Fire, insects, logging and reforestation change the amount of carbon stored in forests (see Ecosystem dynamics, Timber harvest).
- Retaining older forests may help store carbon and provide habitat for old-growth-dependent species (see Species diversity).
- Management responses include prompt reforestation, planting trees on previously non-forested land, controlling fire and pests, changing the rate of logging (see Silviculture, Timber harvest) and reducing fossil fuel use.

Ownership and management

Nisga'a Agreement intialling ceremony on Aug. 4, 1998 – MARR

Why is this important?

Benefits and obligations are tied to ownership and management. Public concerns include log exports, public control of development, corporate concentration and access to resources.

Overview

- Ownership and management convey both rights to benefits and responsibilities for resource stewardship, as specified by international, national and, primarily, provincial policies and agreements.
- Most of B.C.'s forests are owned and managed by the provincial government on behalf of all British Columbians, with consideration of aboriginal rights and title.
- Changes in public expectations result in ongoing reallocations of rights and changes in management responsibilities.

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

Questions about ownership and management

11-1 Who owns B.C.'s forests?
11-2 Who manages the forests, and for what uses?
11-3 How much timber is available to large operators?
11-4 How much timber is available to small operators?

➡ Ministry of Forests and Range's assessment

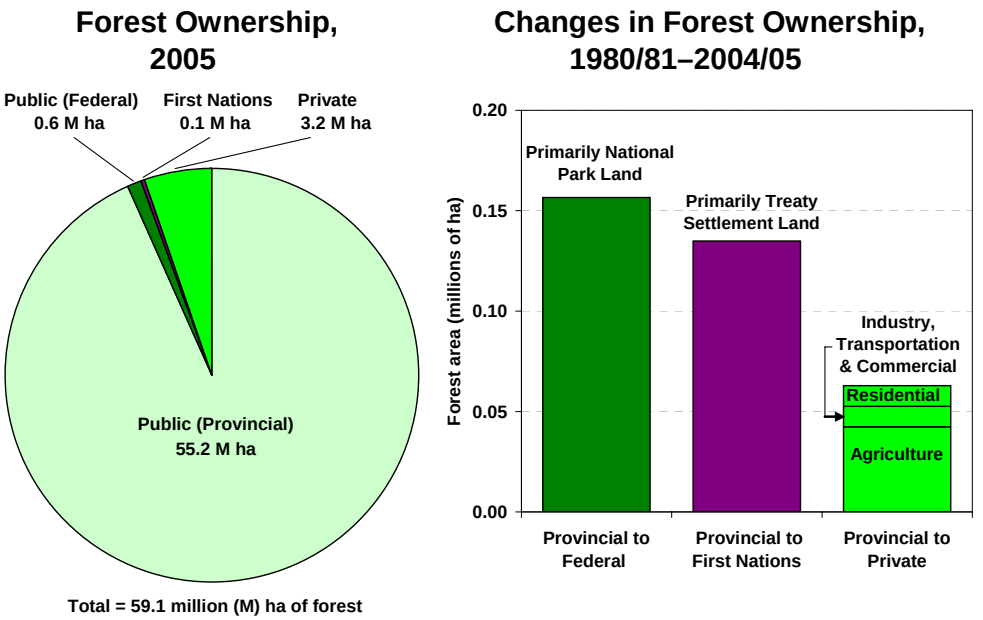
Related indicators

- Ownership and management are affected by resolution of aboriginal rights and title issues and changing social values (see First Nations involvement, Public involvement)
- The security and stability of ownership and management rights affects economic activity and communities (see Forest products, Jobs and communities).
- Management responses include revision of laws and policies (see Law).

For data tables, see:
www.for.gov.bc.ca/hfp/sof/

Economic and Social Indicator 11-1

Who owns B.C.'s forests?



Why is this important?

The right to make land use and forest management decisions depends primarily on ownership.

State and Trend

- Most of the province's forests are publicly owned: the province owns 93% and the federal government owns 1%.
- Private owners hold 5% of the forests. In 2000, 0.2% were granted to First Nations, mostly as Nisga'a treaty settlement lands.
- Over the past 25 years, 350,000 hectares (less than 1% of the province's forests) within provincial forests changed ownership category.
- First Nations' claimed aboriginal rights and title affect land use and forest management decisions on public and private forest land[8].
- Extensive forest practices regulations apply to forest land owned by the province. Simpler regulations apply to some private land designated as managed forest land. Minimal regulations apply to the remaining private forest land.
- Log exports are permitted only if they are surplus to the needs of provincial mills[9]. The amount of logs exported, as a percentage of the provincial harvest, averaged 1% in the 1970s, 3% in the 1980s, 1% in the 1990s and over 4% since 2000, with most of the recent increase from private land.
- Private owners have the right to preclude public access for recreation.
- **Maps:** Land ownership

Information

- Ownership data and maps are not precise at the provincial level.
- Private land forest cover inventories are not publicly available.
- Log export data are publicly available from MFR and Statistics Canada.
- **References:** MAL's ILMB; Private Managed Forest Land Council; MFR's Log Exports; Statistics Canada's Trade Database

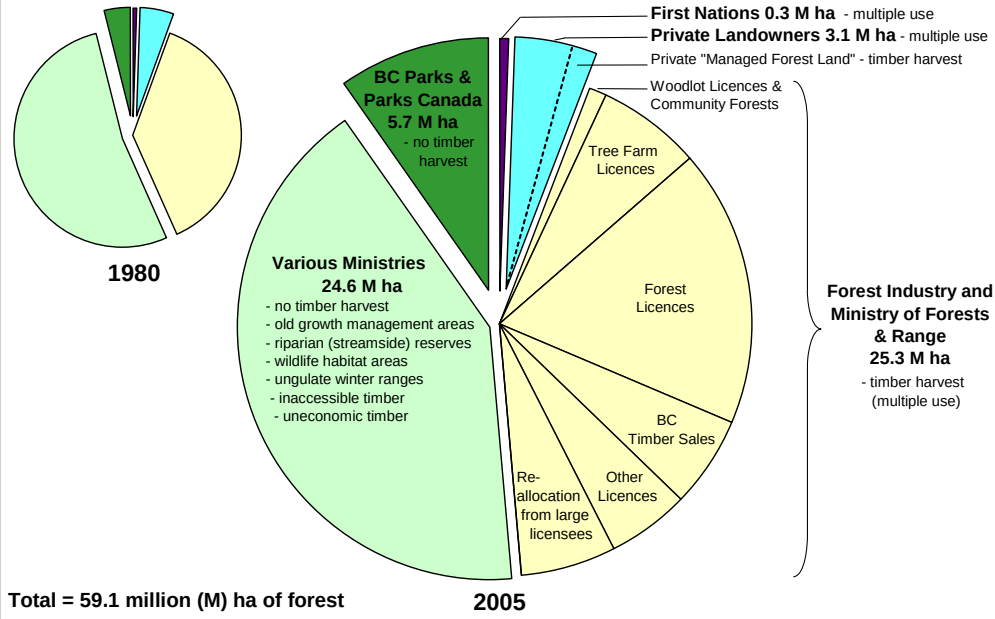
Related international and national indicators:

MP 7.1.a

CCFM 6.1.2

Economic and Social Indicator 11-2

Who manages the forests, and for what uses?



Why is this important?

Forest management results depend on the rights and objectives of the manager.

State and Trend

- B.C.'s landowners manage their forests for a variety of uses, including timber and non-timber values. The mix of uses evolves to reflect changing economic conditions and social values.
- First Nations and private forests (6% of B.C.'s forests) are managed for a variety of uses. Private managed forest land (1% of provincial forests) is managed for timber harvesting, with consideration of other values.
- Government oversees the management of public forests and delegates most operational management decisions to holders of resource tenures. Oversight by several agencies ensures accountability to the public.
- Several types of tenures are used to manage timber harvests on 43% of B.C.'s forest area (up from 37% in 1980). Most are long-term tenures that require the holder to plan for timber harvests and other resource values, reforest, build roads and control wildfires.
- Tenures sold by BC Timber Sales (a division of the Ministry of Forests and Range) establish the market price of timber. As of 2003, a portion of tenures held by large operators is being reallocated to BC Timber Sales, woodlots, community forests and First Nations enterprises.
- The other 51% of B.C.'s forests are managed by various ministries for non-timber uses, primarily conservation and recreation. This includes protected forests, which increased from 4% in 1980 to 10% in 2005.
- **Maps:** Forest Management Units

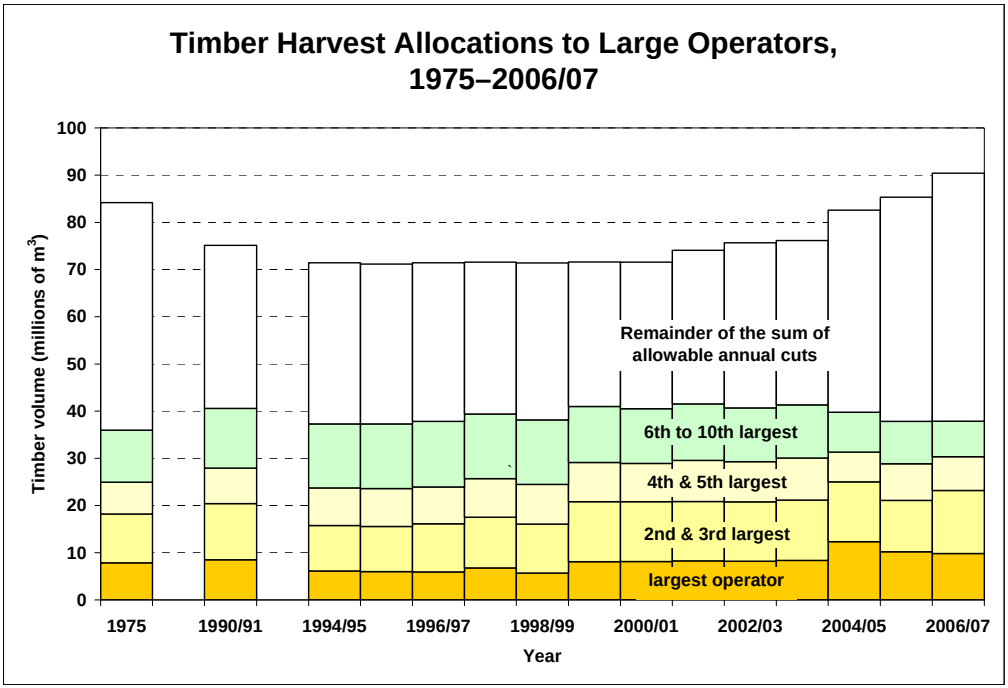
Related international and national indicators:
MP 7.1.a
CCFM 5.2.1

Information

- Current allocations of timber tenures are publicly available.
- **References:** MFR's Timber Tenures, Apportionment; BC Parks, Parks Canada

Economic and Social Indicator 11-3

How much timber is available to large operators?



Why is this important?

Larger companies can be stronger competitors in global markets; however, too much corporate concentration may stifle diversity and innovation in the forest sector.

State and Trend

- The timber harvesting rights held by major companies have repeatedly led to concerns about corporate concentration.
- Ownership of companies, and related timber rights, change fairly often. From 1975 to 2006, four different companies were in top position, with the largest share of government-set allowable annual cuts (AACs). Only one of the top 10 companies in 1975 is still in the top 10 list.
- The company with the largest share of the sum of AACs increased from 8% 1995/96 to 15% in 2004/05. With subsequent increases in AACs in some management units, and government's reallocation of timber to a variety of small operators, its share decreased to 11% in 2006/07.
- The share held by the three top companies similarly increased from 22% to 30%, and then decreased to 26% in 2006/07.
- The share held by the top 10 companies peaked at 57% in 1999/00[10], and decreased to 38 million m^3 or 42% of AACs in 2006/07.
- The number of large operators[11] increased from 37 in 2000/01 to 61 in 2006/07. Their share of AACs, however, decreased from 75% to 59%.
- Geographic concentration of companies may result in the proportions of AAC held by individual companies being greater within regions and individual timber supply areas than for the province as a whole.
- **Maps:** Forest Management Units, Forest Regions and Districts

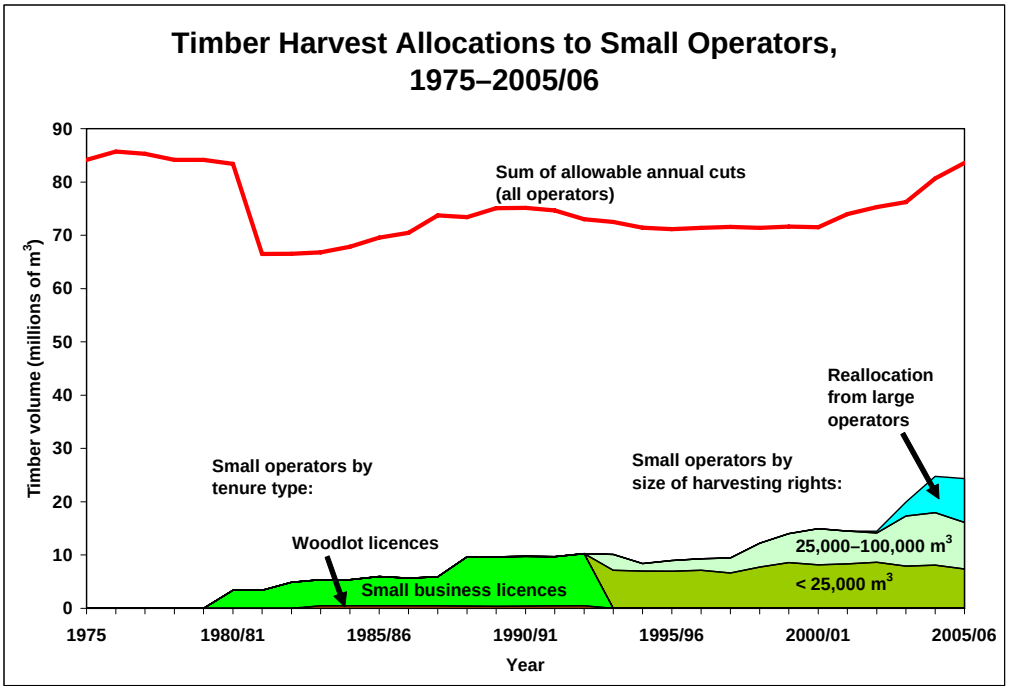
Information

- Current ownership and allocation information is publicly available on the internet for timber supply areas and tree farm licences.
- **References:** MFR's Timber Tenures, Apportionment

Related international and national indicators:
MP (none)
CCFM (none)

Economic and Social Indicator 11-4

How much timber is available to small operators?



Why is this important?

Providing small operators with access to timber can encourage innovation, community involvement and competitive bidding.

State and Trend

- Timber harvest volumes allocated to small operators[12] increased from near nil in 1980 to over 24 million m^3 in 2005/06. This includes the planned reallocation of volume from large operators.
- Programs for woodlots and small businesses were initiated in 1980, and their combined allocations increased to 10 million m^3, by 1990. Policies changed over the years, but continued to target small operators.
- In response to public demand, 16 community forest tenures were issued in 2000 through 2006, accounting for 0.3 million m^3 in 2006.
- In 2003, BC Timber Sales replaced the small business program. Its mandate is to sell public timber by auction to establish market prices and optimize net revenue to the government. Although it does not target small operators, most of its customers are small operators.
- The reallocation of part of the AACs held by large operators, begun in 2003, will boost timber volumes available to small operators.
- Since 1995, changes in policy, along with market pressures, increased the volume held by operators with between 25,000 m^3 and 100,000 m^3.
- At the end of 2005, small operators had 824 woodlots, 11 community forests, 764 BC Timber Sales licences, and 210 other licences.
- **Maps:** (none)

Information

- Data are only available by licence program up to 1993/94. Data by individual operators, rather than by program, are preferable and are only available from 1993/94 on.
- **Related sources:** MFR's Annual Reports, Timber Tenures

Related international and national indicators:

MP (none)

CCFM (none)

Ownership and management

Ministry of Forests and Range's assessment

State

mixed

Public forests account for 94% of the province's forests, with the province owning 93%. First Nations claim aboriginal rights and title to many areas of B.C., and this creates some uncertainty for land use and forest management decisions on both public and private land. It is also one of several considerations driving the current reallocation of forest tenures. Just over half of B.C.'s forests are managed for non-timber uses such as conservation and recreation. Most of the rest is managed by the forest industry and government under a variety of tenures. The ten companies with the largest shares of these tenures currently hold 42% of government-set AACs. Sixty-one large operators, including the top ten companies, hold 59% of the AACs in 225 licences. Over 24 million m^3 annually is available to small operators that hold over 1,800 licences.

Trend

mixed

Forest ownership has been stable over the past 25 years, and less than 1% changed from provincial to other ownerships. The area managed for timber harvests expanded over the past 25 years, as did the area of protected forests managed for conservation. The province, First Nations and the forest industry continue to increase cooperation and partnerships in land use planning and forestry, to better manage the multiple values of forests. The portion of government-set AACs held by the top ten companies peaked 57% in the 1999/00. Their combined AAC holdings have decreased in both volume and percentage terms, despite ongoing consolidation of companies, due to the current reallocation of AACs and short-term AAC increases. The volume allocated to small operators has increased, and is expected to increase the industry's flexibility to respond to global market challenges. The growing number of licences presents considerable administrative challenges.

Information

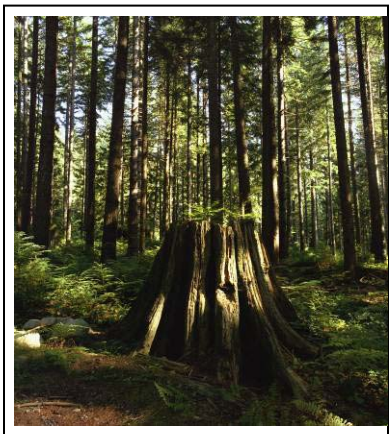
adequate

A comprehensive and precise provincial map of current ownership is not available, but is being developed. Historical ownership data are not in readily useable form. Current allocations of timber tenures are readily available on the internet. Some historical information on tenure allocations is available.

Economic and Social Indicator 12

Timber Production Forests

Mosaic of clearcuts and patch cuts – MFR



Young forest on logged site – MFR

Why is this important?

Timber production forests provide the resource base for B.C.'s forest industry.

Note: This indicator will be addressed fully, with detailed information and an assessment, in a future edition of the report.

Overview

- Timber production forests – forests from which timber has been, or is expected to be, harvested – exclude protected forests, other reserves and forests that are uneconomical for timber production.
- Their extent has changed historically, and further changes are likely. Currently, they cover about 25 million hectares (less than half of British Columbia's forests). About half are a mix of older and younger forests originating from natural disturbances, and have never been harvested. The remaining half are younger forests that have regrown after timber harvests, and some of these are now being harvested a second time.
- The time required to grow harvestable trees in B.C. is typically between 40 and 120 years, depending on the productivity of the land, as influenced by climate, soil, tree species and disturbances.
- Less than 1% of the timber production forests are harvested annually.
- To maintain non-timber values within timber production forests (e.g., visual, cultural, wildlife, riparian and old-growth ecosystem values), timber harvests are deferred or limited in various ways.

Related indicators

- Timber production forests are subject to competing demands for land use, natural disturbances and climate change (see Protected forests, Recreation, Range, Ecosystem dynamics, Greenhouse gases).
- The state of the timber production forests may affect wildlife habitats, water quality (see Ecosystem diversity, Water) and economic outputs (see Timber harvest, Jobs and communities, Forest products).
- Management responses include land use planning and operational planning (see Public involvement, First Nations involvement, Law), prompt reforestation, controlling wildfires and pests, and regulating the rate of logging (see Silviculture, Ecosystem dynamics, Timber harvest).

Related international and national indicators:

MP 2.a, 2.b, 2.c

CCFM 2.1

Economic and Social Indicator 13

Timber harvest

Felling – MFR

Yarding – MFR

Loading – MFR

Why is this important?

Timber harvests have direct implications for environmental integrity and sustainable economic activity.

Overview

- This indicator examines timber volume; for area harvested and economic importance, see the indicators Ecosystem dynamics, Forest products, and Jobs and communities.
- Timber harvests supported much of British Columbia's economic development, and continue to be important to the province's economy.
- Provincial harvest levels are projected to be higher over the next decade as a response to the current mountain pine beetle epidemic, followed by compensating decreases.

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

Questions about the timber harvest

13-1 How much timber is harvested annually?
13-2 How does the 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?

➡ Ministry of Forests and Range's assessment

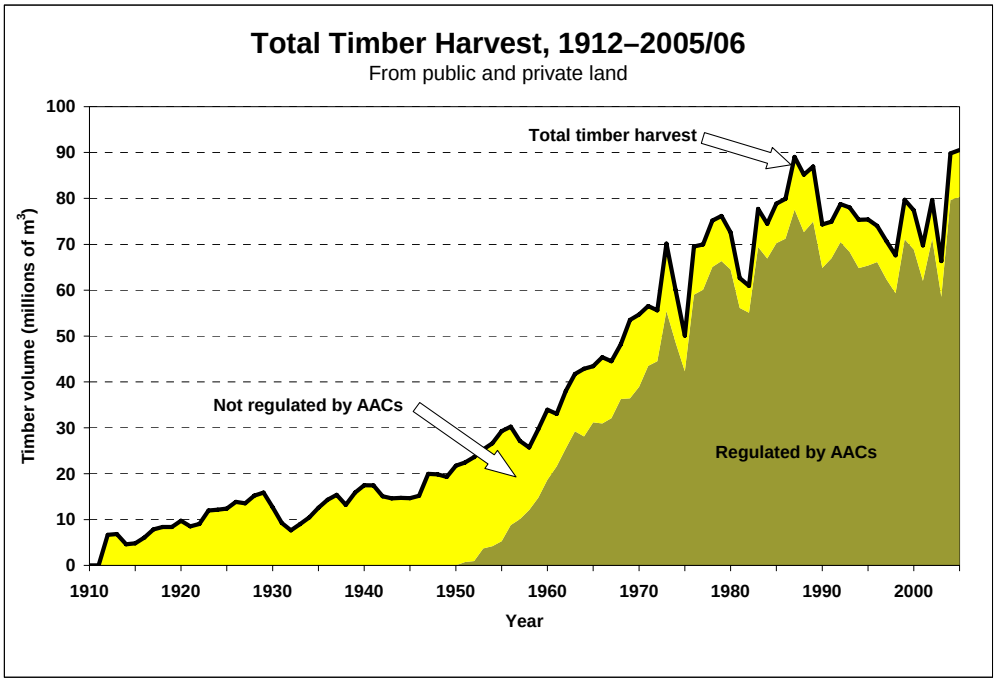
Related indicators

- Natural disturbances such as wildfires and pest infestations affect planned timber harvest levels (see Ecosystem dynamics).
- The 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).

For data tables, see:
www.for.gov.bc.ca/hfp/sof/

Economic and Social Indicator 13-1

How much timber is harvested annually?



Why is this important?

Timber harvests supported a large part of B.C.'s economic development and continue to provide the economic base for many rural communities.

State and Trend

- The annual timber harvest from all public and private land increased ten-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.
- Over the last ten years, the average total timber harvest was 77 million m^3 per year, of which 68 million m^3 per year (89%) were from forests where harvest levels are regulated by AACs.
- Almost all of the harvest regulated by AACs is from 37 timber supply areas (TSAs) and 33 tree farm licences (TFLs), for which the provincial government's chief forester sets AACs. These provided about 86% of the total timber harvest over the last ten years. The government's senior decision-makers also set AACs for more than 800 woodlot licences and community forests that comprised 3%.
- The remaining 9 million m^3 per year (11%) were from lands with no government-set AACs, primarily private land and some public land.
- **Maps:** Forest Management Units

Information

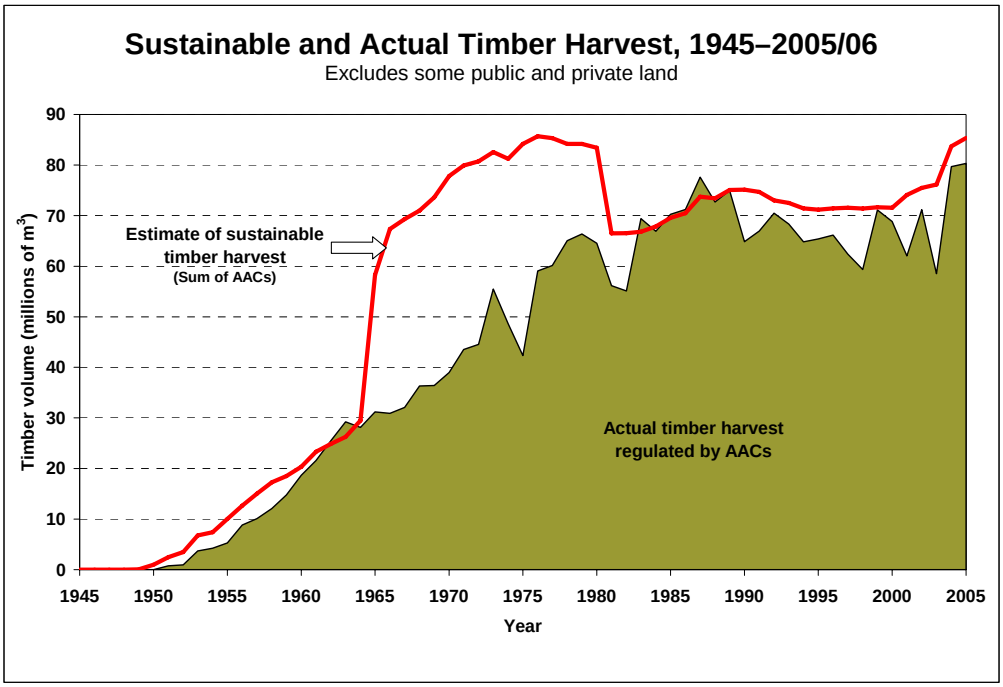
- Detailed data on timber harvest volumes and areas by land status and species exist for most of the past century, with only a few minor gaps.
- Data are publicly available in the Ministry of Forests and Range's annual reports.

References: MFR's Annual reports, Resource Tenures

Related international and national indicators:
MP 2.d
CCFM 5.3.1

Economic and Social Indicator 13-2

How does the timber harvest compare with the sustainable level?



Why is this important?

Environmental integrity and sustainable economic activity depend on maintaining a long-term balance between forest growth and timber harvest.

State and Trend

- This comparison can be made for areas regulated by government-set AACs. In the last ten years, these accounted for 89% of the total harvest.
- Each forest management unit's AAC represents a sustainable harvest level that balances environmental, economic and social considerations.
- In the last 10 years, the average harvest regulated by AACs was 68 million m^3 per year, or 10% less than the sustainable level (sum of AACs) of 77 million m^3 per year. Among the causes for this difference are market fluctuations and delays in forest planning.
- AACs are the maximum average level of harvests for a five-year period. Within this period, actual harvests may exceed AACs for a short period, if offset by lower subsequent harvests.
- In the last few years, AACs of some management units have been increased to address the current mountain pine beetle epidemic with pest control measures and salvage programs. Decreases in the AACs of these units are projected for the future.
- AACs have also 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 parks and forest practices (the decrease in the early 1990s).
- **Maps:** Forest Management Units

Related international and national indicators:

MP 2.d

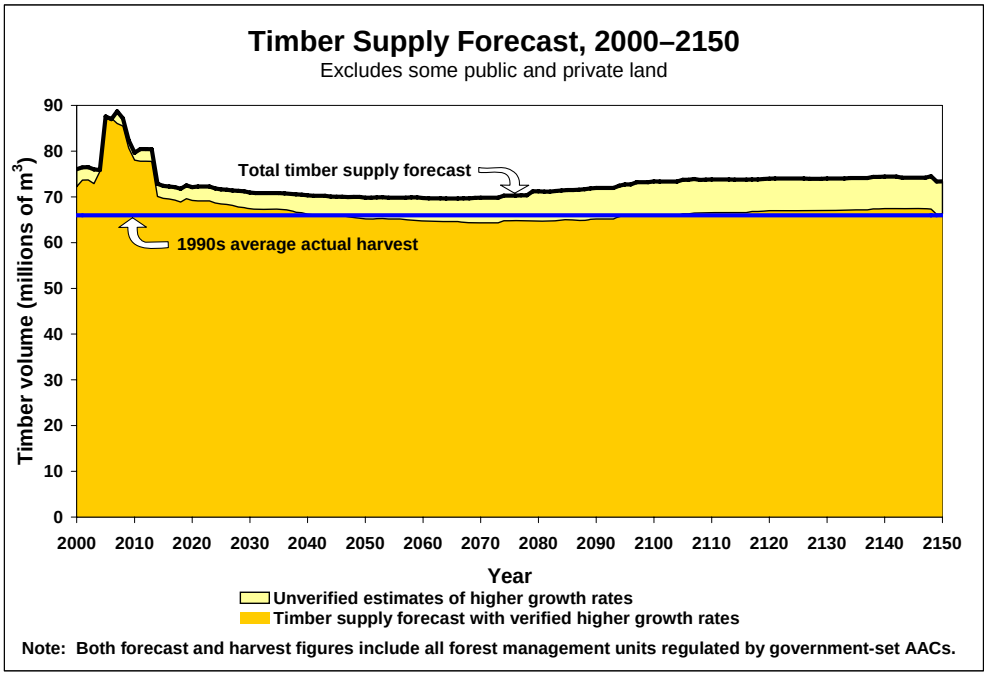
CCFM 5.3.1

Information

- Analyses and rationales for government-set AACs are publicly available. Little information is available for forests without government-set AACs.
- **References:** MFR's Forest Analysis

Economic and Social Indicator 13-3

What is the provincial timber supply forecast?



Why is this important?
Stable timber supplies are important to the provincial economy and to customers who rely on B.C.'s forest products.

State and Trend

- Timber supply forecasts are influenced by many factors: past harvest levels, the current mountain pine beetle epidemic, the shift to harvesting more second-growth forests and estimates of future growth rates. Current harvests are based on accumulated volumes in older forests. Future harvests will rely on the faster growth of second-growth forests.
- Increases in AACs, for pest control measures and salvage programs, the provincial timber supply forecast peaks at 89 million m^3 per year in 2007, or 34% above the average actual harvest of 66 million m^3 per year in the 1990s (before the AAC increases).
- A decrease to 73 million m^3 per year is projected in 2014, followed by further decreases until 2060. The forecast remains between 6% and 13% higher than the average actual harvest in the 1990s.
- **Maps:** Forest Management Units

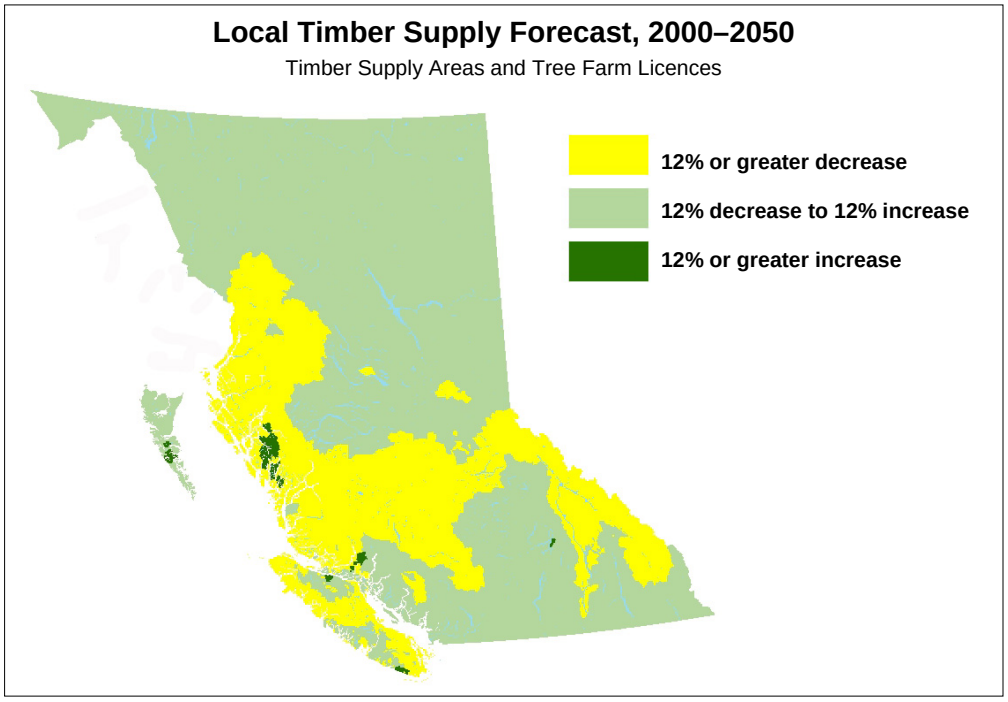
Information

- Detailed timber supply forecasts and their related assumptions are publicly available for timber supply areas and tree farm licences.
- Research shows that second-growth forests grow faster than previously estimated. Higher growth rates have been verified by field sampling and included in the timber supply forecasts for about half of the management units. Unverified estimates are shown separately for the other half.
- Uncertainties in timber supply forecasting include merchantability of species, operability, future management practices, the future harvestable land base, wildfires and insect epidemics[13]. New AACs every five years, set with the latest information, reduce the risks related to uncertainty.
- **References:** MFR's Forest Analysis, Site Productivity

Related international and national indicators:
MP 2.d
CCFM 5.3.1

Economic and Social Indicator 13-4

How does the timber supply forecast vary locally?



Why is this important?

Stable timber supplies are important to local economies, especially in rural areas with substantial economic dependence on the forest sector.

State and Trend

- Local timber supply forecasts vary considerably due to localized factors such as the current mountain pine beetle epidemic and in the timing of the shift to harvesting second-growth forests.
- Forecast changes in long-term timber supply for TSAs and TFLs show where economic and social impacts can be anticipated.
- Decreases of 12% or more[14] between 2000 and 2050 are forecast in 16 TSAs and 12 TFLs. Large decreases can be expected to lead to changes in the structure of local economies.
- Increases of 12% or more by 2050 are forecast in 2 TFLs. Increases in timber supply create opportunities for economic growth.
- **Maps**: Forest Management Units

Information

- Recent temporary AAC increases, related to the mountain pine beetle epidemic, averaged over 50% in 7 TSAs and over 100% in 6 TFLs. Only one of the 13 increases is included in data for 2000, making 2000 a good base for comparison. Subsequent decreases in timber supply are projected to continue for many years, including the forecast for 2050.
- Timber supply forecasts and their related assumptions, are publicly available for TSAs and TFLs. Economic and social impact assessments are publicly available for TSAs.
- Verified higher growth rates were used in forecasts for half of the forest management units. Unverified estimates were not included in others.
- These forecasts are based on the current harvestable land base and management practices.
- **References:** MFR's Forest Analysis, Site Productivity

Related international and national indicators:

MP 2.d

CCFM 5.3.1

Timber harvest

Ministry of Forests and Range's assessment

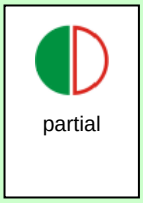
State

British Columbia's early economic development was largely dependent on timber harvests that increased rapidly during the 1900s. Forest management units with government-regulated AACs provided 89% of the total harvest in the last 10 years, and harvests in these units averaged 10% below the sustainable level represented by the provincial sum of AACs. The mountain pine beetle epidemic led to temporary increases in AAC of about 15 million m^3 per year to enable the harvest of timber that would otherwise become commercially unusable. The provincial harvest in 2005/06 was a record 90 million m^3, well above the average of 77 million m^3 over the last 10 years.

Trend

Collectively, forests with government-regulated AACs are forecast to have timber supplies that will provide a stable, long-term base for the provincial economy. However, timber supply forecasts show significant local variation. Some forest management units have had temporary AAC increases of over 100% to address the current mountain pine beetle epidemic. Over the next 50 years, other increases of more than 12% are expected in a few units. These increases provide opportunities for new investments in the forest industry. In the units with temporary AAC increases, large decreases will ultimately be required. Over the next several decades, decreases of more than 12% are expected for other reasons in several more units. These decreases are likely to require future transitions for workers and communities.

Information



Substantial, detailed information related to timber supply exists for forests with government-regulated AACs. Most of this information is publicly available. Research shows that many second-growth forests grow faster than previously estimated. This allays previously published concerns that timber supplies would decrease to 50–60 million m^3 per year. Forests that do not have government-regulated harvest levels (mostly on private land) account for 11% of the provincial timber harvest. The government has little information about the sustainability of harvests from these forests.

Economic and Social Indicator 14

Silviculture


Wildlife tree patch – MFR


Conifer seedlings – MFR


Mechanical brushing – MFR

Why is this important?

Silvicultural choices shape forests and their future contributions to the environment, economy and communities.

Overview

- Silviculture is the art, science and practice of growing and cultivating trees in forests to meet the objectives and values of the landowner.
- With British Columbia's high level of public ownership, most silvicultural activities in B.C. have depended on government policies or funding.
- Changes in silvicultural practices over the past 30 years have increased reforestation, improved conservation of biological diversity, and increased the volume and value of future timber supplies.

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

Questions about silviculture

14-1 Are appropriate silvicultural systems used?
14-2 How much is reforested after disturbances?
14-3 What other silvicultural treatments have been done?
14-4 What gains do silvicultural investments yield?

➡ Ministry of Forests and Range's assessment

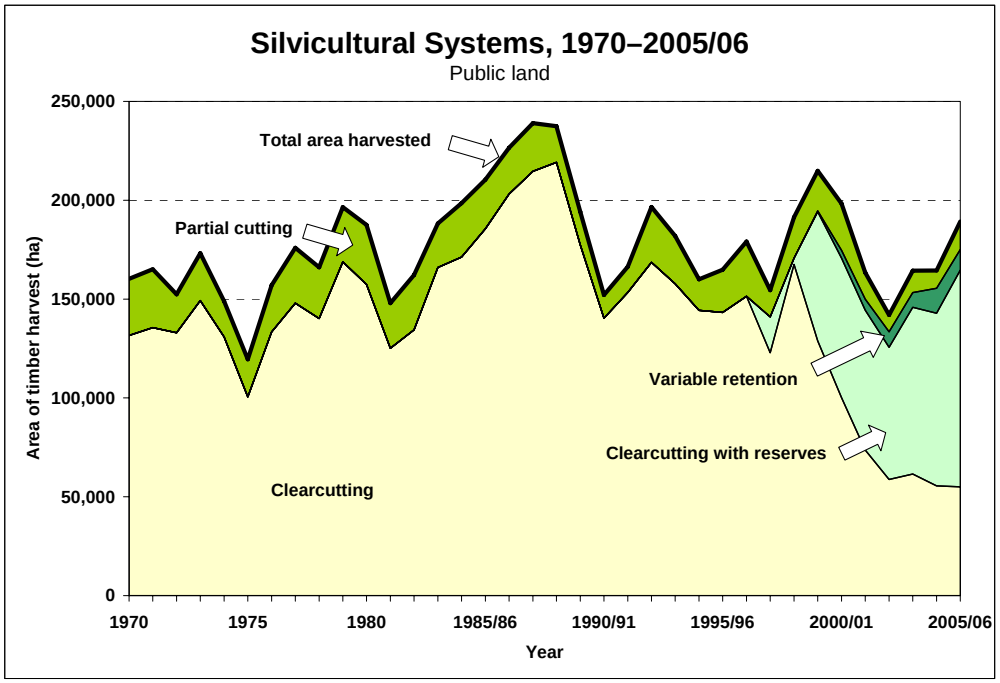
Related indicators

- Silvicultural choices are often influenced by natural disturbances, public expectations and market demands (see Ecosystem dynamics, Public involvement, Certification).
- Silvicultural practices affect many aspects of forest ecology (see Ecosystem diversity, Species diversity, Genetic diversity) and can create short-term and long-term economic opportunities for rural communities (see Jobs and communities).
- Management responses to improve silvicultural practices include new government policies (see Law).

For data tables, see:
www.for.gov.bc.ca/hfp/sof/

Economic and Social Indicator 14-1

Are appropriate silvicultural systems used?



Why is this important?

Silvicultural systems are chosen to achieve specific environmental, economic and social objectives over the life of a stand.

State and Trend

- A silvicultural system is a planned program of activities that encompasses how trees are harvested, regenerated and managed over time. Selection of a silviculture system depends on the ecological traits of the tree species, and on balancing the objectives of the landowner.
- From 1970–1996, clearcutting systems were applied on 87% of the area harvested on public land; and various partial cutting systems on 13%. Clearcutting systems were chosen for their low logging costs, worker safety near large trees, and efficient reforestation; partial cutting for the ecological characteristics of drier forests in the Interior of the province.
- A shift in the balance of objectives towards conservation of biological diversity led to the use of clearcutting with reserves and variable retention systems, which by 2005/06 accounted for 58% and 6%, respectively, of the area harvested on public land. These systems can provide[15] greater stand structure and diversity that better emulates natural disturbances, conserves wildlife trees and increases stand-level biodiversity while enabling acceptable volume growth of new trees.
- Social concerns about large cutblocks led to a decrease in average size of cutblocks[16] on public land from 45 ha in 1989 to 26 ha in 2003.
- **Maps:** (none)

Information

- Detailed silvicultural records are stored in the Reporting Silviculture Updates and Landstatus Tracking System (RESULTS).
- Private land accounts for 9% of the total area harvested in the province between 1983/84 and 2005/06. Earlier data are not available.
- **Related sources:** MFR's Annual Reports, RESULTS, Silviculture

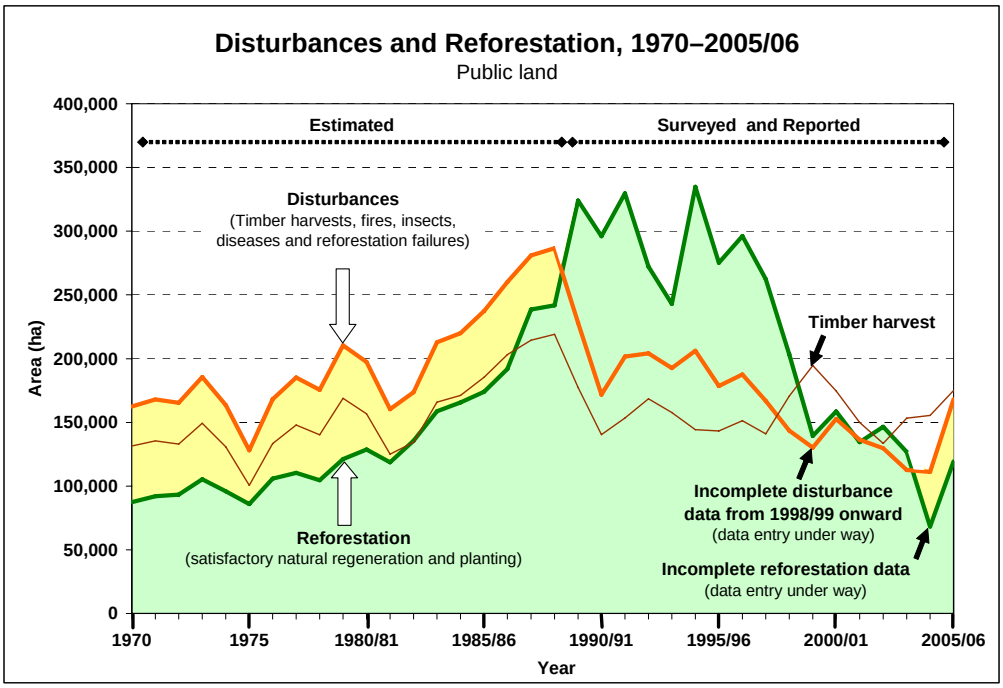
Related international and national indicators:

MP (none)

CCFM 2.3

Economic and Social Indicator 14-2

How much is reforested after disturbances?



Why is this important?

Prompt reforestation increases future timber supplies and can help prevent soil erosion and restore wildlife habitats.

State and Trend

- Forests disturbed by timber harvests and other causes reforest naturally over time. Silvicultural investments can accelerate reforestation and thereby increase timber supplies and restore ecological services sooner.
- The area deemed not satisfactorily restocked (NSR) after timber harvesting and other disturbances increased over several decades until 1988/89, due to the gap between disturbances and reforestation.
- This gap was closed during the 1980s with increasing investments in site preparation, research that led to better planting methods, planting, backlog planting and brushing to ensure free growth of desired trees.
- The explicit reforestation obligations on public land introduced in 1987 led to planting of a greater proportion[17] of current harvest areas.
- By 2002/03, the backlog of economically treatable NSR area[18] was reduced to 0.07 million ha.
- Catastrophic wildfires in 2003 and 2004, and the mountain pine beetle epidemic, may add large new NSR areas[19] over the next several years.
- Fewer obligations apply on most private land[20]. Reported planting decreased from 6,000 ha annually in the 1970s to 1,000 ha since 1993.
- **Maps:** NSR Areas Harvested Pre-1982 and 1982-1987

Information

- Reported disturbances and reforestation[21] on public land are published annually (since 1989/90). Data are incomplete[22] since 1998/99: Completion of data acquisition and data entry is under way.
- Owners of private land outside tree farm licences are not required to report NSR data. Reporting of areas planted is voluntary and incomplete.
- **References:** MFR's Annual Reports, RESULTS, Silviculture

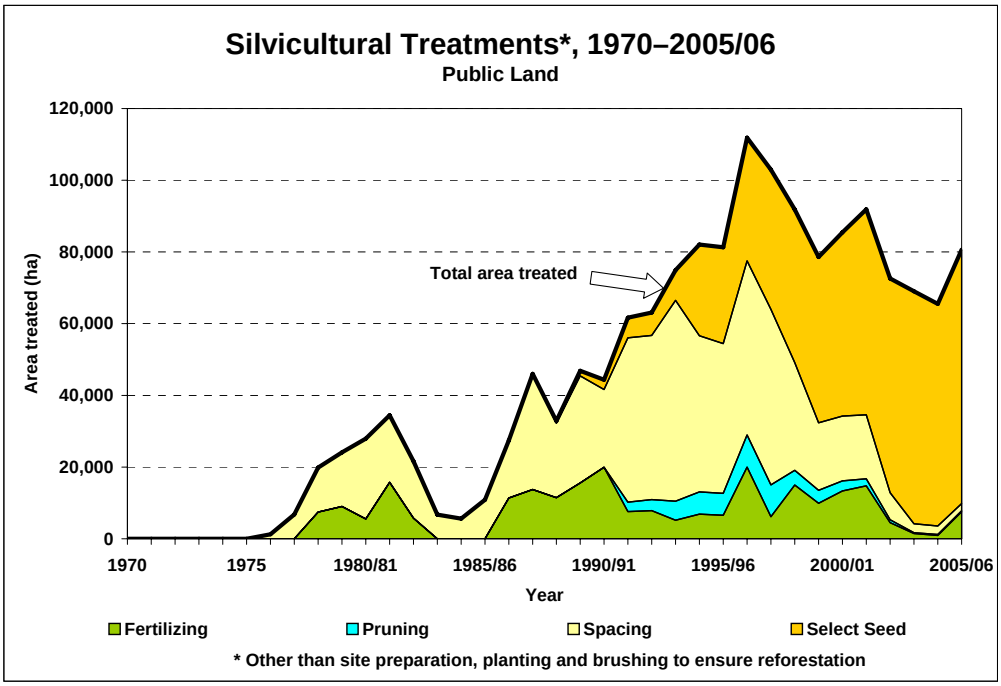
Related international and national indicators:

MP (none)

CCFM 2.3, 2.5

Economic and Social Indicator 14-3

What other silvicultural treatments have been done?



Why is this important?

Silvicultural treatments are investments in future timber production and environmental benefits from forests.

State and Trend

- In addition to reforestation activities, several other silvicultural treatments can also increase timber quantity and quality, and improve habitats, water management and visual landscapes. They can also be used to create employment opportunities for First Nations and others affected by changes in the forest industry.
- Treatments on public land totalled 1.6 million ha (an individual site may be treated more than once).
- Between 1976 and 2005/06, investments to improve the growth and quality of future crop trees included fertilizing (0.2 million ha), pruning (0.06 million ha) and spacing (0.7 million ha) and use of select seed for planting (0.6 million ha).
- Public funding of the first three treatments was largely discontinued in recent years.
- Public funding is continuing for research, production, storage and monitoring of select seed use on public land.
- By increasing the rate of tree growth, use of select seed can increase future timber volume, reduce constraints on harvesting adjacent areas and reduce the need for (and cost of) brushing.
- **Maps:** Use of Select Seed

Information

- Treatments are tracked in RESULTS and in MFR Annual Reports. Recent data for fertilizing may be incomplete.
- Private landowners are not required to report treatments.
- **References:** MFR's Annual Reports, RESULTS, Silviculture

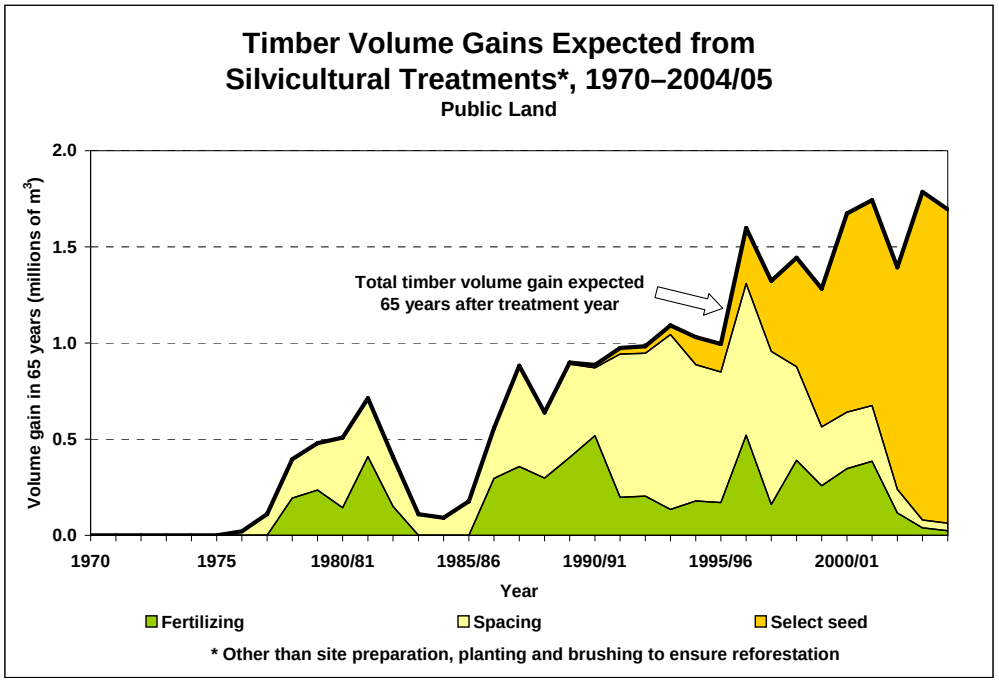
Related international and national indicators:

MP (none)

CCFM (none)

Economic and Social Indicator 14-4

What gains do silvicultural investments yield?



Why is this important?

Investments in silviculture depend on clear objectives and adequate expected gains.

State and Trend

- Gains in timber volume, quality and timing of harvests are usually the primary objectives. Short and long-term employment opportunities and various conservation values are at times the main objective. Economic returns on investment are usually considered and often disputed[23].
- Compared with natural regeneration, planting increases harvestable volume by about 15%, and about 25% with the use of select seed.
- Recent levels of planting increase future harvests by at least[24] 6 million m^3 per year, and use of select seed adds about 2 million m^3 per year. The annual gain of 8 million m^3 per year amounts to 12% of the average annual harvest of 66 million m^3 on public land during the 1990s.
- Cumulative volume gains[25] 65 years after investments in reforestation and other treatments since 1970 are estimated at 266 million m^3, based on planting (95 million m^3), backlog planting (142 million m^3), fertilizing (6 million m^3), spacing (11 million m^3) and select seed (11 million m^3).
- Other gains from silvicultural treatments include increased short and mid-term timber supply, accelerated development of mature or old growth forest characteristics where needed for wildlife or biodiversity, higher wood quality (e.g., by pruning) and more pleasing visual landscapes. These are measured in different ways that cannot be readily summed.
- **Maps:** Use of Select Seed

Information

- Volume gains were estimated with the Performance Measures Calculator used for results published in Forest Renewal BC's Annual Reports.
- Genetic gain data are in the Seed Planning and Registry system (SPAR).
- **References:** MFR's Annual Reports, RESULTS, SPAR

Related international and national indicators:

MP (none)

CCFM (none)

Silviculture

Ministry of Forests and Range's assessment

State

Silvicultural systems and treatments are dependent on government policies and funding in most of British Columbia. Policies have evolved to reflect changing public priorities and new scientific information. The dominant silvicultural system is now clearcutting with reserves for maintaining stand-level biodiversity. Past shortfalls in reforestation after logging have been corrected with policy changes and large investments in planting during the 1980s and 1990s. Currently, virtually all logged areas are reforested within allowable timeframes. Reforestation and other silvicultural investments in 1970–2005/06 increased future timber volumes by an estimated 266 million m^3 (equivalent to four years of the provincial harvest from public land), and improved other timber and non-timber values.

Trend

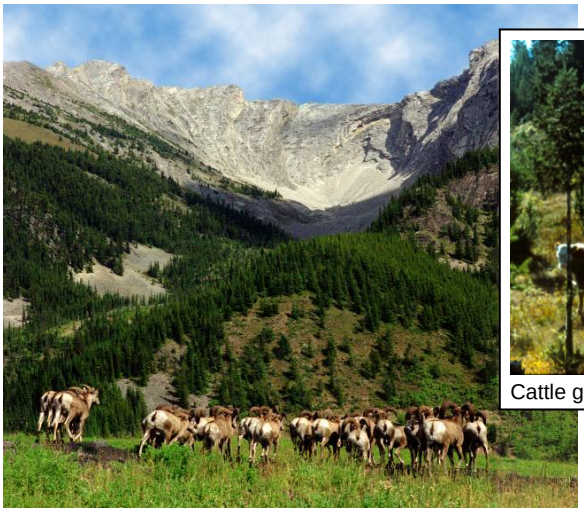
The use of clearcutting with reserves and variable retention has increased since the late 1990s, and the average size of clearcuts decreased, improving the balance of environmental and economic objectives. Improved practices increased the success rates for natural regeneration and planting, and reduced failures by 90% since 1989. The quantity and quality of select seed used are expected to increase over time. Silvicultural investments increased in the 1980s; however, public funding for several treatments has been largely discontinued in recent years. The mountain pine beetle epidemic is creating substantial reforestation challenges and loss of silvicultural investments.

Information

Research has greatly improved the effectiveness of silvicultural activities. Large amounts of operational data are collected in the RESULTS database to track silvicultural activities on public land. Data on seed selection, planned use and seedlot genetic quality are tracked in the SPAR database. Information from RESULTS and SPAR is used for policy development, strategic planning, silvicultural investment decisions, predicting timber supplies, supporting AAC decisions, habitat modelling and effectiveness monitoring at the management unit level. Most silvicultural information is not available for private land. Completion of data entry for reforestation on public land is being addressed.

Economic and Social Indicator 15

Range



Big horn sheep – MFR

Cattle grazing – Candace Kenyon

Why is this important?

Rangelands support the ranching industry and a variety of wildlife.

Note: This indicator will be addressed fully, with detailed information and an assessment, in a future edition of the report.

Overview

- Range or rangeland supports vegetation suitable for grazing by cattle, other livestock and wildlife. Range covers over 10% of British Columbia's land base, and is mostly forested, with some grasslands.
- B.C.'s cattle industry was the first to become established in Canada. Ranching is a way of life and a small but important industry in B.C.
- The area and condition of rangelands are threatened by expanding urban and agricultural areas, forest encroachment due to wildfire suppression, and invasive weeds.
- Timber harvesting increases forage on recently logged areas, but it also removes natural barriers that control livestock movement.
- Sheep are used to control brush and improve tree growth, but livestock also damage planted trees and reduce forage for wildlife.
- Range improvements such as seeding, fertilizing, prescribed burning, fencing and water supplies can increase forage production and improve livestock distribution and forage use.

Related indicators

- Rangeland is subject to competing land uses (see Ecosystem diversity, Ownership and management, Timber production forests). Forage productivity can be affected by timber harvesting and silvicultural practices (see Silviculture), invasive weeds (see Exotic species) and natural disturbances (see Ecosystem dynamics).
- Rangeland supports the ranching industry's contribution to the economy (see Forest products, Jobs and communities). Livestock grazing affects wildlife habitat (see Species diversity).
- Resource use conflicts related to range activities can be mitigated by inclusive planning processes and regulation of forest and range practices (see Public involvement, Law).

Related international and national indicators:

MP 2.e

CCFM 5.3.2

Economic and Social Indicator 16

Recreation

Horseback riders in a woodlot – Candace Kenyon

Canoe on a lake – MFR

Why is this important?

British Columbia's forest recreation opportunities are highly valued by both British Columbians and visitors from around the world.

Note: This indicator will be addressed fully, with detailed information and an assessment, in a future edition of the report.

Overview

- British Columbia's forest landscapes and cultural heritage offer opportunities for a wide variety of outdoor recreation activities, such as scenic viewing, hiking, camping, biking, fishing, skiing and snowmobiling.
- Each year, B.C.'s outdoor recreation infrastructure is used by millions of residents and visitors.
- Outdoor recreation areas, trails and facilities exist throughout the province, although accessibility varies considerably.
- Road-building and other activities by the forest industry, construction and maintenance of facilities by volunteer groups, and government programs and facilities provide public access to outdoor recreation opportunities.
- Managing recreation helps to protect natural resource features and ecosystems; reduce wildfires and vandalism; avoid or minimize conflicts (e.g., between the forest and tourism industries, and between different recreation activities); and limit government's liability.
- Demand for recreation opportunities and facilities changes with changes in population size, distribution and age.

Related indicators

- Forest ownership and timber harvesting affect access to recreation opportunities (see Ownership and management, Timber production forests).
- Nature-based tourism and recreation provide significant contributions to the economy (see Forest products, Jobs and communities). Some recreation activities cause soil degradation (see Soil), and some threaten forest-dependent species (see Species diversity, Ecosystem dynamics).
- Public consultation helps determine where recreational opportunities exist and how to manage them (see Public involvement, Protected forests).

Related international and national indicators:

MP 6.2.a, 6.2b, 6.2.c, 6.4.a

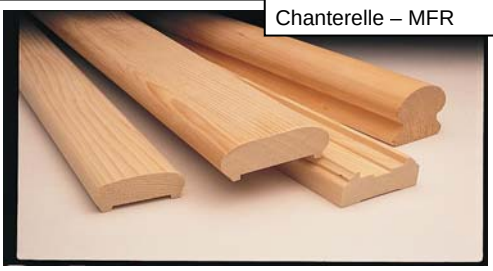
CCFM (none)

Economic and Social Indicator 17

Forest products

Architect -Brian Hemingway
Photographer – Peter Powles

Chanterelle – MFR



Staircase handrails – www.bcforestproducts.com

Why is this important?

B.C.'s forest products and services contribute billions of dollars annually to the economy.

Note: This indicator will be addressed fully, with detailed information and an assessment, in a future edition of the report.

Overview

- British Columbia's forests and rangelands provide a wide range of forest products and services.
- Timber products include lumber, panelboards, pulp and paper; non-timber forest products include forage for livestock, mushrooms and medicinal products. Many services such as recreational opportunities and regulation of water flows support the social fabric of life in the province.
- Timber-based industries generate substantial public and private revenues. B.C.'s timber products account for about half of B.C.'s total exports and about half of Canada's softwood products. The primary export market is the U.S.A. Asian nations have replaced Europe as the second major market. With its reliance on export markets, B.C.'s timber-based industries are susceptible to changes in international competition, trade restrictions and currency exchange rates.
- Non-timber forest product industries such as ranching and mushroom picking have well-established markets. Many non-timber forest products are used or enjoyed without direct market valuation.
- Services provided by forests support a variety of nature-based tourism industries with well-established markets. Many other services that are not sold through markets contribute to the quality of life in British Columbia.

Related indicators

- Access to forest resources and regulatory requirements affect the economic viability of forest-based industries (see Ownership and management, Timber production forests, Law, Certification).
- Forest-based industries help support many of B.C.'s communities (see Jobs and communities, First Nations involvement). They also affect the province's environmental integrity (see Species diversity).
- Trade policy and other regulations consider industry viability (see Law).

Related international and national indicators:

MP 6.1.a to 6.1.d, 6.1.f, 6.3.d

CCFM 5.1.1 to 5.1.5, 5.2.2, 5.3.3

Jobs and communities


Forest workers – BC Forest Safety Council


Faller – MFR


Community timber processing facility – MFR

Why is this important?

Forests provide a major source of employment and income for many of B.C.'s communities.

Overview

- Forest-based jobs support individual workers, their families, and the economic and social fabric of their communities. Worker safety is a vital aspect of maintaining this support.
- Many of British Columbia's rural and First Nations communities are dependent on forest-based employment.
- Since 1970, employment in the forest sector has been fairly stable while the province's economy grew and diversified. Provincial dependence on the forest sector has decreased, but many areas are still highly dependent.

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

Questions about jobs and communities

18-1 How many jobs rely on B.C.'s forests?
18-2 How much income is based on B.C.'s forests?
18-3 How dependent on forests are B.C.'s communities?
18-4 How many injuries and fatalities occur in the forest sector?

➡ Ministry of Forests and Range's assessment

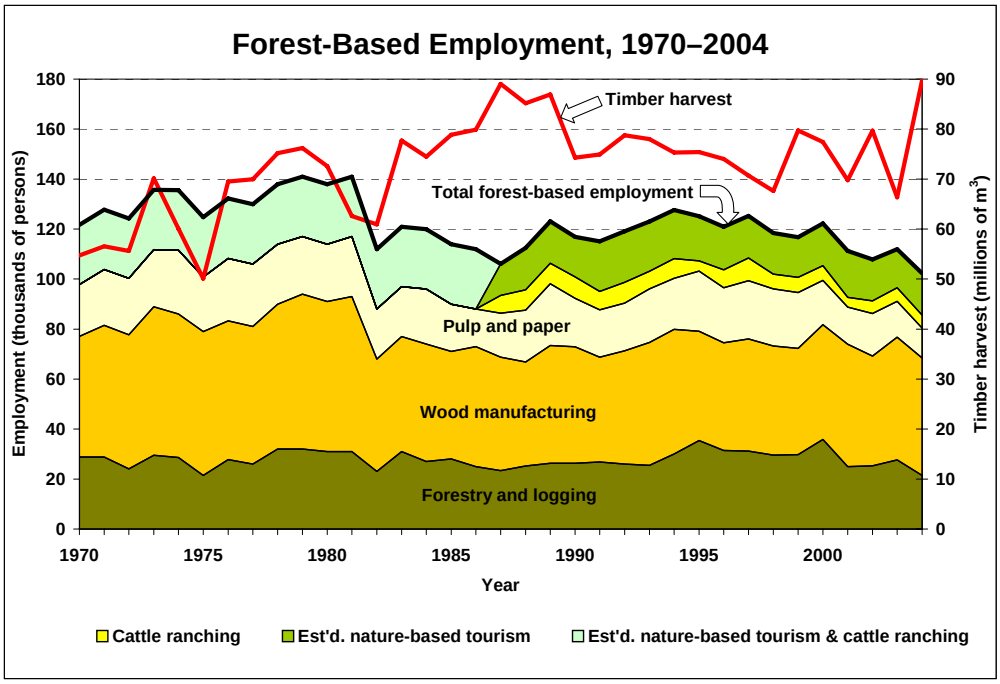
Related indicators

- Changes in technology and market demands affect employment in the forests and related manufacturing (see Timber harvest, Forest products).
- Employment and community stability affects government revenues and expenses (see Management capacity).
- Management responses include policy changes (see Law).

For data tables, see:
www.for.gov.bc.ca/hfp/sof/

Economic and Social Indicator 18-1

How many jobs rely on B.C.'s forests?



Why is this important?

A significant portion of the province's jobs depend on B.C.'s forests.

State and Trend

- Forest-based industries include harvesting and processing of timber, cattle ranching, nature-based tourism and non-timber forest products.
- Direct employment in these industries averaged about 120,000 jobs since 1970, fluctuating with changing product demand, increasing productivity, a changing mix of products and services, and contracting[26].
- Indirect employment in industries that support the forest-based industries was estimated at 60,000 additional jobs in 2004.
- Direct forest-based employment accounted for 6% of total employment in B.C. in 2000. Direct and indirect employment accounted for 9%.
- From 1987 onward, timber-based industries averaged about 93,000 jobs, or 80% of forest-based jobs. Mechanization in sawmills in the early 1980s, and pulp and paper mill closures and modernization in the late 1990s, reduced employment while the timber harvest increased.
- Direct employment in cattle ranching averaged about 7,000 jobs, or 6% of forest-based jobs, but decreased to about 5,000 jobs in 2004.
- Direct employment in nature-based commercial tourism that relies on forests (e.g., hunting, fishing, wildlife viewing and backcountry hiking) averaged an estimated 17,000 jobs (15%), and trend varied by activity.

Information

- Employment data are from Statistics Canada's Labour Force Survey, with adjustments by BC Stats. Tourism data are estimated[27].
- Non-timber forest products (NTFPs) industries[28] are estimated to provide the main employment for less than 1,500 people.
- **References:** 2001 Census, Statistics Canada, BC Stats, BC Wilderness Tourism, Tourism BC, Integrating NTFPs

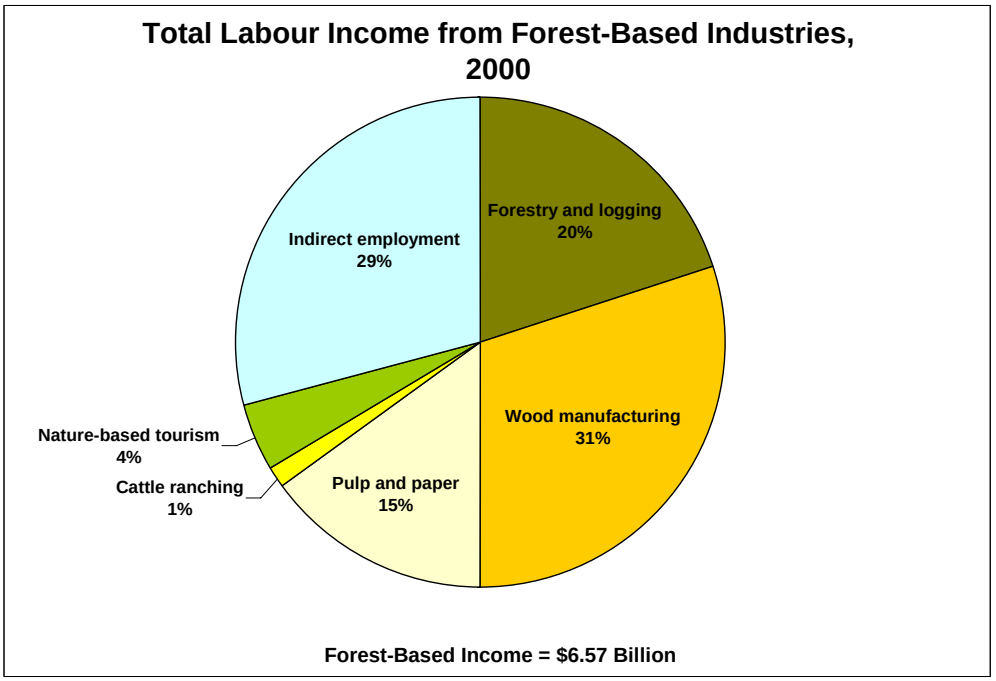
Related international and national indicators:

MP 6.5.a

CCFM 5.3.5

Economic and Social Indicator 18-2

How much income is based on B.C.'s forests?



Why is this important?

Income based on forests supports many of B.C.'s workers, their families and communities.

State and Trend

- Forest-based labour income is earned through direct employment in forest-based industries and indirect employment in service industries that support the forest-based industries.
- In 2000, direct and indirect forest-based labour income was $6.57 billion, or about 10% of the provincial labour income from all industries.
- Timber industries (forestry, logging, lumber, panels, pulp and paper) accounted for $4.27 billion (92% of direct forest-based income).
- Non-timber industries (cattle ranching and nature-based tourism) accounted for $0.38 billion (8% of direct forest-based income). Images of forests are also important to the rest of the tourism industry.
- Average income in forest-based industries was $38,400, 20% higher than the $31,900 in all industries. It was highest in pulp and paper ($57,500), followed by wood manufacturing ($41,800), logging ($38,400), nature-based tourism ($16,900) and cattle ranching ($16,700).
- Between 1991 and 2004, average weekly earnings adjusted for inflation increased about 10% in forestry and wood manufacturing, and decreased about 5% in pulp and paper and nature-based tourism.
- **Maps:** Wood-processing mills

Information

- Labour income statistics for 2000 are from the 2001 census.
- Reliable data are not available for labour income from harvesting NTFPs. The work is generally seasonal and few people identify this as their primary employment. Earnings vary greatly, as do skills and experience.
- **References:** 2001 Census, Survey of Labour and Income Dynamics

Related international and national indicators:

MP 6.5.b

CCFM 5.3.6

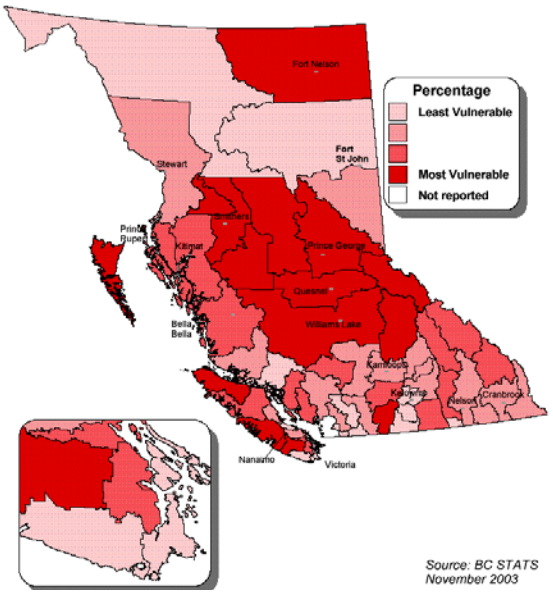
Economic and Social Indicator 18-3

How dependent on forests are B.C.'s communities?

Why is this important?

Many B.C. communities depend on a strong local forest industry for their economic and social well-being.

Forest Sector Vulnerability, 2001



State and Trend

- Community sustainability depends on many factors such as income, diversity of income sources, potential for and proximity to alternative employment, amenity values and leadership in addressing change.
- Timber-based industries supported community sustainability with around 10% of the provincial gross domestic product (GDP) in the late 1980s. By the early 2000s, their GDP increased by about one quarter. However, with diversification and faster growth in the rest of the provincial economy, their share of provincial GDP decreased to about 7%[29].
- The sale of most forest-based goods and services provides basic income[30] that flows into a community, pays resident employees, and creates other local jobs as the money circulates within the community.
- Many B.C. communities obtain a high proportion of their basic income from timber-based industries. In 2001, 35 of 63 local areas[31] (excluding greater Vancouver) obtained 20% to 57% of their basic income from the timber and tourism industries. These areas include 48 communities with a total population of 350,000, not including surrounding rural areas.
- The map of forest sector vulnerability shows relative sensitivities of the 63 local-area economies to downturns in timber-based industries.
- Many of the most vulnerable communities are in areas where future timber supplies are at risk due to the mountain pine beetle epidemic.
- **Maps:** Dominant Income, Local Timber Supply Forecast

Related international and national indicators:

MP 6.5.c

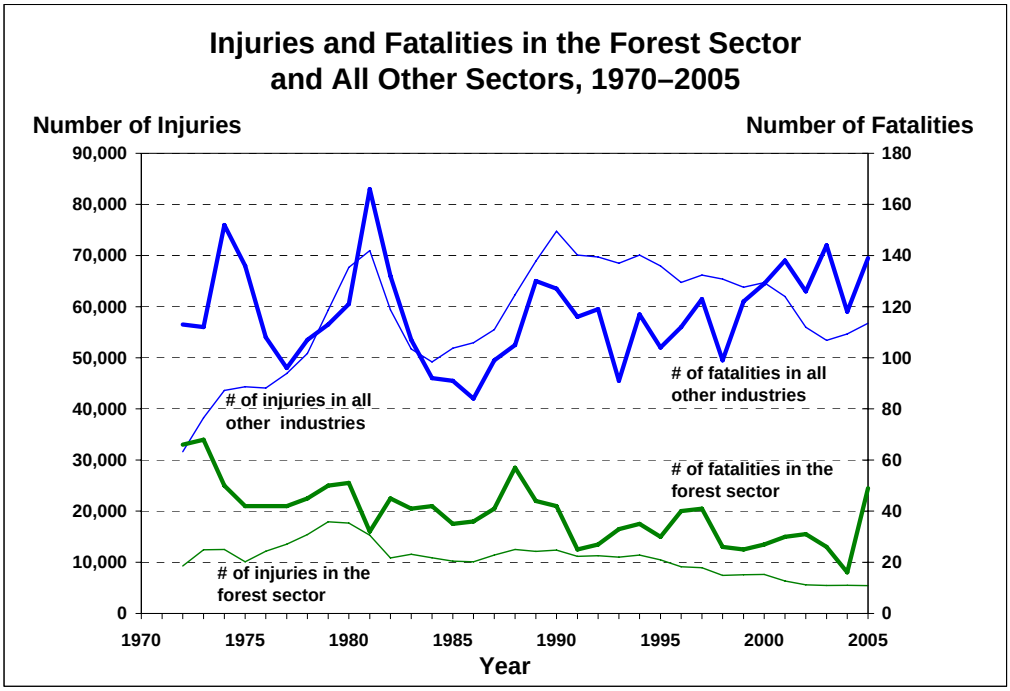
CCFM 6.3.1 to 6.3.4

Information

- The vulnerability index[32] is based on the percentage of income from timber-based industries and on the diversity of basic income sources.
- **References:** BC Stats, 2001 Census

Economic and Social Indicator 18-4

How many injuries and fatalities occur in the forest sector?



Why is this important?

Injuries and fatalities disrupt workers' lives, families and communities, and reduce the forest sector's productivity and ability to attract skilled workers.

State and Trend

- Injuries and fatalities result from dangerous situations, equipment failure, cultural attitudes, market and workplace pressures, company and government policies, human error and other factors (fatigue, dehydration, inadequate conditioning, stress, drugs and alcohol).
- The forest sector's number of fatalities has generally decreased over the past 35 years, but its number of fatalities is still the second highest of all sectors (the transportation sector is highest). The number of fatalities for other industries has increased over the past 20 years.
- The number of injuries reported in the forest sector has decreased since the 1970s. No clear trend is apparent for the sum of all other sectors.
- Small operations, employing 20 or fewer workers, employ 50% of forestry workers and experience 70% of fatalities and 67% of serious injuries in the forest sector.
- Annual, inflation-adjusted benefits paid out for disability and fatalities from 1991 to 2004, inclusive, averaged $128 million (in 2004 dollars) for the forest industry and $522 million for all other industries. Benefits paid per worker in the forest industry were almost four times those paid in all other industries ($1,149 and $306 per person-year, respectively).
- **Maps:** (none)

Information

- Some injury and fatality data are published annually.
- **References:** BC Forest Safety Council, WorkSafeBC

Related international and national indicators:

MP 6.5.b

CCFM (none)

Jobs and communities

Ministry of Forests and Range's assessment

State

Forest-based employment accounted for 9% of total employment and 10% of labour income in British Columbia in 2000. Timber-based industries accounted for most of this employment, and provided substantially higher average incomes than nature-based tourism and cattle ranching. In more than half of B.C.'s 63 local economies, over 20% of labour income was forest-based in 2001. Many communities and surrounding rural areas are vulnerable to downturns in timber product markets and the impacts of the current mountain pine beetle epidemic. Compared with most other industries, work in timber-based industries can be dangerous. Average benefits paid for forest worker injuries and fatalities are almost four times the average for other industries.

Trend

Forest-based employment continues to play an important role in B.C.'s economy and communities. However, market pressures and trade disputes have reduced employment in the timber-based industries in recent years, especially along the Coast. As companies continue to reduce their non-skilled labour force in order to stay viable and competitive, communities can no longer rely on timber-based industries to provide employment to large numbers of mill workers and will need to continue looking for employment growth in other sectors. Forest worker injuries and fatalities have generally decreased since the 1970s. A sharp increase in fatalities in 2005 has prompted inquiries into possible causes and solutions.

Information

Extensive employment and labour income statistics are publicly available. Statistics for nature-based tourism are not tracked separately, and can only be estimated. Changes in the classifications of sub-sectors of timber-based industries may cause minor unreliability of trend analyses by sub-sector. Sophisticated modelling of community dependence on the forest sector and other sectors has been reported periodically. Some injury and fatality data are published annually.

Economic and Social Indicator 19

First Nations involvement

Central Coast – Moresby Creative

Ksan totem – Tom Ryan

Chief Susan McKamey, Leq'a:mel First Nation, and Rich Coleman, Minister of Forests and Range, announce the 100th forest and range agreement –

Why is this important?

Forests have been economically, culturally and spiritually significant to First Nations people for thousands of years.

Overview

- First Nations involvement includes consultation for planning and decision-making, gaining access to forest resources for timber and other uses, revenue sharing, and traditional use projects.
- First Nations people (not including Métis) now make up about 3% of British Columbia's population. 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 aboriginal rights and title issues being resolved?

➡ Ministry of Forests and Range's assessment

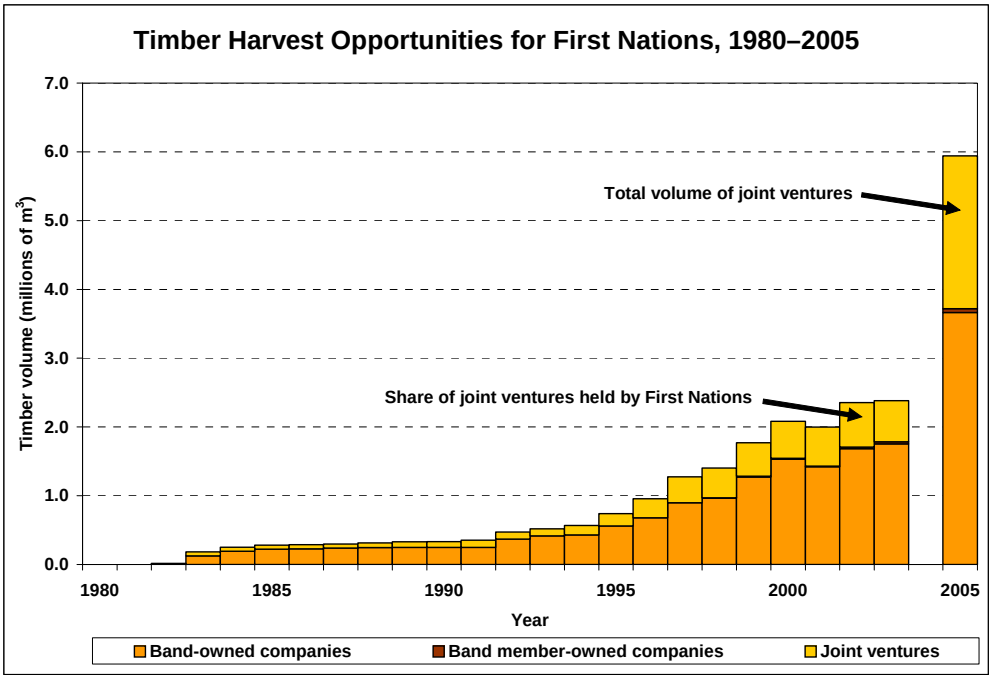
Related indicators

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

For data tables, see:
www.for.gov.bc.ca/hfp/sof/

Economic and Social Indicator 19-1

What timber harvesting opportunities do First Nations have?



Why is this important?

Timber harvesting and milling provides an important source of income for First Nations.

State and Trend

- In 2005, companies owned by First Nations bands and band members held tenures with annual harvest volumes of 3.7 million m^3 or 4.5% of the provincial allowable annual cut (AAC), double the 1.8 million m^3 in 2003.
- In 2005, First Nations had a share[33], along with non-aboriginal companies, in joint ventures that held rights to 2.2 million m^3 or 2.7% of the AAC. Joint ventures 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 provincial initiatives enable increased allocations of timber to, and sharing of forestry revenues with, First Nations through interim measures agreements.
- Harvests on reserves are administered by the federal government.
- **Maps:** First Nations Bands

Information

- Records of First Nations' timber tenures are reliable for recent years. Some minor gaps are known to exist in the data before 1995.
- First Nations shares of joint ventures were not tracked for 2005.
- The volumes presented represent rights to harvest, not actual volumes harvested.
- **References:** MFR's Aboriginal Affairs

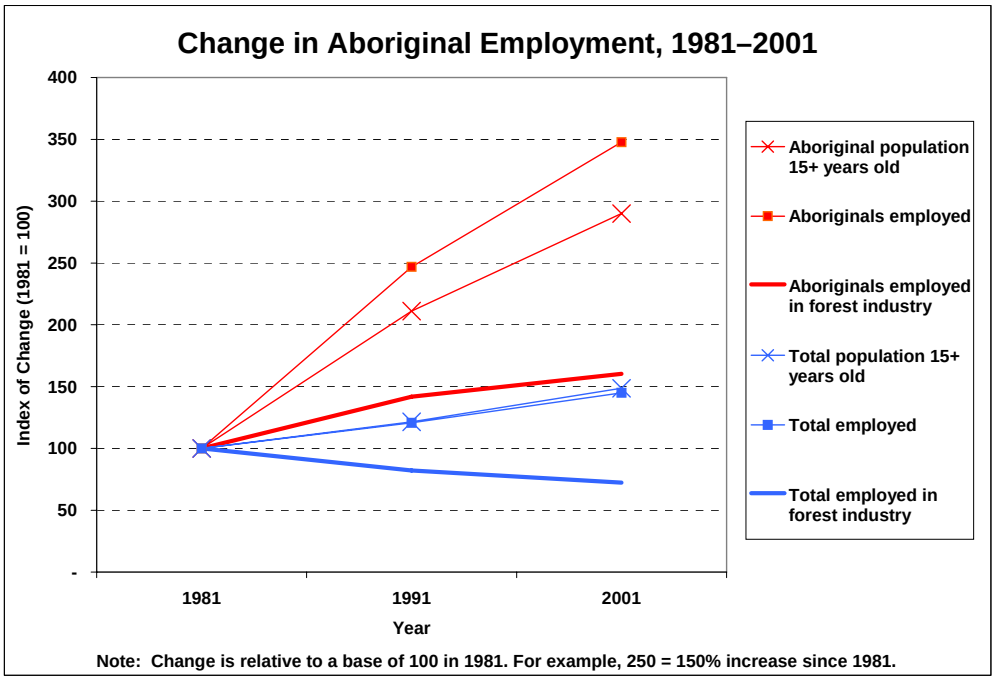
Related international and national indicators:

MP (none)

CCFM (none)

Economic and Social Indicator 19-2

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



Why is this important?

Participation throughout the forest sector provides First Nations with economic benefits and the opportunity to influence forest management.

State and Trend

- First Nations hold interim measures agreements, 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, more First Nations people are filling 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. Some First Nations lack the capacity to participate meaningfully in forums for land use planning.
- Harvesting of fish, wildlife and other non-timber forest products continues to play an important role in First Nations' livelihoods and culture.
- **Maps:** First Nations Bands

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.
- **References:** 2001 Census

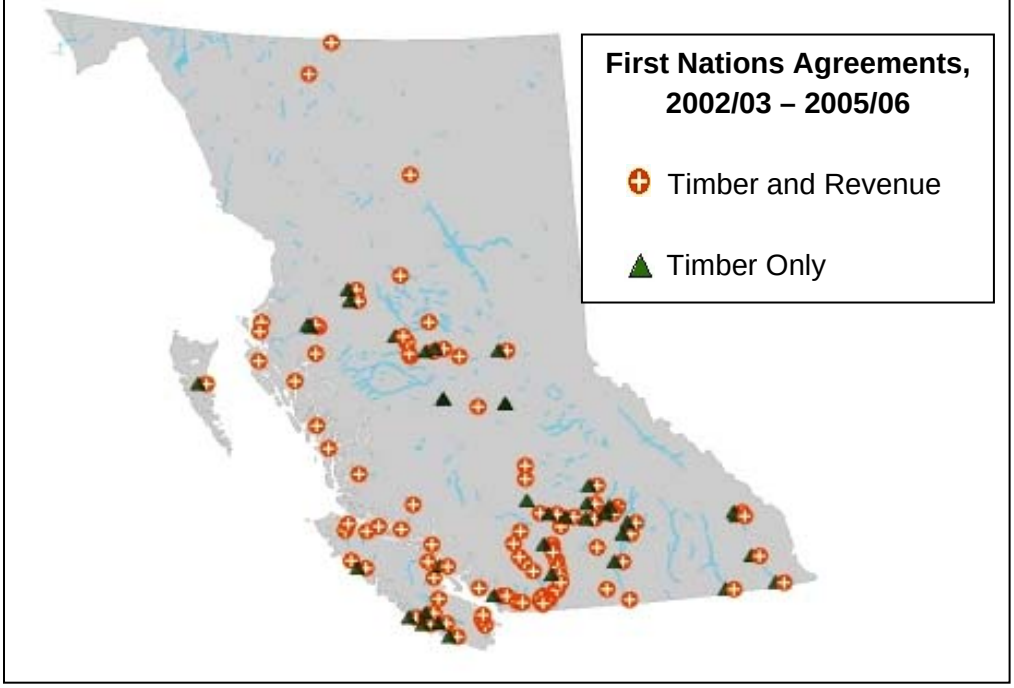
Related international and national indicators:

MP 6.5.a

CCFM 5.3.5

Economic and Social Indicator 19-3

How are First Nations interests considered in forest management?



Why is this important?

Forest management directly affects the economic, social, cultural, spiritual and legal interests of First Nations.

State and Trend

- A variety of initiatives are in place to address First Nations' interests in forest management.
- In May 2002, legislation was amended to allow forest tenures to be directly awarded to First Nations.
- Between September 2002 and March 2006, agreements that provide for timber and/or revenue have been signed with 110 First Nations, providing a total of 18.4 million m^3 of timber and $131 million in revenue.
- Timber for these agreements is made available from beetle-killed and fire-damaged timber, from timber that was not harvested under other forest tenures, and through the timber reallocation process.
- First Nations and other governments are working together to effectively mitigate the impacts of the current mountain pine beetle infestation.
- Over the past decade, over 55 traditional use projects have documented traditional ecological knowledge and cultural use of land and resources. These projects involved at least 126 of 199 bands in the province.
- In March 2005, legislation was enacted to ensure consideration of First Nations' cultural heritage resources located in public forests.
- **Maps:** Bands with Traditional Use Projects

Information

- Detailed information about agreements is publicly available.
- Information from the traditional use projects and consultations is restricted to participating First Nations and within government.
- **References:** MFR's Agreements with First Nations; MAL's ILMB

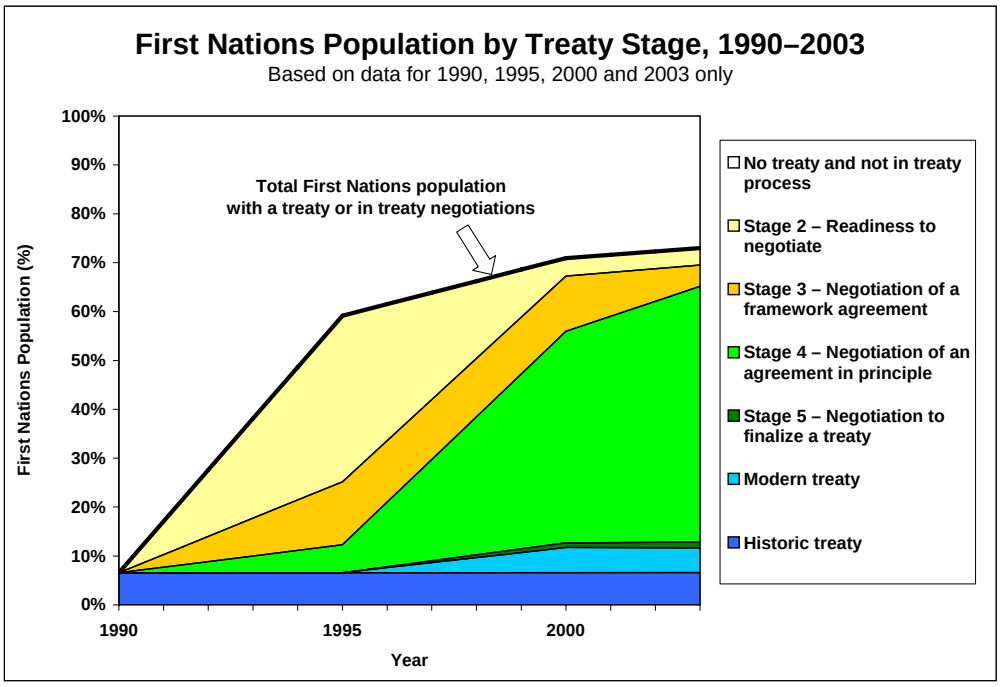
Related international and national indicators:

MP 7.1.a

CCFM 6.1.1, 6.2.1

Economic and Social Indicator 19-4

Are aboriginal rights and title issues being resolved?



Why is this important?

Resolution of aboriginal rights and title issues is expected to increase certainty for land and resource development in B.C.

State and Trend

- Issues about aboriginal rights to use forest resources, and aboriginal land title remain unresolved. Government, industry and most First Nations prefer effective treaty negotiations for resolving these issues.
- In 1999, 7% of the total First Nations population had rights and title addressed under treaties signed in the 1800s.
- In 2000, the Nisga'a Treaty and an adhesion to Treaty 8 increased that coverage to 12% of the First Nations population.
- In 2003, over 40 First Nations groups, involving more than 60% of the First Nations population, were in tripartite negotiations with the provincial and federal governments. Most were in the fourth stage (negotiation of an agreement in principle) of the six-stage process.
- These negotiations are overseen and facilitated by the BC Treaty Commission, an independent body established in 1992 by the governments of Canada and 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.
- **Maps:** First Nations Bands

Information

- Treaty process information is well documented and readily available.
- **References:** BC Treaty Commission, Ministry of Aboriginal Relations and Reconciliation, Indian and Northern Affairs Canada

Related international and national indicators:

MP 7.1.a

CCFM 6.1.1

First Nations involvement

Ministry of Forests and Range's assessment

State


mixed

Forests are economically, culturally and spiritually significant to B.C.'s First Nations, who have depended on them for thousands of years. In 2005, First Nations had ownership involvement in timber harvest opportunities amounting to about 7% of the province's allowable annual cut. Proportionally, this is double 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. Interim measures agreements with 110 First Nations are providing timber and revenue. While the economic situation of many First Nations is well below the average for all British Columbians, this is expected to improve with the interim measures agreements and, ultimately, treaty settlements that resolve aboriginal rights and title issues.

Trend


improving

Over the past two decades, First Nations' access to economic opportunities based on timber has increased substantially. These opportunities are expected to increase through new interim measures agreements. Between 1981 and 2001 First Nations employment in the forest sector increased 60%. Consultation on forest management decisions also increased, including direct involvement in addressing the mountain pine beetle infestation. Documentation of traditional uses improved. These trends are expected to continue. Ongoing efforts to reach new treaty settlements are expected to resolve many aboriginal rights and title issues. 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.

Information


adequate

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

Economic and Social Indicator 20

Public involvement

Workshop and field tour – Pat Teti

Why is this important?

Public involvement can improve decision-making and reduce conflicts.

Note: This indicator will be addressed fully, with detailed information and an assessment, in a future edition of the report.

Overview

- The provincial government owns 93% of the province's land on behalf of the public, and is accountable to manage it in the public interest.
- In the late1970s, in response to land and resource use conflicts, public involvement was initiated at strategic and operational planning levels.
- By the 1990s, the public was involved at strategic and operational levels in many planning processes, including the Old Growth Strategy, Parks and Wilderness for the 90s, the Commission on Resources and the Environment (CORE), land and resource management plans (LRMPs) and the *Forest Practices Code of British Columbia Act*.
- Public involvement was an important component of the processes for developing strategic land use plans that covered 80% of B.C. in 2006, and it remains so in the current development of plans for 5% more.
- Today, public involvement continues to be intensive in strategic-level processes such as LRMPs, operational plans under the *Forest and Range Practices Act* and certification processes.
- New approaches and methods for enabling public involvement continue to be developed. Examples are model forests, sustainable resource management plans (SRMPs) and forest visualization technologies.

Related indicators

- B.C.'s growing population and increasing demands for goods and services from forests (see Protected forests, Timber harvest, Recreation) raise the need for public involvement to ameliorate potential conflicts.
- Involvement in land use planning and forest management planning can place considerable demands on the participating public. First Nations are strongly encouraged to be involved (see First Nations involvement).
- Management responses include providing opportunities for public involvement (see Law) and access to information (see Knowledge).

Related international and national indicators:

MP 7.1.c, 7.2.a, 7.2.b

CCFM 6.4.1

Law

British Columbia Legislature, Victoria – MFR

Forest practices audit – MFR

Why is this important?

B.C.'s legal framework encompasses all forest related activities and enables sustainable forest management.

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 forest law.
- B.C.'s forest law 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?

➡ Ministry of Forests and Range's assessment

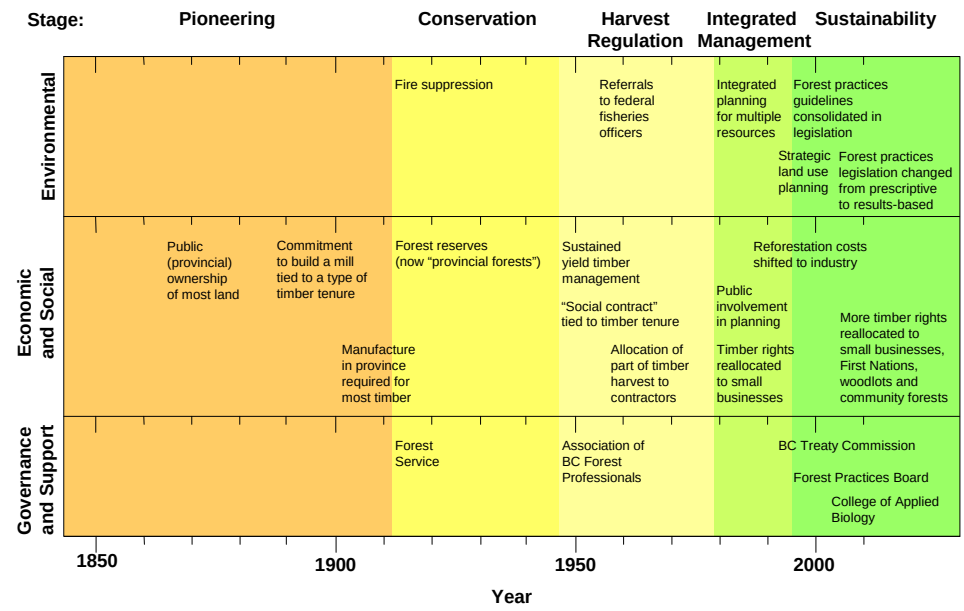
Related indicators

- Stakeholder interests in forests (see Ownership and management, Timber harvest, First Nations involvement, Public involvement) are formalized as specific rights and obligations in law.
- Excessive complexity of laws governing sustainable forest management can lead to high costs for government, the forest industry and other stakeholders (see Jobs and communities).
- The province can reduce costs of governance by delegating some management obligations to tenure holders (see Ownership and management). Historical perceptions of inadequacies in the law of various states led to the emergence of non-state governance (see Certification).

For data tables, see:
www.for.gov.bc.ca/hfp/sof/

Governance and Support Indicator 21-1

How are the elements of sustainable forest management governed?



Why is this important?

Forest law continues to evolve and develop different approaches to protect and balance changing environmental, economic and social values.

State and Trend

- B.C.'s forest law establishes organizations and professions to support forestry, and functions to allocate economic opportunities, conserve forests, and set requirements for forest planning and forest practices.
- Law authorizes some activities and constrains others, to reduce harm and the risk of harm.
- 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, First Nations consultation, public involvement and explicit objectives to conserve environmental, social and cultural values.
- Initial reliance on contract law and administrative policy was replaced over time by prescriptive regulatory requirements and, in recent years, by regulatory requirements that enable innovation with a focus on achieving defined objectives of sustainable forest management. 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.
- **Maps:** (none)

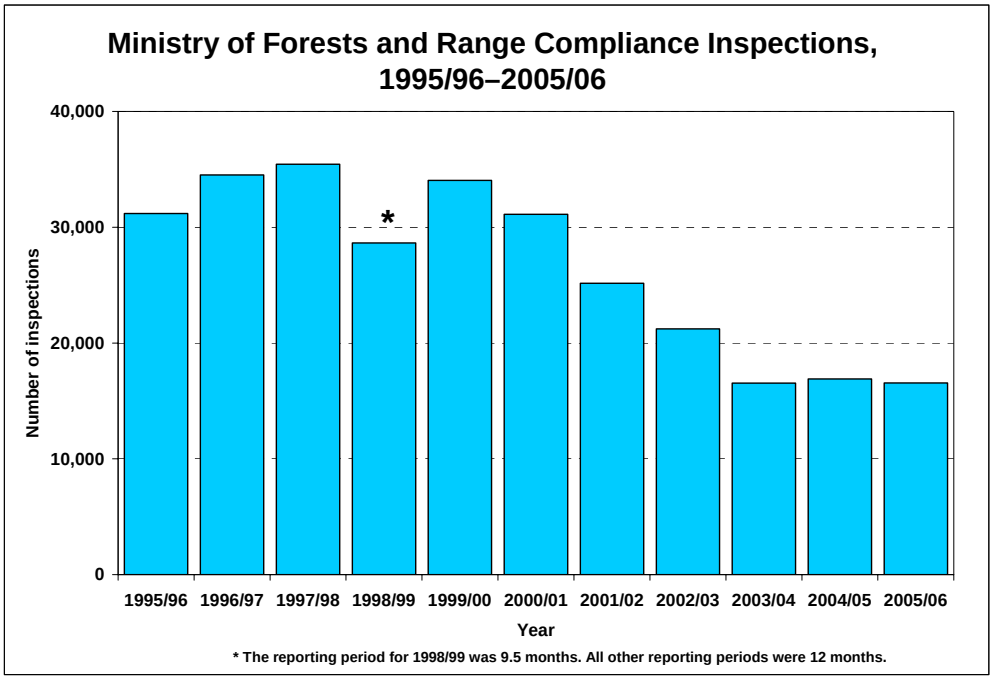
Related international and national indicators:
MP 7.1.a to 7.1.e
CCFM 6.5.4

Information

- Various inquiries document the reasons for major changes in the law.
- **References:** MFR's Forest legislation; ABCFP's Forest Legislation and Policy Reference Guide

Governance and Support Indicator 21-2

Is government assessing compliance with the law?



Why is this important?

Assessing compliance with the law is required to ensure that forest practices are being conducted in a manner that supports sustainability.

State and Trend

- The Ministry of Forests and Range is the main agency responsible to assess compliance with forest law, using site inspections and patrols.
- Before 1979, government's 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 assessments were not systematic. Compliance assessments became more systematic to enforce the *Forest Practices Code of British Columbia Act* of 1995, and their rigour was improved in 2001. The *Forest and Range Practices Act*, introduced in 2004, has resulted in further improvements to 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 MFR cooperates with MoE to protect habitats for fish and wildlife, and with the federal DFO to protect fish and fish habitat. The MoE also monitors pollution emissions from pulp mills and sawmills.
- **Maps:** (none)

Related international and national indicators:

MP 7.2.e

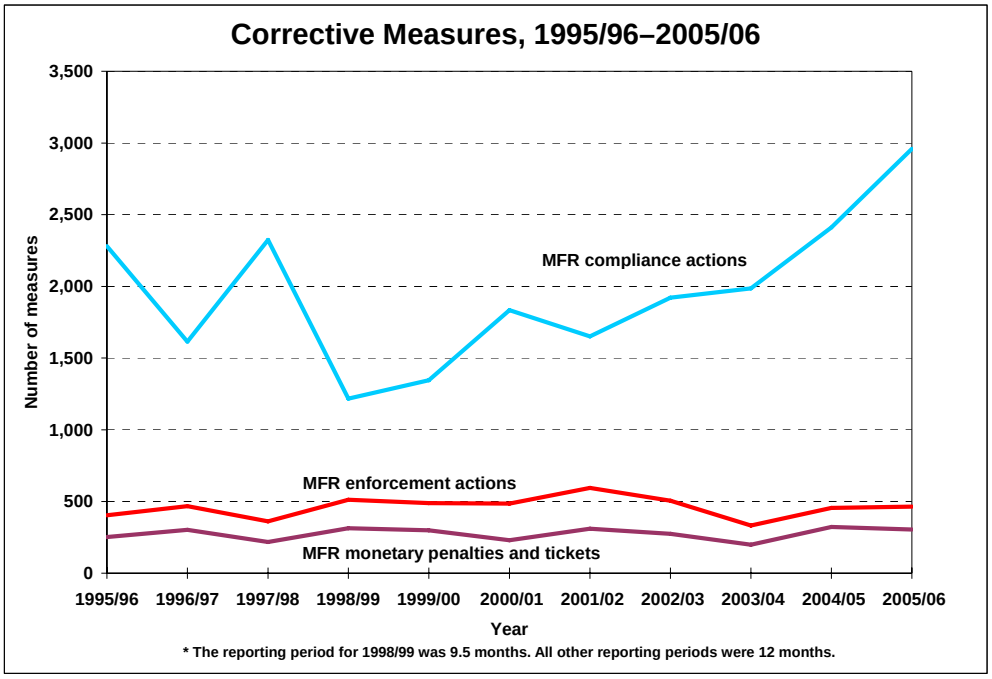
CCFM 3.1, 3.2, 6.4.2

Information

- Statistics are published for MFR inspections and Forest Practices Board audits, but not for MoE and DFO inspections.
- **References:** MFR's C&E; Forest Practices Board

Governance and Support Indicator 21-3

What corrective measures are taken?



Why is this important?

Corrective measures detect non-compliance, promote compliance with the law and prevent non-compliance.

State and Trend

- Compliance actions by the Ministry of Forests and Range, averaging 1959 per year, mitigate minor problems and avoid major problems by re-directing the activities of tenure holders.
- Enforcement actions, averaging 461 per year, result in formal sanctions. They include monetary penalties, violation tickets 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 violation tickets averaged 275 per year with an average total value of $0.5 million annually. Most are for relatively minor infractions, and over 80% of the monetary penalties are therefore 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.
- Courts have ordered about two jail sentences per year.
- Enforcement actions by the Ministry of Environment averaged 25 fines per year for pollution from mills, especially pulp mills. These have decreased in number. The largest single fine was $250,000 in 1990.
- Administrative reviews and appeals are available.
- **Maps:** (none)

Information

- The Ministry of Forests and Range publishes details of its compliance and enforcement activities. The Ministry of Environment does not.
- **References:** MFR's C&E; Forest Practices Board; Forest Appeals Commission

Related international and national indicators:
MP 7.2.e
CCFM 3.1, 3.2, 6.4.2

Governance and Support Indicator 21-4

Is the law effective in achieving sustainable forest management?

Why is this important?

Ensuring that the law is effective requires systematic evaluation and continual improvement.

Effectiveness Evaluations[1], 2006/07

State of B.C.'s Forests indicators[2]	Forest and Range Evaluation Program monitoring protocols	Resource Stewardship Monitoring[3]	Intensive evaluation projects
Ecosystem diversity	Karst features	Pilot testing	Planned
Protected forests	Landscape-level biodiversity	In development	Planned
Ecosystem dynamics	Landscape-level biodiversity	Pilot testing	Planned
	Cutblock size vs. natural disturbances	n/a	One completed
Species diversity	Wildlife	Pilot testing	Planned
	Post-harvest tree species	n/a	In publication
Exotic species	Invasive species (in several indicators)	Implementing	Planned
Genetic diversity	Post-harvest tree seedlots	n/a	In publication
Soil	Cutblock-level soils	Pilot testing	Planned
	Terrain-level soils	Planned	Planned
Water	Drinking water quality	Pilot testing	Planned
	Fish/riparian habitat	**Implementing**	Under way
	Fish passage	Planned	-
	Hydrological function after MPB harvests	-	Planned
Timber production forests	Free-growing stands	Planned	Under way
	Partial cutting (residual stand value)	Planned	In publication
Silviculture	Stand-level biodiversity	**Implementing**	One completed
Range	Range function	Pilot testing	Five completed
Recreation	Recreation sites	Planned	One completed
	Visual quality	Pilot testing	Planned
Jobs and communities	Worker safety	n/a	Under way
First Nations involvement	Cultural heritage resources	Pilot testing	Planned

Notes: [1] The Ministry of Environment and the Ministry of Tourism, Sport and the Arts assist the MFR on some FREP monitoring protocols.
[2] Only the State of B.C.'s Forests indicators that are addressed by FREP monitoring protocols are listed.
[3] Bold indicates reporting is mandatory; non-bold indicates it is voluntary.

State and Trend

- The Forest and Range Evaluation Program (FREP) has begun conducting effectiveness evaluations, to assess whether resource values under the *Forest and Range Practices Act* are managed sustainably.
- Resource stewardship monitoring (RSM) by district staff identifies resource value status, trends, implementation issues and areas that may require more intensive evaluations by regional and headquarters staff.
- Both RSM and intensive evaluations may lead to recommendations to improve training, forest and range practices, policies and legislation.
- These processes are in relatively early stages of development and have not yet provided conclusive evaluations about the effectiveness of the law and firm recommendations for changes.
- Other reviews by government also evaluate policies and law.
- The Forest Practices Board cooperated with MFR and MoE in developing and testing evaluation indicators, and used them to assess effectiveness of forest practices and comment on relevant legislation.
- Royal commissions and other inquiries[34] periodically assess the law's effectiveness in protecting and balancing economic and social values.
- **Maps:** (none)

Information

- FREP monitoring protocols and results are publicly available. The protocols are rigorously peer-reviewed and field-tested to ensure scientific validity.
- **References:** MFR's FREP; Forest Practices Board

Related international and national indicators:
MP 7.1.b, 7.1.d
CCFM 6.5.4

Law

Ministry of Forests and Range's assessment

State

British Columbia's legal framework encourages economic development while maintaining high environmental standards, 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.

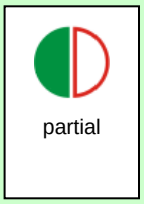
The rate of compliance is high, so the number of corrective measures required and the total amount collected in monetary penalties and fines are relatively low.

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 to 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 ten 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 and Range compliance assessments and corrective measures are publicly available, as are the well-documented, independent audits of the Forest Practices Board.

New processes are rigorously assessing the ultimate effectiveness of the law in achieving specific objectives of sustainable forest management, but have not yet provided conclusive evaluations and recommendations for changes.

Governance and Support Indicator 22

Management capacity

Clearcutting with reserves, in the forest and in a model – MFR

Why is this important?

Without adequate management capacity, sustainable forest management is not achievable.

Note: This indicator will be addressed fully, with detailed information and an assessment, in a future edition of the report.

Overview

- Managing British Columbia's forests requires substantial management capacity in the form of personnel, extensive infrastructure, effective management plans and financial resources.
- B.C.'s government has a long history of leveraging its management capacity by sharing management responsibility with the forest industry and, more recently, local communities and First Nations.
- All personnel, from tree planters to forest-level planners, have specialized skills and knowledge that must be continually updated.
- The size of B.C.'s forest land base requires the development and maintenance of an extensive network of roads, air transport, and communications systems.
- Management plans help ensure the protection and productivity of forests, identification and integration of land uses, orderly resource development, and consideration of different rights and perspectives.
- Management capacity depends on adequate financial resources, takes a long time to develop and requires ongoing effort to maintain.

Related indicators

- Economic pressures can reduce the management efforts of both government and industry (see Silviculture, Forest products). Differing stakeholder perspectives can create significant challenges for management (see First Nations involvement, Public involvement).
- The level of management capacity affects outcomes for all environmental, economic, social and governance aspects of forest management (see all other indicators).
- Management responses include new roles and responsibilities (see Law), long-term development of human resources, improved planning methods and research (see Knowledge).

Related international and national indicators:

MP 6.3.a, 7.2.b, 7.2.c, 7.2.d

CCFM (none)

Governance and Support Indicator 23

Knowledge


Weighing a bear cub – Bruce McLellan


BC Interior – Moresby Creative


Research presentation – MFR

Why is this important?

The quality of resource management decisions depends on the ability to generate, store, distribute and apply knowledge.

Note: This indicator will be addressed fully, with detailed information and an assessment, in a future edition of the report.

Overview

- Collection of resource data (e.g., inventories, research) and resource-use information (e.g., values, goals, First Nations traditional ecological knowledge) is influenced by decision-making needs, the cost of information, budgets and the risks of acting on insufficient knowledge.
- Managing the huge volumes of data related to forest management is a challenge, even with modern computer technology. Organizing the data into useable information requires collation and analysis.
- Making the information useful requires developing an understanding, or knowledge, of why events unfold as they do. Research and analysis are typically required to develop models of spatial and causal relationships.
- Foresters, other resource specialists and the public benefit from dissemination of the best available knowledge. Technical training and extension encourages its use in the daily management of forests. Making data and knowledge publicly available helps to inform decision-making and support transparency of forest management.
- Individual and organizational experience deepens knowledge of how best to use information. Systematic efforts to ensure continuous improvement in the face of ongoing changes can ensure more effective development and use of knowledge.

Related indicators

- Knowledge generation and dissemination are sensitive to budget pressures (see Management capacity).
- The state of knowledge about British Columbia's forest resources affects decision-making at all levels and the quality of information used for the indicators in this report.
- Management responses include new tools and partnerships to address complexity, accelerate learning and extend knowledge.

Related international and national indicators:

MP 7.2.a, 7.4.a, 7.4.b, 7.4.c, 7.5.a to 7.5.e

CCFM 6.5.1, 6.5.2, 6.5.3

Certification


Lumber bound for international customers – MFR

Why is this important?

Certification requires operators to adopt practices that support sustainable forest management.

- Certification is a voluntary, market-based instrument that gives buyers of forest products assurance that the products come from well-managed forests. Third-party verification is used to increase the credibility of certification. Meeting the requirements of some certification standards is intended to be a guarantee of sustainable forest management.
- British Columbia is a world leader in forest certification.
- Three-quarters of B.C.'s forest operations are certified.

STATE good **TREND** improving **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?

➡ Ministry of Forests and Range's assessment

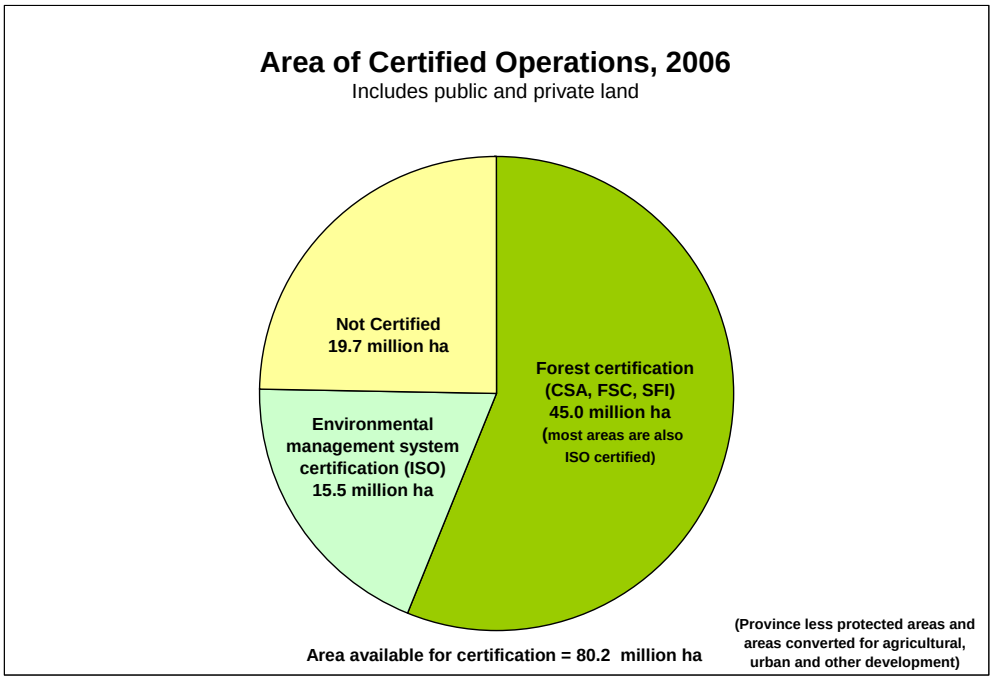
Related indicators

- 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).

For data tables, see:
www.for.gov.bc.ca/hfp/sof/

Governance and Support Indicator 24-1

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



Why is this important?

Certified forest operations have been assessed as supporting sustainability.

State and Trend

- Forest certification standards address environmental, economic and social aspects of sustainable forest management, so they are often referred to as sustainable forest management standards. To earn forest certification, a forest operation obtains independent, third-party verification that the operation meets the requirements for a standard.
- Three forest certification standards are used in B.C.: The national sustainable forest management standard of the Canadian Standards Association[35] (CSA), the Forest Stewardship Council[36] (FSC) standard and the Sustainable Forestry Initiative[37] (SFI) standard.
- In early 1999, no forest operation in B.C. was certified. By the end of 2006, the area certified under the forest certification standards increased to 45 million ha (56% of the province, excluding protected areas and areas converted for agricultural, urban or other development).
- ISO 14001[38] is the International Organization for Standardization standard for certification of environmental management systems. With third-party verification, it provides a framework for better forest management, and is often used as a first step towards forest certification. Including ISO 14001, the total area certified by late 2006 increased to 60 million ha (75% of the applicable area of the province).
- **Maps:** (none)

Information

- Certified areas generally include lakes, alpine areas and other non-forest land within certified forest management units.
- Data on areas certified are publicly available, but not always accurate.
- **References:** CSFCC; MFR's Forest Certification

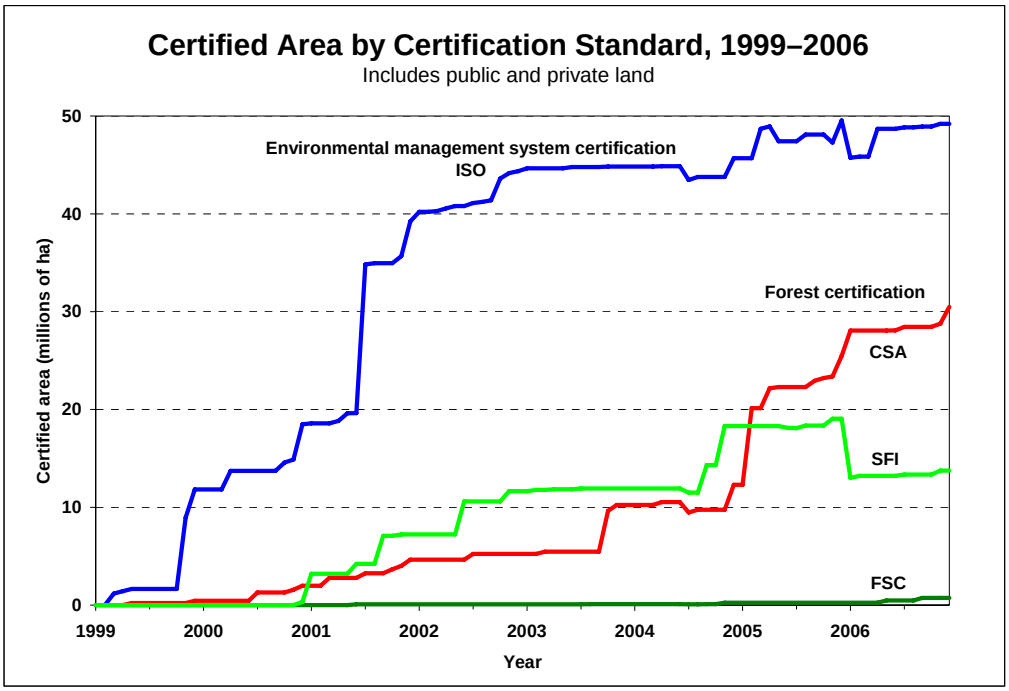
Related international and national indicators:

MP (none)

CCFM (none)

Governance and Support Indicator 24-2

How much area is certified under each standard?



Why is this important?

The area certified shows the extent of each standard's influence on forest management in B.C.

State and Trend

- B.C.'s first forest certification was under the CSA's CAN/CSA-Z809-96 standard. By late 2006, about 30 million ha were CSA certified. The CSA standard has process requirements consistent with those of ISO 14001, and on-the-ground performance requirements related to national forest values and local objectives established with public participation.
- Next was the FSC standard that is widely supported by environmental NGOs and First Nations. The FSC's B.C. standard and national boreal standard, both applicable in B.C., have detailed process and performance requirements. About 0.7 million ha were FSC certified.
- The SFI standard followed. SFI also has process and performance requirements. About 14 million ha were SFI certified in late 2006.
- About 49 million ha were managed under an environmental management system certified to the ISO 14001 standard. This certifies that operators meet or exceed requirements of law and other objectives set by government. It also requires a process of continual improvement. The standard itself does not set on-the-ground performance requirements.
- Most operators certified under CSA or SFI are also ISO certified.
- Further increases in area certified are anticipated under all standards.
- **Maps:** (none)

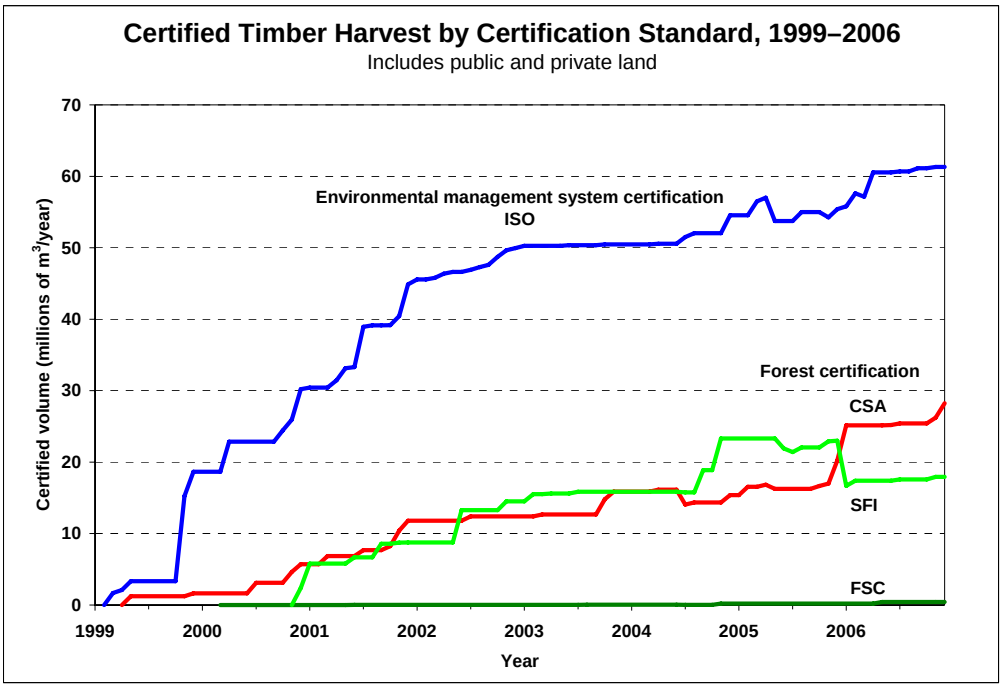
Information

- Certified areas generally include lakes, alpine areas and other non-forest land within certified forest management units.
- Data on areas certified are publicly available, but not always accurate.
- **References:** CSFCC; MFR's Forest Certification

Related international and national indicators:
MP (none)
CCFM (none)

Governance and Support Indicator 24-3

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



Why is this important?

Each standard's acceptance by the forest industry and its customers is most clearly shown by the volume of timber certified.

State and Trend

- By late 2006, operators with forest certification accounted for over 47 million m^3/year, or 49% of government-set allowable annual cuts (AACs) plus the average harvest from private land not subject to AACs.
- The CSA certified volume was about 28 million m^3/year by late 2006. In March 2005, the CSA certification was endorsed by the Programme for the Endorsement of Forest Certification[39] (PEFC), thereby improving access to European customers.
- The FSC certified volume was 0.4 million m^3/year. Only one major operator in B.C. has obtained FSC certification.
- The SFI certified volume was about 18 million m^3/year. Certification under this standard is widely recognized and sought in the U.S.A., B.C.'s main market. The SFI standard was endorsed by the PEFC in December 2005.
- Including the ISO 14001 standard, the total volume certified by late 2006 was 69 million m^3/year, or 73% of the sum of AACs and private land harvests.
- Further increases in certification are anticipated under all standards.
- **Maps:** (none)

Information

- Volumes are based on government-set AACs of forest management units or portions of them, and on certified harvests from private land.
- Data on volumes certified are publicly available, but not always accurate.
- **References:** CSFCC; MFR's Forest Certification

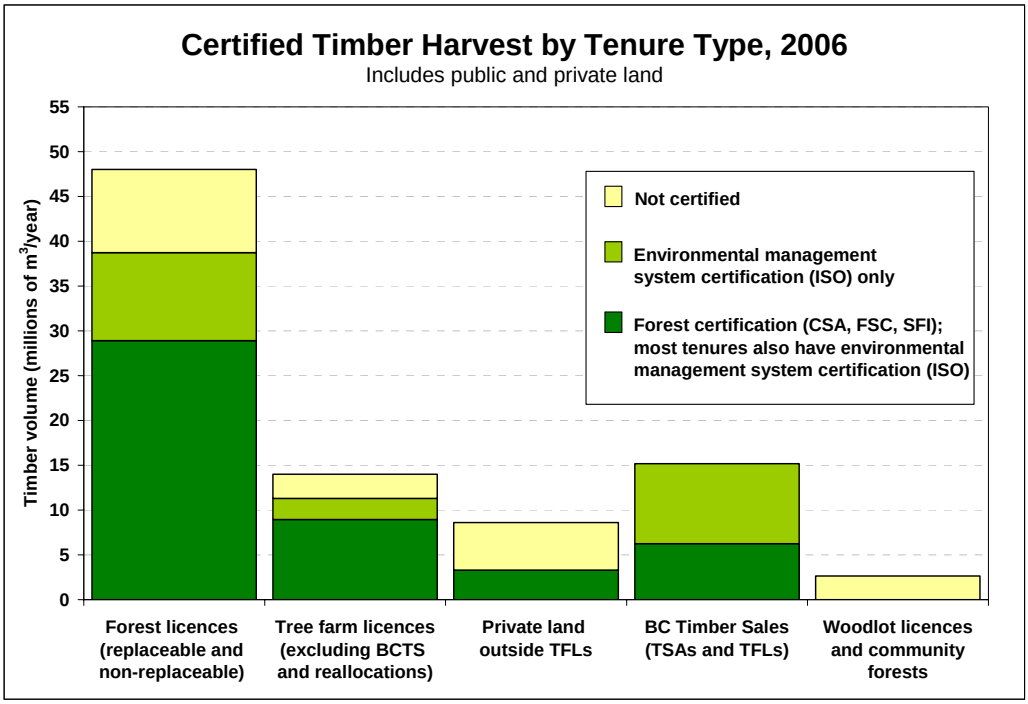
Related international and national indicators:

MP (none)

CCFM (none)

Governance and Support Indicator 24-4

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



Why is this important?

The various tenure types are subject to different market incentives and costs of certification.

State and Trend

- Large, long-term tenures have the highest rates of forest certification. They include volume-based forest licences (60%), area-based tree farm licences (TFLs; 64%) and private land outside TFLs (38%).
- These tenure types account for almost 80% of the provincial harvest, and are mostly held by large operators. These operators seek certification to satisfy customer demand for certified products. Many are members of the Forest Products Association of Canada, which required forest certification of member operations by the end of 2006.
- BC Timber Sales (BCTS), a division of MFR formed in 2003, primarily sells timber sale licences, which are small, short-term tenures on public land. By the end of 2006, BCTS had obtained forest certification for 41% of its allocated volume, with more under way in response to customer demand and BCTS forestry objectives.
- The cost of certification is prohibitive for most holders of small woodlot licences and community forests, but for some it is a matter of principle. The rate of forest certification for these tenures is 0.2%.
- Including the ISO 14001 standard, the 2006 rate of certification for each tenure type was 81% for forest licences, 81% for TFLs, 38% for private land outside TFLs, 100% for BCTS, and 0.3% for woodlots and community forests.
- **Maps:** Forest Management Units

Related international and national indicators:
MP (none)
CCFM (none)

Information

- Volumes by tenure type can be derived from publicly available data.
- **References:** CSFCC; MFR's Forest Certification, Apportionment

Certification

Ministry of Forests and Range's assessment

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, and is intended to be a guarantee of 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.

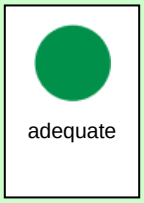
In terms of area certified, B.C. is a world leader in forest certification. About 56% of the relevant public and private land base and 49% of the total provincial harvest are certified under a sustainable forest management standard. Including the ISO standard for environmental management systems, 75% of the relevant land base and 73% of the harvest are certified.

Trend

Since 1999, about half of the province's relevant public and private land base and timber harvest have been certified under the CSA and SFI forest certification standards. Only relatively small areas and volumes have been certified under the FSC standard. BC Timber Sales has CSA certification for 41% of its volume and more forest certification is under way.

Including the ISO 14001 certification, three quarters of the land base and timber harvest have been certified under one or more systems since 1999. BC Timber Sales accounts for a large part of the increase in ISO 14001 and CSA certification since 2004.

Information



The Canadian Sustainable Forestry Certification Coalition monitors certified areas and volumes for all of Canada and publishes its data, but the data are not always accurate. The MFR also monitors certified areas and volumes. Certified areas and volumes by tenure types are not tracked explicitly, but can be derived from publicly available data.

Appendix 1: International and National Criteria and Indicators

The Montréal Process, 1995 (1999)

This list of indicators 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

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

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

6.1c Supply and consumption of wood and wood products, including consumption per capita
6.1d Value of wood and non-wood products production as percentage of GDP
6.1e Degree of recycling of forest products
6.1f 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.d 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, 2003

The Canadian Council of Forest Ministers published its first list of indicators of sustainable forest management in 1995. A shorter, updated list was published in 2003.
Taken from *Defining Sustainable Forest Management in Canada: Criteria and Indicators 2003* (found at http://www.ccfm.org/ci/CI_Booklet_e.pdf).

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)
1.3.4 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

1.1. Rate of compliance with locally applicable soil disturbance standards. (Core Indicator)
1.2. Rate of compliance with locally applicable road construction, stream crossing and riparian zone management standards. (Core Indicator)
1.3. 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).

Maps

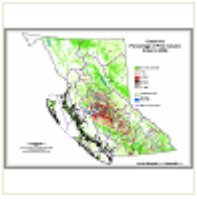
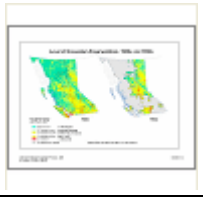
The maps used to illustrate the indicators are listed below, showing availability in one or more of three formats:

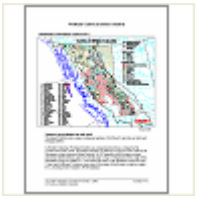
1. PDF (for printing from the State of British Columbia's Forests website)
2. HTML (for viewing on State of British Columbia's Forests website)
3. Interactive HTML (on the BC Forest Information website)

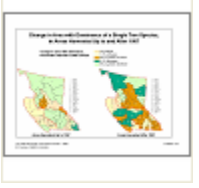
The interactive maps include a zoom function. Several layers can be turned on to show cities and towns, highways, protected areas, private land, agricultural areas and other features. A few layers also have pop-up text for the names of features such as protected areas and ecosections.

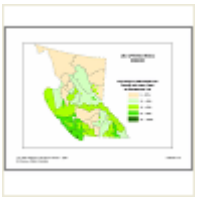
Map Title	Thumbnail	Files
Environmental Indicators		
Forest Land, 2000		PDF (1.3 MB) HTML Interactive
Predominant Tree Species, 2000		PDF (1.3 MB) HTML Interactive
Forest Age, 2000		PDF (1.3 MB) HTML Interactive
Old Growth, 2000		PDF (1.3 MB) HTML Interactive
Biogeoclimatic Zones, 2000		PDF (1.3 MB) HTML Interactive
Land Use Conversion, 2000		PDF (1.2 MB) HTML Interactive

For PDF and HTML maps, see:
www.for.gov.bc.ca/hfp/sof/

Map Title	Thumbnail	Files
Environmental Indicators		
Protected Areas, 2002		PDF (1.2 MB) HTML Interactive
Protected Areas & Special Management Zones, 2002		PDF (1.2 MB) HTML Interactive
Level of Forest Protection by Ecosection, 1991 and 2002		PDF (0.2 MB) HTML
Level of Land Protection by Ecosection, 2002		PDF (1.2 MB) HTML Interactive
Pine Volume Killed, 2004 Observed		PDF (2.6 MB) HTML
Pine Volume Killed, 2011 Projection		PDF (2.7 MB) HTML
Level of Ecosystem Fragmentation, 1980s and 1990s		PDF (0.1 MB) HTML
Intact Areas, 1980s/1990s		PDF (0.1 MB) HTML

Map Title	Thumbnail	Files
Environmental Indicators		
Population Trends of Selected Forest-Associated Species, 2006		PDF (0.1 MB) HTML
Species Range – Caribou, 2004		PDF (0.3 MB)
Species Range – Moose, 2000		PDF (0.1 MB)
Species Range – Elk, 2000		PDF (0.1 MB)
Species Range – Grizzly Bear, 2004		PDF (0.2 MB)
Species Range – Cougar, 2007		PDF (0.1 MB)
Species Range – Vancouver Island Marmot, 2004		PDF (0.1 MB)
Species Range – Pacific Water Shrew, 2006		PDF (0.1 MB)

Map Title	Thumbnail	Files
Environmental Indicators		
Species Range – Pileated Woodpecker, 2005		PDF (0.1 MB)
Species Range – Spotted Owl, 2004		PDF (0.1 MB)
Species Range – Marbled Murrelet, 2004		PDF (0.1 MB)
Species Range – Rocky Mountain Tailed Frog, 2004		PDF (0.2 MB)
Species Range – Rubber Boa, 2003		PDF (0.1 MB)
Species Range – Coho Salmon, 1999		PDF (0.1 MB)
Species Range – Tall Bugbane, 2004		PDF (0.1 MB)
Change in Area with Dominance of a Single Tree Species, in Areas Harvested Up to and After 1987		PDF (0.1 MB) HTML

Map Title	Thumbnail	Files
Environmental Indicators		
In Situ Conservation of Genetic Resources of Forest Trees – Western Redcedar (*Thuja plicata*), 2001		PDF (0.1 MB) HTML
Natural Stand Seed Planning Zones, 2004		PDF (9.0 MB)
Use of Select Seed, 2002/03		PDF (0.1 MB) HTML
Economic and Social Indicators		
Land Ownership, 2000		PDF (1.2 MB) HTML
Forest Management Units (TFLs and TSAs), 2006		PDF (3.7 MB)
Forest Regions and Districts, 2003		PDF (0.2 MB) HTML
Local Timber Supply Forecast, 2000–2050		PDF (0.1 MB) HTML
NSR Areas Harvested Pre-1982, 2002		PDF (0.1 MB) HTML

Map Title	Thumbnail	Files
Economic and Social Indicators		
NSR Areas Harvested 1982–87, 2002		PDF (0.1 MB) HTML
Wood Processing Mills, 2004		PDF (6.2 MB)
Forest Sector Vulnerability, 2001		PDF (0.2 MB) HTML
Dominant Income, 2001		PDF (0.1 MB) HTML
First Nations Bands, 2006		PDF (5.6 MB)
First Nations Agreements, 2002/03–2005/06		PDF (0.1 MB) HTML
Bands with Traditional Use Projects, 2003		PDF (0.1 MB) HTML
Strategic Land Use Plans in British Columbia, 2006		PDF (1.0 MB) HTML

Endnotes

Forest Management in British Columbia: An Overview

1. 1956**,** Public Inquiries Act – Report of the Commissioner relating to The Forest Resources of British Columbia / The Honorable Gordon McG. Sloan, Commissioner. pp. 398-399.

   The following full quote of H.R. MacMillan appears in a section titled Future Trends Affecting Policies:

   "Let us think how long is ninety years. What has happened to stable countries in the last ninety years?

   "United States has ended its Civil War and engaged in two World Wars. Its population has grown from 35 million to 165 million.

   "The population of California has grown from 470,000 to 13 million.

   "Ninety years ago Canada extended only from the Strait of Belle Isle to the Lake of the Woods, and northerly to James Bay. Now it is a Confederation of 10 Provinces extending from the Island of Newfoundland in the Atlantic to the Queen Charlotte Islands in the Pacific, and from the Northern boundary of United States to the Northern boundary of Russia.

   "The population of Canada has grown from 3 million to 15 million, and that of British Columbia from 30,000 to 1,500,000.

   "Within 30 years our old political parties have virtually disappeared in important areas. Completely new political parties have arisen, grown and taken command of Canada's three most Western Provinces.

   "Income taxes have come to Canada.

   "France has been three times invaded by the Germans. France has had 125 Governments.

   "The Russian monarchy was assassinated and succeeded by a Communist Government.

   "The British barely survived two world wars. They have departed from India, Burma, Ceylon and China, where they had dominated affairs for over a century.

   "Albania, Bulgaria, Czechoslovakia, Estonia, Hungary, Latvia, Lithuania, Poland and Romania, nine sovereign countries, have disappeared behind the Iron Curtain.

   "China has driven out the foreigner and gone Communist.

   "Japan abandoned her age-long isolation, defeated China and Russia, established an Empire, which included Formosa, Korea, Manchuria, the Pacific Islands, became one of the four World Powers, took on one World War too many, and is crowded back on to her original Islands, facing an uncertain future.

   "Spain and Holland have been expelled from and lost their Philippine and Indonesian Island Empires.

   "Human habits have changed equally drastically. Wireless communication, the internal-combustion engine, the aeroplane, atomic fission and fusion, plastics and man-made fibres have been invented. Nickel and aluminum have been produced commercially. The ***per capita use of lumber*** has dropped by over 50 per cent. Who shall say what further changes will affect the value of the crop by the end of the rotation the Licensee is now starting?"

Indicator 1 – Ecosystem diversity

2. Several factors influence the accuracy of area, species and age data.

   Area: The Coast/Interior boundary for 1957 is not the same as the one for 2000. The

total area considered Coast was 16.4 million ha in 1957 and 17.6 million ha in 2000, or 1.2 million ha greater in 2000. This was primarily a matter of where people chose to draw lines on a map with consideration of complex terrain and boundaries of administrative units such as tree farm licences. The forest area in the Coast was 6.953 million ha in 1957 and 9.757 million ha in 2000, or 2.8 million hectares greater in 2000. Only part of this change is explained by the change in land base. Much of the change is likely due to changes in inventory methods, especially photo-interpretation. Some marginal forests near mountain tops probably got counted in 2000 that did not get counted in the 1950s.

Species: Large shifts in the proportions of predominant species occur between the 1957 and 2000 inventories. These shifts are probably primarily due to changes in inventory methods, not changes in the forest. Species composition is largely based on photo-interpretation, and improvements in methods and experience between 1957 and 2000 suggest that fewer errors in species identification occurred in the 2000 inventory. Inventory audits in the 1990s showed that the inventory's species were reasonably accurate when summarized for a whole forest management unit (timber supply area or tree farm licence). For individual stands, species recorded in the inventory are not always reliable.

Age: After a century of harvesting older forests on the Coast, it is reasonable to expect a decrease in the proportion of old age classes and an increase in young age classes. The increase in young age classes is supported by the data: the 1–40 year age class increased from 12% to 14%, and the 41-80 year class from 7% to 10%. However, the 250+ year age class also increased, from 2.211 million ha to 4.150 million ha, or from 32% to 43%. This is explained by several factors: the changes in forest area, aging of forests, and the difficulties of estimating age. (1) Much of the 2.8 million ha increase in area of forests in the Coast is likely due to the inclusion of high elevation forests in the 2000 inventory, but not the 1957 inventory. Most of these high elevation forests can be expected to be older forests. (2) The age class of 161-250 year forests decreased from 26% to 12%. This reduction occurred when these forests were logged or grew older and moved up into the 250+ year class. As much as 0.6 million ha may have moved up from the 161-250 age class to the 250+ age class. (3) Estimation of age in older forests (over 120 years old) is difficult and therefore prone to misclassification. Trees that are estimated to be 200 years old may actually be 500 years old, and vice versa. Chances of estimating the wrong age class for an individual stand are considerable (perhaps 1 in 2), but many of the errors tend to cancel out at the forest level. Nonetheless, since personnel and estimation methods both change over time, it's hard to know whether a systematic bias may exist in one or both inventories. Conceivably, there are systematic biases in opposite directions in the two inventories. This could account for some of the shift between the 160-250 and 250+ year age classes.

Conclusion: Comparisons of area and species do not provide reliable trend information. Age class trends are reasonably reliable, but only on a proportional basis, due to the increase in forest area. The inventory audits done in the 1990s showed that the recent inventory data were fairly reliable across the province, with some biases apparent in a few management units. These audits were done in a statistically sound way, using random sampling. We can therefore be reasonably confident about the data for 2000.

Indicator 3 – Ecosystem dynamics

3. The mountain pine beetle epidemic is attributed to the combined effect of fire suppression that increased the beetle's food supply (mature lodgepole pine), and warm winters that increased survival of beetles to the next year. The warmer winters are part of ongoing climate change in B.C.

4. Woods, A., D. Coates and A. Hamann. 2005. Is an unprecedented Dothistroma needle blight epidemic related to climate change? BioScience, Vol. 55, No. 9, pp. 761-769.

5. The increase in biomass levels from 1950 to 2000 is likely overestimated due to the underestimate of the age of the forests in 1950, and to the underestimate of the area disturbed by fire and harvesting. If forests in 1950 are, on average, older, they will be accumulating less biomass over time, and any disturbances in these forests will cause a larger decrease in biomass. The model does not adequately represent changes in growth curves before or after a disturbance event. Thus, forests in 1950 that are disturbed prior to 2000 are assumed to be growing on a second-growth yield curve, even if they represent old growth forests. In addition, changes in species or regeneration delays after disturbances are not captured by the model.

6. The oil and gas industry's increasing impacts on forests and the forest industry are a growing concern. Wells, roads, pipelines and seismic lines directly cover more than 130,000 ha of land, including over 26,000 ha of forest in the timber harvest land base (THLB), in the three timber supply areas in north-eastern British Columbia. These developments reduce the amount of timber available to the forest industry, reduce future timber productivity and fragment much larger areas of forest ecosystems.

   For most oil and gas developments, the volume of timber removed and its value (stumpage payable to government) are estimated from the area that is cleared. Measuring the timber itself is not required on well sites and associated access, on seismic developments or on pipeline segments that remove less than 2000 m^3, nor is it practical given the nature and density of these linear developments. The Ministry of Forests and Range receives final (as-built) plans delineating the area of oil and gas developments, and charges an area-based stumpage rate. The stumpage rate is based on the value of the district's productive forest averaged across the total land base, and includes a nominal silviculture levy for reforestation. It does not include a value for immature forest, so the potential value associated with immature, free-growing forests affected by developments is foregone. For a limited number of oil and gas development projects, timber volumes and stumpage revenues are appraised based on the timber harvested and hauled to a processing facility, rather than the area.

   The Ministry of Forests encourages hauling timber to a mill, but does not require it for areas where the area-based stumpage is applied. Similarly, where there is no plan to use the timber, the ministry encourages, but does not require, hazard abatement by piling and burning to prevent wildfires and pest outbreaks. The volume of timber that is left unused can only be estimated from field inspections or the forest inventory.

   Forest productivity is reduced by wells, roads and pipelines that are installed for 10-20 years or more, and the forest areas affected are permanently removed from the THLB considered in allowable annual cut determinations. Exploration activities (seismic lines) are less permanent and affected areas are not removed from the THLB. Seismic lines can vary from low impact (less than 1 metre wide) to caterpillar tractor swaths exceeding six metres, and there is no requirement to reforest them. Future timber productivity is reduced on these parts of the THLB, due to loss of immature trees and soil disturbance, but the magnitude of the loss is uncertain.

   Fragmentation of forest ecosystems by oil and gas developments affects the habitats of many species over large areas. The information available is limited.

   The Peace Forest District is the district with the largest area of oil and gas industry developments. It covers 7.7 million ha (8.1% of B.C.), consisting of the east slopes of the Rocky Mountains, foothills and boreal plains, and encompasses the cities of Dawson Creek, Chetwynd, and Fort St. John. In 2004 and 2005, the oil and gas industry removed trees from approximately 14,000 ha annually, exceeding the approximately 12,500 ha

harvested annually by the forest industry. Stumpage paid by the oil and gas industry in 2004 and 2005 was about $5 million and $6 million, compared with the forest industry's $28 million and $39 million. The higher rates paid by the forest industry are explained by the industry's targeting of more productive and more mature forests, and the certainty provided by measuring the actual timber harvested. The process for estimating stumpage for the oil and gas industry may be somewhat underestimating the actual timber volumes removed.

While the impacts of the oil and gas industry on forests and the forest industry are significant, this should be considered in the context of the substantial economic activity and government revenues generated by the oil and gas industry.

Indicator 4 – Species diversity

7. Species composition after harvest can be determined at two points: 1) the regeneration date, when a new stand is reported as established by natural regeneration or planting, and 2) the free growing date, when a stand is declared free growing and the reforestation obligation has therefore been met. The regeneration date is usually within five years after harvest. The free growing date is usually between 10 and 20 years after harvest, depending on a site's productivity, the size and quality of the planted trees, the quality of the planting effort and subsequent brushing where required.

   Species composition at the regeneration date may not reflect the anticipated species composition of the future mature stand, since natural establishment of additional species may be expected to occur after the regeneration date. Species composition at the free growing date usually reflects the final composition more closely, and was therefore chosen for analysis in Indicator 4-4. Since the analysis is limited to stands for which species composition data were available for before harvest and at the free growing date after harvest, possible changes in species composition trends within the last 10-15 years are not reflected.

   This shortcoming is partly addressed by a Forest Practices Board report based on harvests between 1995 and 2004. The report is based on species composition before harvest and at the regeneration date. It shows that planting practices in three forest districts with high mountain pine beetle impacts shifted in response to the mountain pine beetle epidemic. In these districts, the proportion of forests dominated by one species (lodgepole pine) increased after harvests before 2000 and was unchanged in areas harvested after 2000. In 18 other districts (with almost four times the area harvested) that are less affected by mountain pine beetle, proportions of forests dominated by one species (lodgepole pine) increased from 9% before harvest to 12% after harvest in areas harvested before 2000 and from 12% to 21% in areas harvested after 2000. For all Interior districts combined, the proportion of post-harvest areas dominated by lodgepole pine increased 6% relative to the pre-harvest proportion during the period 1995–2004. The widespread increase in forests dominated by one species after 1987, shown in the Indicator 4-4 analysis based on the free growing date, appears to be continuing in most of the Interior.
   http://www.fpb.gov.bc.ca/special/investigations/SIR15/SIR15.pdf

Indicator 11 – Ownership and management

8. On public land where First Nations interests are identified, timber harvesting activities can be restricted through the creation of a designated area. This protects resource values during treaty negotiations. Current designated areas cover approximately 35,000 ha.

9. Logs harvested from land owned by the province are also subject to a fee in lieu of manufacturing within the province and various restrictions on grades. For example, western redcedar logs and large old growth logs cannot be exported; only logs of various lower grades can be exported.

10. The 1976 royal commission on forestry in B.C. reported that 59% of the committed allowable cut was held by the top 10 companies. The committed allowable cut represents the operationally feasible level of harvest at the time. This was considerably lower than the sum of AACs set by government, which were more theoretical, based on Hanzlik's formula. The top 10 companies held 43% of the sum of AACs. After 1980, new analytical techniques narrowed this gap between theoretical AAC determinations and operationally feasible harvest levels.
http://www.for.gov.bc.ca/hfd/pubs/Docs/Mr/Rc/Rc007/Rc007-2.pdf
(Appendix B, Table B-9 on page B 7)

11. Companies listed in MFR's timber apportionment reports that hold tenures with combined AACs totalling 100,000 m^3 or more are deemed large operators in this report. An AAC of 100,000 m^3 or more is sufficient to run a large sawmill. A few joint ventures and BCTS operators with commitments over 100,000 m^3 are not included in the count.

12. Individuals and companies holding tenures with AACs and non-AAC commitments totalling less than 100,000 m^3 are deemed small operators in this report.

Indicator 13 – Timber harvest

13. Current timber supply forecasts may be underestimating mountain pine beetle impacts.

14. For the sum of all TSAs and TFLs, the timber supply for 2000 was 12% higher than the average harvest in the 1990s. This suggests that decreases of more than 12% by 2050 may result in localized economic impacts.

Indicator 14 – Silviculture

15. The nomenclature for clearcuts with reserves and variable retention is not yet applied consistently. In some cases, practices on the ground have not changed significantly.

16. Contiguous cutblocks may create openings that are larger than an individual cutblock. In 1989, guidelines to restrict contiguous cutblocks (overall opening size) varied across the province, and large openings consisting of many cutblocks were permitted in some areas. In 1995, the *Forest Practices Code Act* limited opening size to 40 ha in the three southern forest regions and 60 ha in the three northern forest regions. For an evaluation of the effect of this regulation, see:
http://www.for.gov.bc.ca/hfp/frep/publications/reports.htm#rep03

17. Even though natural regeneration could be expected to fulfil reforestation obligations in many situations, planting was increasingly chosen because it serves one or more additional purposes:

    1) Increasing growth rates. Planting, especially with seedlings grown from select seed, increases volume at harvest, typically in over 60 years on the Coast and 80 years in the Interior. This increase in future timber supply may permit changes in harvest schedules that justify short-term and mid-term increases in the allowable annual cut.
    2) Shortening the time required for "green-up" of the harvested area. This makes

adjacent areas available for harvest sooner, and can increase short-term and mid-term timber supply.
3) Reduction of liabilities for reforestation. The risk, and attendant costs, of failure to meet reforestation obligations with natural regeneration may be reduced by planting. If brush takes over a naturally regenerated site, treatments to remove the brush and plant trees can be very expensive.

Planting within a few years after harvest is called "current planting," in contrast to later or overdue planting called "backlog planting." Current planting has increased as a proportion of area harvested.

18. The 1979 Forest and Range Resource Analysis reported 1.1 million ha of NSR. The 1984 Forest and Range Resource Analysis reported 1.6 million ha of backlog (pre-1982) NSR on Crown land, of which 738, 000 ha were on good and medium sites, and considered economically treatable. The largest area of NSR was 2.1 million ha in 1990, reported in Table 6 of the Ministry of Forests annual report for 1990/91.
http://www.for.gov.bc.ca/hfd/pubs/docs/mr/annual/ar_1981-93/annual_1991.pdf

    In 1987, the government created legal obligations to reforest areas denuded by harvesting, fire, insects and diseases, with the forest industry explicitly responsible for reforesting the areas it harvests. In 1995, the *Forest Practices Code of British Columbia Act* re-defined a backlog area as "an area from which the timber was harvested, damaged or destroyed before October 1, 1987; and, which in the district manager's opinion, is insufficiently stocked with healthy, well-spaced trees of a commercially acceptable species." This led to reporting of both pre-1982 and 1982–87 backlog NSR statistics for Crown land, with government responsible for funding reforestation of both. By 2002, extensive planting programs succeeded in reducing these backlog areas to 36 927 ha of treatable pre-1982 backlog NSR on good and medium sites, and 33 585 ha of treatable 1982–87 backlog NSR on good, medium and poor sites.
(Ministry of Forests. 2002. Summary of backlog NSR, impeded, and free growing forest land – 2002.)
http://www.for.gov.bc.ca/hfp/publications/00066/2002BacklogNSR.pdf

    By 2002, the total NSR area had been reduced to 0.6 million ha, approximately equal to three years of timber harvesting. Most of this NSR was "current" – the time since it was created by recent logging or other disturbances had not exceeded the legal time limits for reforestation. The 1.5 million ha reduction from 2.1 million ha in 1990 to 0.6 million ha in 2002 was achieved through a combination of planting and natural regeneration. It also included about 0.4 million ha that were reclassified from NSR forest to non-productive lands because their initial classification as NSR was inappropriate.

19. In 2002, the obligation to reforest areas denuded by wildfire, insects and diseases was removed from legislation. Government considers reforestation of these areas an investment that is weighed against other options for use of available budgets.

    The current mountain pine beetle epidemic has killed pine trees on over 8,000,000 ha, and the catastrophic wildfires of 2003 and 2004 disturbed 490,000 ha. With respect to NSR status, these areas fall into three categories:

    1) Protected areas. Most areas in parks and some areas outside parks will be left as is for environmental reasons, and the NSR classification and reforestation obligations do not apply.
    2) Salvage logging. Some areas have been or will be salvage logged. Thereupon they become surveyed NSR areas with a legal obligation to reforest. These areas are or will be included in the data for the graph for Indicator 14-2. Salvage logging of areas less than one hectare in size does not carry an obligation to reforest. This exception is significant, as the cumulative extent of these areas is considerable, and

policies to address this are under consideration.
3) Other. About 60,000 ha disturbed by wildfire, and probably over 1,000,000 ha with dead timber left standing after the beetle infestation, are outside parks and will not be salvage logged. Surveys of these areas are ongoing. Based on the surveys and analysis of expected returns from planting, decisions will be made for individual areas whether to invest in planting. The primary benefits expected from planting may be economic or environmental. These areas are or will be included in the data for the graph for Indicator 14-2. The Forests For Tomorrow program was established to reforest these areas.
http://www.for.gov.bc.ca/hfp/fft/

20. Private land falls into three main tenure categories with differing obligations for reforestation:

    1) Private land within tree farm licences is subject to the same detailed regulations as public land.
    2) Private land outside tree farm licences that is classified as "private managed forest land" under the *British Columbia Assessment Act* receives a beneficial tax status in return for commitments to manage the forest. The commitments include an obligation to reforest after harvest, but the requirements are less stringent than on public land.
    3) Other private land is not subject to any reforestation obligations.

21. Disturbance and reforestation are reported in the Ministry of Forests and Range annual report table "Changes in the Not Satisfactorily Restocked (NSR) Crown Land." The data are taken from the RESULTS database. Disturbance data are shown by category as "Additions in NSR due to: Harvesting; Fire; Pests; Other disturbances; Plantation failure; Natural regeneration failure." Reforestation data, based on surveyed areas that have achieved free-growing status of commercially desirable tree species, are shown by category as "Reductions in NSR due to: Planting; Natural regeneration; Reclassification of NSR to non-productive land." The data are further split into several categories of responsibility for reforestation.

22. The Ministry of Forests and Range recognizes that data capture has been incomplete in recent years and is directing resources to rectify this situation.

    Disturbance areas (additions in NSR) in the RESULTS database are demonstrably incomplete if they are less than the area harvested (independently reported from another database for tenure administration). The area of disturbance in RESULTS should be greater than the area harvested, since it includes timber harvest and several other types of disturbance. From 1998/99 onward, this condition is not met (even though the area harvested is conservatively based on clearcutting and variable retention only; and does not include partial cutting silvicultural systems.) This shows that the disturbance data are incomplete, due to shortcomings in one or more of the following: 1) data entry by tenure holders, and 2) data entry by the ministry.

    Reforestation areas (reductions in NSR) in the RESULTS database are demonstrably incomplete if the area of successful reforestation by planting falls far below the area planted 5-15 years earlier. The area planted in one year should result in a similar area successfully reforested 5-15 years later, with some reduction (less than 20%) due to plantation failures. In 2004/05, the reforestation area due to planting decreased by half from the preceding years, without an accompanying increase in plantation failures, and did not reflect area planted in earlier years. This shows that the reforestation data are incomplete, due to shortcomings in one or more of the following: 1) surveys of free-growing status, 2) data entry by tenure holders, and 3) data entry by the ministry. Although not as apparent as in 2004/05, reforestation data are likely also incomplete for other years (1998/99 onward).

23. The risk and opportunity cost of tying up money in an investment is compounded over time. Since the time between an investment (e.g., planting) and its return (e.g., greater volume at timber harvest) is usually several decades in British Columbia, the financial return on investment and net present value of silvicultural treatments in B.C. are typically low. A financial analysis based on expected timber volume for an individual treatment area can be argued to be too simplistic, as it ignores forest-level effects on allowable harvests, increased ecological services and social benefits such as employment that may result from silvicultural investments. A more inclusive economic analysis that considers more aspects of sustainability should typically suggest higher returns than a simple financial analysis. Concern that reforestation investment decisions based on financial analysis alone would result in passing greatly diminished forests to future generations led to the 1987 legislation that made reforestation an obligation tied to current harvests.

24. The 6 million m^3 gain from planting is based on about 150,000 ha planted annually and a gain of 40 m^3 per ha at the time of harvest, relative to the alternative of natural regeneration of satisfactorily restocked forests. This modest gain applies in the context of legislation that requires successful reforestation by one or another means. In the absence of such legislation, the benefit from planting would likely be 300 m^3 per ha or more for forests on the more productive, moist areas that tend to become covered by competing vegetation if not planted and brushed.

25. Cumulative volume gains were estimated for 65 years of growth using the following average annual rates per hectare:

    - 0.50 m^3 planting one to three years after logging (relative to satisfactory natural regeneration)
    - 2.93 m^3 backlog planting (relative to a NSR site, overgrown by competing vegetation)
    - 0.40 m^3 fertilizing
    - 0.25 m^3 spacing (see below)
    - 0.41 m^3 select seed (average gain in 2004/05, adjusted for lower and higher genetic quality in earlier and later years, respectively)

    Site preparation before planting can improve planting success. No gain was calculated for site preparation before planting, as it is included in the gain from planting. Gains from site preparation to improve natural regeneration success were not estimated.

    Similarly, brushing may be necessary on some sites to ensure successful reforestation. No gain was calculated for brushing after planting, as it is included in the gain from planting. Gains from brushing to maintain acceptable tree growth after natural regeneration were not estimated.

    Spacing reduces competition among trees by reducing the number of trees per unit area and thereby provides more growing space, nutrients, water and light to the trees that are kept for future harvest. These crop trees often respond with increased diameter and merchantable volume growth. However, spacing directly reduces the standing total volume and total photosynthetic capacity (volume productivity) at the time of treatment, and research has shown that total (gross) volume per unit area at the time of harvest typically does not exceed that of an untreated area. On the other hand, spacing can cause crop trees to reach harvestable size (diameter) sooner, and permit greater merchantable volumes to be harvested by a given date than would be commercially feasible without spacing. The combined effects at the forest level, involving many areas treated and harvestable at different times, are complex and can vary from one forest to another depending on age class distribution and other factors.

26. Increased use of contractors reduces direct employment and increases indirect employment as a proportion of total forest-based employment. For example, accounting that was previously performed by staff of a forest company may now be contracted out to staff of an accounting firm. The previous employment was classified as being in the forest sector; the new employment in the accounting firm is classified as being in another sector that supports the forest sector.

27. Tourism businesses do not correspond to a standard industrial classification, so an employment record is not directly available. Special studies use published employment trends of related industries tracked by Statistics Canada. Employment in commercial nature-based tourism is for the base year 2001 with adjustments to persons (rather than full-time equivalents) and activities reliant on the forests (Characteristics of the Commercial Nature-Based Tourism Industry in British Columbia. Tourism British Columbia, January 2005). The sector is assumed to have a similar employment growth profile as the "R.V. Parks and Recreation Camps" industry category reported in the Labour Force Survey for subsequent years.

28. Employment in non-timber forest products (NTFPs) industries is not well documented. NTFPs are an important source of employment, but a reliable quantitative estimate comparable to the other forest-related industries is not currently available. Statistics Canada employment numbers for the industry "Forest Nurseries and Gathering of Forest Products" are suppressed, because there are fewer than 1,500 persons employed in the broader industry classification.

    "The commercial harvest of NTFPs has been occurring for several decades and is believed to be expanding. One study (Wills and Lipsey, 1999) estimated that in 1997 the commercial harvest of wild mushrooms, floral greens and other products employed almost 32,000 people on a seasonal or full-time basis, which generated direct business revenues of $280 million and overall provincial revenues in excess of $680 million. However, there is a lack of recent economic data available for the industry in BC and what does exist is based on rough estimates."
    (Forest Practices Board, 2004. Integrating Non-Timber Forest Products into Forest Planning and Practices in British Columbia.)
    http://www.fpb.gov.bc.ca/special/reports/SR19/SR19.pdf

    NTFPs cover a wide range of products, the more commercially important being edible mushrooms and floral greens. Picking occurs for commercial and personal purposes in several regions of the province. The activity is not presently tenured by the Ministry of Forests, and participation in the industry is not well documented, although some research has been completed.
    (Ministry of Forests. March 2000. Seeing the Forest Beneath the Trees: The Social and Economic Potential of Non-Timber Forest Products and Services in Queen Charlotte Islands/Haida Gwaii.)
    http://www.for.gov.bc.ca/ftp/Het/external/!publish/web/non_timber_forest_products/qcismf~1.pdf

    Royal Roads University, in Victoria, recently established a post-secondary education program to assist expansion of NTFPs industries.
    http://www.royalroads.ca/programs/faculties-schools-centres/non-timber-resources/ntfp/

29. The gross domestic product (GDP) of timber-based industries averaged $6.7 billion annually in the late 1980s (1987 to 1989 inclusive) and $8.4 billion annually in the early 2000s (2000 to 2002 inclusive). The GDP of all industries increased from $65.0 billion in the late 1980s to $123.4 in the early 2000s. All figures in current dollars. Timber-based industries include Forestry and Logging, Wood Product Manufacturing and Pulp and

Paper Manufacturing as defined in the North American Industry Classification System (NAICS). See: BC Stats. The BC economic accounts: BC gross domestic product at basic prices, by industry – NAICS aggregations.
http://www.bcstats.gov.bc.ca/data/bus_stat/econ_acct.asp

30. Basic income is defined as income that flows into the community from the outside world, in the form of either employment income or non-employment income.

    Basic employment income is earned in jobs that produce goods and services that are exported outside the community, jobs that produce tourism goods and services that outsiders pay for with money earned elsewhere, and public sector jobs paid for by senior governments and not directly by local residents. These include “direct employment” jobs in the forest sector (timber-based industries in this analysis), tourism, and eight other sectors, along with “indirect employment” jobs in businesses supplying goods and services to these 10 basic sectors.

    Basic non-employment income includes transfer payments from senior governments, such as welfare payments and employment insurance benefits; and other types of income such as investment income, retirement pensions, and alimony.

    In addition to jobs that provide basic income, communities also support jobs in the community that provide goods and services to individuals who live in the community. Examples include the retail trade, local financial services, taxis and hairdressers. Income from these jobs is called nonbasic income, nonbasic employment income or “induced employment” income, and is not included in calculations of community income dependency, because the nonbasic sector is dependent on a healthy basic sector. (Horne, Garry. 2004. British Columbia's Heartland at the Dawn of the 21st Century: 2001 Economic Dependencies *and Impact Ratios for 63 Local Areas*. BC Stats, Ministry of Labour & Citizens' Services.)
    http://www.bcstats.gov.bc.ca/pubs/econ_dep.asp

31. The 63 local areas are based on aggregations of 527 census subdivisions used in the 2001 Census; of these 210 were Indian Reserves, many of which have small populations. (Horne, Garry. 2004. British Columbia's Heartland at the Dawn of the 21st Century: 2001 Economic Dependencies and Impact Ratios for 63 Local Areas. BC Stats, Ministry of Labour & Citizens' Services.)
    http://www.bcstats.gov.bc.ca/pubs/econ_dep.asp

32. A community is likely to be vulnerable to potential downturns in the forest sector (specifically, timber-based industries) if its basic income dependence on the sector is high and its diversity of basic incomes is low. The vulnerability index indicates the vulnerability of each local area, relative to others in the province. A high value does not mean that the timber-processing industry in a local area is more likely to shut down. Rather, it means that if a downturn occurs in the forest sector, the area will likely experience greater economic difficulties than other areas would with a similar downturn.

    The index is calculated by multiplying each local area’s basic income dependence on the timber-based sector by (100 – its diversity index), and then normalizing the products for all local areas so that the highest vulnerability is assigned 100 and the lowest is 0. (Horne, Garry. 2004. British Columbia's Heartland at the Dawn of the 21st Century: 2001 Economic Dependencies and Impact Ratios for 63 Local Areas. BC Stats, Ministry of Labour & Citizens' Services.)
    http://www.bcstats.gov.bc.ca/pubs/econ_dep.asp

Indicator 19 – First Nations involvement

33. The proportion of each joint venture held by First Nations was not available in 2005. Data for 2003 showed a share of 0.57 million m^3, representing an average 32% share of the 1.8 million m^3 in joint ventures. Assuming this 32% also holds for 2005, the First Nation share of the 2005 total of 2.2 million m^3 in joint ventures would be about 0.71 million m^3 or 0.9% of the provincial AAC.

Indicator 21 – Law

34. See annex "Related Publications."

Indicator 24 – Certification

35. Canadian Standards Association (CSA). The CSA's CAN/CSA-Z809-02 national standard for sustainable forest management certification sets public participation, system, and performance requirements for a defined forest area.
http://www.csa-international.org/product_areas/forest_products_marking/program_documents/

36. Forest Stewardship Council (FSC). The council, based in Mexico, administers a global certification process that involves an inspection of a forest management unit by an independent FSC-accredited certifier. FSC standards are based on ten principles for responsible forest management. FSC Canada coordinates the development of regional standards, including the British Columbia standard, which reflect local ecology and social circumstances.
http://www.fsc-bc.org/BritishColumbia.htm

37. Sustainable Forestry Initiative (SFI). Based in the United States of America, this program is a comprehensive system of principles, objectives and performance measures developed by professional foresters, conservationists and scientists, among others that combines the perpetual growing and harvesting of trees with the long-term protection of wildlife, plants, soil and water quality.
http://www.sfiprogram.org/

38. ISO 14001. The International Organization for Standardization (ISO) provides this standard for certification of environmental management systems that govern the environmental aspects of an organization's processes, products and services. Its requirements may be internally audited for self-declaration, or certified by a third-party audit. To ensure credibility, forest operations in B.C. obtain third-party certification.
http://www.iso.org/iso/en/prods-services/otherpubs/iso14000/index.html

39. Programme for the Endorsement of Forest Certification (PEFC). PEFC is the world's largest forest certification umbrella organisation with 32 independent national schemes in membership from all over the world. The PEFC Council (Programme for the Endorsement of Forest Certification schemes) is an independent, non-profit, non-governmental organisation, founded in Europe in 1999, which promotes sustainably managed forests through independent third party certification. The PEFC provides an assurance mechanism to purchasers of wood and paper products that they are promoting the sustainable management of forests.
http://www.pefc.org/internet/html/about_pefc.htm

Data Sources and Notes

Data tables are available from the HTML version of each indicator:
http://www.for.gov.bc.ca/hfp/sof/2006/contents.htm#indicators

FIGURE 6. Population of British Columbia, 1800–2003

Sources

Duff, Wilson. 1997. The Indian history of British Columbia: the impact of the white man. Victoria, BC: British Columbia Provincial Museum.

BC Stats. Census data from Statistics Canada prepared by BC Stats.
http://www.bcstats.gov.bc.ca/data/pop/pop/BC1867on.csv

Indicator 1 – Ecosystem diversity

Sources

Bailey, R.G. 1998. Ecoregions: the ecosystem geography of the oceans and continents. Springer-Verlag, New York, N.Y.

B.C. Ministry of Agriculture and Lands, Integrated Land Management Bureau. Baseline thematic mapping.
http://ilmbwww.gov.bc.ca/bmgs/ (Indicator 1-1)

B.C. Ministry of Forests and Range, Research Branch. Biogeoclimatic ecosystem classification.
http://www.for.gov.bc.ca/hre/becweb/resources/classificationreports/provincial/index.html (Indicators 1-1, 1-4)

B.C. Ministry of Forests and Range, Forest Practices Branch. Seamless forest cover inventory (2000) of British Columbia (available only in the ministry). (Indicators 1-2, 1-3, 1-4)

Department of Lands and Forests. 1957. Continuous forest inventory of British Columbia. Victoria, B.C. (Indicator 1-3)

Notes

1. Of the 30 global terrestrial ecoregions (Bailey, 1998), 6 are found in B.C.: Subarctic Division, Subarctic Regime Mountains, Warm Continental Regime Mountains, Marine Division, Marine Regime Mountains, Temperate Steppe Regime Mountains.

Indicator 1-1:

2. Land cover is based on baseline thematic mapping (version 1), derived from LANDSAT TM imagery, 1:70,000 aerial photographs, Ministry of Forests and Range Mapgen age class information, biogeoclimatic data, and structured digital 1:250,000 topography.

3. Biogeoclimatic zones are based on the British Columbia biogeoclimatic ecosystem classification (version 4). Since this analysis, version 4 has been superseded.

4. The Alpine Tundra (AT) and Bunchgrass (BG) zones are treeless, by definition. Vegetated areas are dominated by shrubs, herbs, bryophytes and lichens in the AT zone; and by grasses and shrubs in the BG zone. Nonetheless, forest cover inventories show

some forest in the areas mapped as AT and BG. This is the result of the combination of methods and definitions used in interpretation of satellite imagery, and of the inaccuracies in the mapping of biogeoclimatic zones. Biogeoclimatic zone maps were improved in version 5, published after this analysis.

Indicator 1-2:

5. Forest cover is from the seamless forest cover inventory (2000) for the whole province, which combined four spatial databases to provide the best data available in government in early 2001:
   a) TSA inventory: The current government inventory, used primarily for managing timber supply areas (TSAs), was used for about 90% of the province.
   b) TFL inventory: Parts of 1990s forest company inventories, used for managing tree farm licences (TFLs), were used for about 6% of the province.
   c) Park inventory: The 1957 provincial forest cover inventory, the only forest cover inventory available for part or all of 11 of British Columbia's parks, was used for about 2% of the province
   d) Proxy inventory: Baseline thematic mapping (BTM), based on LANDSAT satellite imagery from the 1990s, and biogeoclimatic ecosystem classification (BEC) at the subzone/variant level were combined to approximate forest cover for the remaining 2% of the province, primarily private land and a few protected areas.

   The first three inventories are interpreted from air photos, calibrated with ground samples and mapped at 1:20,000 scale (about 7,000 map sheets are required to cover B.C. at this scale). Tree growth was projected to January 2000 for the TSA inventory and to January 1999 for the TFL and Park inventories. Species composition of forests changes over time, but this ecological succession is not modelled in the projection. Updating for major disturbances (e.g., fire, logging) is typically done within a few years in the TSA and TFL inventories. The Park inventory was updated to the early 1990s. The Proxy inventory's land/forest cover and forest age are from BTM, and predominant species are based on species found in the TSA and TFL inventories for like combinations of forest age and ecosystem (BEC subzone/variant).

6. Proxy inventory areas 140+ years are assumed to be 250+ years. Most of these areas are coastal hemlock and western redcedar, for which adjacent areas with regular forest inventories show 250+ years.

Indicator 1-3:

7. Provincial coverage from the 1957 inventory is available only as a book with summary tables. For this analysis, tables were combined and in part pro-rated to derive the age class distributions.

8. The age class distributions for 2000 were summarized from the seamless forest cover inventory described in Notes 5 and 6.

9. The Coast/Interior boundary for 1957 is not the same as the one for 2000. Total Coast area was reported as 16.4 million hectares in 1957 and 17.6 million hectares in 2000. The forest area in the Coast is 2.8 million hectares greater in 2000 than in 1957. Only part of this change is explained by the change in land base. Much of the change is likely due to changes in inventory methods (classification).

10. "N/A" stands for age not available.

11. Terms used in the two inventories were aligned as follows:

N/A:

1957	not bearing commercial forest + selectively cut
2000	not-stocked productive (NSR, NC, NCBr) + non-productive

NSR = not sufficiently restocked
NC = non-commercial
NCBr = non-commercial brush

Age known:

1957	bearing commercial forest (productive and low site)
2000	stocked productive + all forest in Proxy inventory

Indicator 1-4:

12. See Notes 3, 4, 5 and 6 for Indicator 1.

Indicator 2 – Protected forests

Sources

B.C. Ministry of Forests and Range, Forest Practices Branch. Seamless forest cover inventory (2000) of British Columbia (available only in the ministry). (Indicators 2-1 to 2-4)

B.C. Ministry of Environment, BC Parks. http://www.env.gov.bc.ca/bcparks/ (Indicators 2-1 to 2-4)

B.C. Ministry of Agriculture and Lands, Integrated Land Management Bureau. http://ilmbwww.gov.bc.ca/ (Indicators 2-1 to 2-4)

B.C. Ministry of Forests and Range, Research Branch. Biogeoclimatic ecosystem classification. http://www.for.gov.bc.ca/hre/becweb/resources/classificationreports/provincial/index.html (Indicators 2-1, 2-4)

B.C. Ministry of Environment, Ecosystems Branch. Ecoregions of British Columbia. http://www.env.gov.bc.ca/ecology/ecoregions/index.html (Indicator 2-3)

Notes

Indicator 2-1:

1. For biogeoclimatic zones and forest cover, see Notes 3, 4 and 5 for Indicator 1.

2. Protected areas are as of December 2002. Only minor changes occurred between then and 2005. Also included are proposed protection areas identified in the preliminary land use plan for the Central Coast. These areas have been off-limits to logging to conserve environmental and cultural values. Final land-use decisions with some adjustments were made in early 2006.

Indicator 2-2:

3. For forest cover, see Notes 5 and 6 for Indicator 1.

4. For protected areas, see Note 2 for Indicator 2.

Indicator 2-3:

5. For forest cover, see Note 5 for Indicator 1.

6. For protected areas, see Note 2 for Indicator 2.

7. The number of ecosections in B.C. has expanded over the years as a result of advances in scientific understanding and mapping. This analysis and the related maps are based on the classification of ecosystems available in 2003, which includes 132 ecosections that are either terrestrial or a mix of terrestrial and saltwater areas.

8. A small area did not have an ecosection assigned to it, because of a lack of overlap between the inventory and ecosection coverages resulting from minor mapping discrepancies.

Indicator 2-4:

9. For biogeoclimatic zones and forest cover, see Notes 3, 4, 5 and 6 for Indicator 1.

10. For protected areas, see Note 2 for Indicator 2.

Indicator 3 – Ecosystem dynamics

Sources

B.C. Ministry of Forests and Range, Forest Analysis and Inventory Branch. Forest Inventory. (Indicators 3-1 to 3-3)

Natural Resources Canada, Canadian Forest Service. Carbon Budget Model of the Canadian Forest Sector (CBM-CFS2).
http://carbon.cfs.nrcan.gc.ca/cbm/index_e.html (Indicators 3-1 to 3-3)

Data for modelling (1951–2000) and forecasting (2001–2050) (Indicators 3-1 to 3-3)

Area Harvested

1951–1973: Volume harvested by region from B.C. Ministry of Forests annual reports was converted to area harvested by region using average volume/ha harvested from 1974–1989. There was no information about the Cariboo Forest Region up to 1973, so a proportion of volume was removed from adjacent regions and allocated to the Cariboo.

1974–1999: by forest region from B.C. Ministry of Forests annual reports

2000–2004: by TSA & TFL from Carbon Accounting Team, Pacific Forestry Centre, Canadian Forest Service

2005–2050: by TSA & TFL from B.C. Ministry of Forests and Range projections

Area Burned

1951–1958: Total area burned in B.C. (Doug Higgins, former Petawawa National Forestry Institute, 1992) was allocated across broad ecoregions by using average distribution from 1959–1968.

1959–1979: Large Fires Database (Steve Taylor, Pacific Forestry Centre, Canadian Forest Service), by region and BEC zone

1980–2004: Fires by TSA and TFL

2005–2050: Average area burned, 1990–1999

Area of Insect Infestations (mountain pine beetle, Douglas-fir beetle and spruce beetle)

1951–1999: PestHistory.mdb database, from B.C. Ministry of Forests and Range website, maintained by Tim Ebata

2000–2004: Carbon Accounting Team, Pacific Forestry Centre, Canadian Forest Service

2005–2050: Douglas-fir beetle and spruce beetle: average of 1995–2004

2005–2050: Mountain pine beetle: potential scenario, one of numerous projections by the Carbon Accounting Team, Pacific Forestry Centre, Canadian Forest Service

Data for provincial total with actual MPB (1981–2005) (Indicator 3-1)

Actual areas for mountain pine beetle are from Tim Ebata, MFR. Other areas (harvest, fire, Douglas-fir beetle and spruce beetle) are the same as those used for modelling and forecasting.

B.C. Ministry of Agriculture and Lands, Integrated Land Management Bureau, Base Mapping and Geomatic Services. Road locations from TRIM 1 and TRIM 2. http://ilmbwww.gov.bc.ca/bmgs/products/mapdata/index.htm (Indicator 3-4)

B.C. Ministry of Agriculture and Lands, Integrated Land Management Bureau, Corporate Data Management Services. Watershed Statistics. http://ilmbwww.gov.bc.ca/dm/ (Indicator 3-4)

B.C. Ministry of Forests and Range. Annual Reports. http://www.for.gov.bc.ca/mof/annualreports.htm (Indicator 3-4)

Notes

Indicator 3-1:

1. The graph shows both a modelled analysis (stacked bars) and a provincial total with actual MPB (line). The area of MPB disturbance shown includes all severity types combined. Douglas-fir beetle and spruce beetle were modelled but not shown in the stacked bars because their level of impact is small; they are included in the provincial total with actual MPB line.

2. Modelling
   a) Areas included in the modelled analysis were: all TSA, all TFL, and four national parks: Glacier, Yoho, Kootenay, Mt. Revelstoke. No other parks or private lands were included.
   b) Harvesting and fire levels are under-predicted in the first 50 years. This occurred for three reasons: methods by which the back-casting was done, over-prediction of the volume/ha harvested (which lead to an under-prediction of the area harvested), and some modelling constraints.
   c) Harvesting levels were given by area in BEC zone and region prior to 2000, and by volume in TSA after 2000. The model then used age data and growth curves to determine where the harvesting occurred. Some inaccuracies prior to 2000 occurred because of the back-casting program. Harvest area includes the area of salvage logging
   d) Modelled forecasts of future area disturbed by fire, Douglas-fir beetle and spruce beetle assumed constant rates. Actual rates of disturbance will be different. Other insects are active in the forests but were not modelled because their impact is not yet defined to model standards, and most do not cause tree mortality.
   e) The sample forecast presented is one of many possible scenarios for mountain pine beetle. Mountain pine beetle was forecast in detail for 2001 onward, based on potential dynamics of the epidemic, as known at the time of analysis, when data for the actual extent of the infestation in 2005 were not available.
   f) Fire, harvest and salvage logging were all assumed to be stand-replacing, i.e., the age of the forest is reset to zero. All insect disturbances were assumed to be partial disturbances that do not reset age to zero. This assumption is correct for most insect disturbances, but does not accurately model severe infestations of mountain pine beetle in pure stands of lodgepole pine. Insect disturbances were classified as either low, medium, or severe (according to the data), and each severity was modelled to have a different impact on the forest.

3. Provincial total with actual MPB
   For 1981–2005 (the periods ending 1985 to 2005), this shows the sum of modelled areas for harvest, fire, Douglas-fir beetle and spruce beetle, plus the provincial actual area of MPB infestation.

Indicator 3-2:

4. For a description of modelling, see Note 2 for Indicator 3.

5. The area of the timber-harvesting landbase (THLB) and the area outside the THLB (non-THLB) were assumed to be the same as in 2000 for all years of modelling.

6. When inventory levels were back-cast to 1951, it was assumed that all forests were between 80 and 150 years old before disturbance. This assumption does not affect the modelled areas that are more and less than 80 years old.

7. The area disturbed by harvest and fire in the first 50 years was underestimated by the model. The area moving from over 80 years old to under 80 years old is therefore underestimated, as are the areas over 80 years old shown for the first 50 years.

Indicator 3-3:

8. For a description of modelling, see Notes 2 and 5 for Indicator 3.

9. Ecosystem carbon includes total live biomass and dead organic matter. Biomass carbon includes all living biomass, both above ground and below ground. It includes the stem, branches, foliage, roots, etc. Merchantable biomass carbon includes the biomass that is merchantable and would be removed from the forest during timber harvest.

10. The increase in biomass levels from 1951 to 2000 is likely overestimated due to the model underestimating the age of the forests in 1951, and to the underestimate of the area disturbed by fire and harvesting. If forests in 1951 are, on average, older, they contain more biomass, will be accumulating less biomass over time, and any disturbances in these forests will cause a larger decrease in biomass.

11. The model does not adequately represent changes in growth curves before or after a disturbance event. Forests disturbed prior to 2000 are assumed to be growing on a second-growth yield curve before the disturbance, even if they represent old growth forests. Changes in species and regeneration delays after disturbances are not captured by the model.

Indicator 3-4:

12. For the detailed analysis of watersheds and resulting display maps, a geographic information system was used to analyze roads from TRIM 1 (1980s) and TRIM 2 (1990s) to determine road density for each of about 18,000 watershed units.

13. To estimate road density for 1970–2022, it was noted that TRIM 2 (circa 1999) indicates a 45% increase in roads since TRIM 1 (circa 1988) in the part of B.C. that was resurveyed. During that same time period there was a 45% increase in forest service roads based on Ministry of Forests annual reports, suggesting that it would be reasonable to use this rate of change for the whole province. Extending that rate of increase to 2005 led to a 70% increase from 1988 to 2005.
    The road density classes from the detailed analysis were subdivided into smaller density classes (e.g., 0 to 0.1 km/km^2 was subdivided into ten classes of 0.01 each; 0.1 to 0.6 was subdivided into 6 classes of 0.1 each, etc.). The area in each broad class was then distributed evenly among these smaller density classes, so that the rate of change could be applied to the finer gradient of the smaller density classes. Backcasting and forecasting of road density with the 70% rate of change for 17 years (based on 1988 to 2005) was done for each of the smaller density classes (e.g., the area in the density class 1.0 to 1.1 km/km^2 in 1988 was backcast to have a density of 0.6 in 1970, and forecast at 1.7 in 2005 and 2.9 in 2022). The areas related to each of the smaller density classes were then regrouped into the broad density classes.

14. A separate analysis based on a review of unroaded watersheds in 1990, and consideration of which watersheds were likely to stay undeveloped due to protection status or remoteness, concluded that 18% of the province would likely stay essentially undeveloped over the long term, well beyond 2020.

Indicator 4 – Species Diversity

Sources

B.C. Ministry of Forests and Range. 2006. Species database. (Species information, including populations and population trends, was assembled from many sources. For a complete listing of sources, see the species database, available from Indicator 4-1 of *The State of British Columbia's Forests – 2006*).
http://www.for.gov.bc.ca/hfp/sof/ (Indicators 4-1 to 4-3)

Canadian Council of Forest Ministers. 2005. Criteria and Indicators of Sustainable Forest Management in Canada – National Status 2005. Indicator 1.2.1 – Status of forest-associated species at risk.
http://www.ccfm.org/ci/rprt2005/English/pg31-47_1-2-1.htm (Indicators 4-1 to 4-3)

B.C. Ministry of Sustainable Resource Management. 2002. Species ranking in British Columbia.
http://wlapwww.gov.bc.ca/wld/documents/ranking.pdf (Indicator 4-2)

B.C. Ministry of Environment, Conservation Data Centre. February 2006. Species Risk Ranking List Changes. (Indicator 4-2)

B.C. Ministry of Environment, Conservation Data Centre. 2006. BC Species and Ecosystems Explorer.
http://www.env.gov.bc.ca/atrisk/toolintro.html (Indicator 4-2, 4-3)

B.C. Ministry of Environment. Identified Wildlife Management Strategy.
http://www.env.gov.bc.ca/wld/frpa/iwms/index.html (Indicator 4-3)

B.C. Ministry of Forests. 2006. Species diversity and composition for British Columbia. Unpublished report. 75 pp. (Indicator 4-4)

Notes

Indicator 4-1:

1. This analysis is based on the CCFM definition of forest-associated species, which uses four categories of forest association, plus non-forest associated and unknown. There are two special cases:
   a) Vascular Plants: The forest association rating for vascular plants reflects the plant's shade tolerance. Those plants not shade tolerant are deemed non-forest associated. Those that grow in the open and often in the forest are '3' (forest using but not forest dependent) and those found only in forest are '1' (forest dependent and forest dwelling). Those rated '2' normally 'dwell' in the (deeper) forest, but occasionally are found in openings where there is more light. Old growth forests are generally poorer in vascular plants than their successional stages.
   b) Freshwater Fish: The forest association rating for freshwater fish is defined as having a high, medium or low (H, M or L) dependence on forests (E for extinct is used where the degree of association was not known). This methodology was developed by the BC State of Environment Reporting Office for Environmental Trends 2000. A complete methodology is available in the Environmental Trends 2000 Technical Document: Forest Species in BC.

Indicator 4-2:

2. See Note 1 for Indicator 4.

3. The CDC lists species risk ranks in B.C. as:
   RED = extirpated, endangered or threatened (red-listed species and sub-species have, or are candidates for, official Extirpated, Endangered or Threatened Status in B.C.),
   BLUE = special concern,
   YELLOW = not at risk.

Indicator 4-3:

4. About 100 forest-associated species were selected for a secondary table (included with the species database), using the following rationale:
   a) All species selected by the CCFM for the National Status 2005 report that occur in B.C. were included.
   b) For species not selected by the CCFM:
      - For red-listed (extirpated, endangered or threatened) or blue-listed (special concern) species, include:
        - All species designated as Identified Wildlife (IW) under the *British Columbia Forest and Range Practices Act*; and/or
        - All species for which timber management is a known major threat.
      - For yellow-listed (not at risk) species, include a small selection of species that:
        - Are forest-associated (Category 1 or 2, i.e., with a known level of dependence on forest); and
        - Are well-known as having ecological, economic or social/cultural significance.

5. From the secondary table, 14 species (and 3 subspecies) were selected for the indicator map to represent:
   a) At least one species from each taxonomic group;
   b) Species for which population and trend data are available (or inferred from habitat conditions for amphibians and reptiles);
   c) All population trends: Increasing (I), Decreasing (D), Stable (S); Variable (V), Unknown (U);
   d) Species dependent on a mix of forest types and ages;
   e) Some of the species that are significant for a variety of ecological, economic or cultural/social reasons; and
   f) Species from various parts of B.C., resulting in a broad geographical distribution on the map.

Indicator 4-4:

6. Data were available for 1,552,207 ha of reforested land harvested in the years 1970 to 1987, inclusive. This represents about 57% of the 2,728,164 ha clearcut in the years 1970 to 1987/88, inclusive. The new reforestation policy came into effect for most public land in October 1987.

7. Data were available for 307,995 ha of reforested land harvested in 1988 and later years, primarily before 1998/99 with small areas from subsequent years. This represents about 11% of the 2,690,365 ha clearcut in 1988/89 through 2004/05.

Indicator 6 – Genetic Diversity

Sources

University of British Columbia Centre for Forest Gene Conservation. 2005. Range maps and conservation status of BC tree species.
http://genetics.forestry.ubc.ca/cfgc/range-maps.html (Indicator 6-1)

Hamann, A., S.N. Aitken and A.D. Yanchuk. 2004. Cataloguing *in situ* protection of genetic resources for major commercial forest trees in British Columbia. Forest Ecology and Management 197 (1-3): 295-305. http://genetics.forestry.ubc.ca/cfgc/proj_cataloguing/files_for_download/DYGENextended.pdf (Indicator 6-1)

Hamann, A., P. Smets, S.N. Aitken and A.D. Yanchuk. 2005. An ecogeographic framework for *in situ* conservation of forest trees in British Columbia. Can. J. For. Res. 35:2553-2561. (Indicator 6-1)

Stoehr, M.U. and El-Kassaby, Y.A. 1997. Levels of genetic diversity at different stages of the domestication cycle of interior spruce in British Columbia. Theoret. And Applied Genetics 94:83-90. (Indicator 6-2)

B.C. Ministry of Forests and Range. Annual reports. http://www.for.gov.bc.ca/mof/annualreports.htm (Indicator 6-3)

B.C. Ministry of Forests and Lands. 2006. Reporting Silviculture Updates and Land status Tracking System (RESULTS) database. (Indicator 6-3, 6-4)

Notes

Indicator 6-1:

1. Species ranges (distribution and frequency) were modelled by combining data from 34,000 ecological sample plots established throughout the province with the biogeoclimatic ecosystem classification (BEC) of the land base into 14 zones, 97 subzones and 152 variants (BEC version 4). The results presented here were subsequently confirmed by a similar, still unpublished analysis of the seamless forest cover inventory that was developed for several indicators in *The State of British Columbia's Forests – 2004* and *2006*. See Indicator 1-2 for details about the inventory.

2. The protected areas used in this analysis are as of 2001. The proposed protection areas identified in the preliminary land use plan for the Central Coast were not included. Levels of conservation of genetic resources were deemed adequate for the coastal areas, without including the proposed protection areas. Final land-use decisions with some adjustments were made in early 2006, further increasing the level of genetic resource conservation.

3. Species range maps for 49 tree species found in B.C. are available at http://genetics.forestry.ubc.ca/cfgc/range-maps.html.

Indicator 6-2:
(None)

Indicator 6-3:

4. Area harvested on public (Crown) land is provided for comparison. Partial cutting includes seed tree, selection, shelterwood and coppice harvesting methods. Data are from ministry annual reports for 1971 onwards; area for 1970 was estimated from volume harvested.

5. Area planted on public (Crown) land is provided for comparison. It includes planting, replanting, fill planting and areas where restocking subsequently failed. Data are from ministry annual reports for 1973 onwards; areas for 1970–1972 were estimated.

6. Area of public (Crown) land that was successfully reforested by natural regeneration and planting is from ministry annual reports for 1989/90 onwards, based on surveyed and

reported changes to Not Sufficiently Stocked (NSR) areas of public (Crown) land. For earlier years, estimates of area reforested are based on area harvested and planted, and estimated rates of natural regeneration, losses to insects, diseases and restocking failures. The annual area successfully reforested by natural regeneration and planting is also shown as "Reforestation" in Indicator 14-2.

7. Genetic source of tree seed was determined as follows: Successful reforestation by natural regeneration necessarily uses wild seed (no selection for desired genetic traits). Successful reforestation by planting uses both wild seed and select seed. The area successfully reforested (planted) with select seed was extracted from RESULTS for 1988 to 2002/03. Data for subsequent years were incomplete at the time of analysis. The remaining area successfully reforested by planting used wild seed.

Indicator 6-4:

8. The data for Indicator 6-4 were extracted from RESULTS a few years after data for Indicator 6-3 were extracted. Differences between the two sets of data are probably the result of additional data entry that occurred between the two data extractions. The biggest change was in the area reforested by planting, which was reported as 116,779 ha in the annual report (used for Indicator 6-3) and is 149,077 ha in this analysis.

Indicator 11 – Ownership and Management

Sources

B.C. Ministry of Agriculture and Lands, Integrated Land Management Bureau. Provincial forest files (for records of all deletions and additions to provincial forests). (Indicator 11-1)

B.C. Ministry of Forests and Range. 1998. Provincial summary reporting system: Management by ownership and classification report (for federal ownership data for Dominion Government Blocks and Military Reserve Lands). (Indicator 11-1)

B.C. Ministry of Forests and Range. Log Exports Administration (log export data). http://www.for.gov.bc.ca/HET/Export/index.htm (Indicator 11-1)

Statistics Canada's Canadian International Merchandise Trade Database (log export statistics). http://www.statcan.ca/trade/scripts/trade_search.cgi (Indicator 11-1)

B.C. Ministry of Forests and Range, Forest Practices Branch. Seamless forest cover inventory (2000) of British Columbia (available only in the ministry). (Indicator 11-2)

B.C. Ministry of Agriculture and Lands, Integrated Land Management Bureau. http://ilmbwww.gov.bc.ca/ (Indicator 11-2)

B.C. Ministry of Forests and Range, Resource Tenures and Engineering Branch. http://www.for.gov.bc.ca/hth/ (Indicator 11-2)

B.C. Ministry of Environment, BC Parks. http://www.env.gov.bc.ca/bcparks/ (Indicator 11-2)

B.C. Ministry of Environment. 2002. Environmental trends in British Columbia in 2002. http://www.env.gov.bc.ca/soerpt/ (Indicator 11-2)

Indian and Northern Affairs Canada. http://www.ainc-inac.gc.ca/index-eng.asp (Indicator 11-2)

BC Assessment.
http://www.bcassessment.bc.ca/ (Indicator 11-2)

Pearse, Peter H. 1976. Timber rights and forest policy in British Columbia. Report of The Royal Commission on Forest Resources. Victoria, B.C.
http://www.for.gov.bc.ca/hfd/pubs/Docs/Mr/Rc/Rc006/Rc006.pdf (Indicator 11-3)

Forest Resources Commission. 1991. The future of our forests. Victoria, B.C.
http://www.for.gov.bc.ca/hfd/pubs/Docs/Mr/Rc/Rc001/Rc001.pdf (Indicator 11-3)

Nawitka Resource Consultants. 1991 (revised). Data on the Corporate Concentration of Harvesting Rights, Manufacturing Capacity and Ownership in the B.C. Forest Industry. *In* Background Papers – Volume 5, prepared for the Forest Resources Commission. Victoria, B.C.
http://www.for.gov.bc.ca/hfd/pubs/Docs/Mr/Rc/Rc001e/V5BPfull.pdf (Indicator 11-3)

B.C. Ministry of Forests and Range, Resource Tenures and Engineering Branch. Apportionment tables for 1995/96–2005/06, data for major licensees, 1993/94–2005/06.
http://www.for.gov.bc.ca/hth/apportionment/apportionment.htm (Indicator 11-3, 11-4)

B.C. Ministry of Forests and Range, Forest Analysis and Inventory Branch. AAC database (available only in the ministry). For related information, see:
http://www.for.gov.bc.ca/hts/tsr.htm (Indicator 11-4)

B.C. Ministry of Forests and Range. Regional summaries of proposed allowable annual cut takeback and reallocation volumes (available only in the ministry). (Indicator 11-4)

B.C. Ministry of Forests and Range, BC Timber Sales. Sales volumes database, 2002/03–2005/06 (available only in the ministry). (Indicator 11-4)

B.C. Ministry of Forests and Range. Annual Reports.
http://www.for.gov.bc.ca/mof/annualreports.htm (Indicator 11-4)

Notes

Indicator 11-1:

1. Provincial Forest Files include documentation for each parcel of land deleted from provincial forests constituting a change in ownership. Some deletions from provincial forests, such as new provincial parks, do not involve a change in ownership and are not shown.

2. For assistance with obtaining statistical log export data from Statistics Canada refer to:
http://www.statcan.ca/cgi-bin/statcomment.pl

3. Residential in Changes table: from 1980/81–1990/91 Residential was categorized as "Settlement".

4. Commercial in Changes table: from 1983/84–1993/94 deletions of land for commercial purposes were not identified as a separate category.

Indicator 11-2:

5. Provincial forest area and land area are from the seamless forest cover inventory (2000) for the whole province. See Indicator 1-2 for details.

6. Protected areas are as of December 2002. Only minor changes have occurred between then and 2005. Also included are proposed protection areas identified in the preliminary

land use plan for the Central Coast. These areas have been off-limits to logging to conserve environmental and cultural values. Final land-use decisions with some adjustments were made in early 2006.

7. First Nations forest and land (treaty settlement land) areas are based on maps and data tables from provincial and federal agencies. Federal Indian Reserve forest and land data for 2005 are from the Integrated Land Management Bureau, current to April, 2005.

8. Private forest and land areas were based on maps and data tables from provincial agencies, with breakdowns by tenure type estimated where necessary.

9. Areas for forest tenures were based on maps and data tables from MFR, with breakdowns for volume-based tenure types estimated on the basis of volume proportions.

Indicator 11-3:

10. The sum of allowable annual cuts (AACs) refers to those set by the provincial government. AACs are as of December 31 of the year listed (the starting year of fiscal years).

11. Company data for 1975 are for July 2, 1975, from the 1976 royal commission.

12. Company data for 1990/91 are for January 22, 1991, as reported by Nawitka (1991), except:
    1) Nawitka showed the Ministry of Forests as the largest "Group/Company," based on sales under the Small Business Forest Enterprise Program which made public timber available to hundreds of small companies; this is not considered relevant to this analysis of large operators.
    2) Nawitka reported Noranda as the second largest "Group/Company," based on its 49% interest in MacMillan Bloedel; this analysis shows MacMillan Bloedel on its own, to be consistent with the *Forest Act* requirement of a controlling interest (greater than 50%) for a transfer of ownership. If Noranda were shown as reported by Nawitka, Noranda would be the top company with 14.1% of AACs, and the top 10 companies would have 57.8% of AACs.

13. Company data for 1995/96–2006/07 are for the nearest available date to March 31 (end of each fiscal year), from Apportionment Report# APTR043.

14. For consistency within this report, all provincial AAC data are from Indicator 13, and include TSA, TFL, woodlot and community forest AACs. Using the AACs for TSAs and TFLs only (as in the apportionment reports) would give an upward bias to the percentage of AACs held by large operators, and this bias would increase as more of the provincial AAC is reallocated from TSAs and TFLs to woodlots and community forests. Provincial AACs for all years are for December 31 of the year listed (the starting year of fiscal years).

Indicator 11-4:

15. The sum of allowable annual cuts (AACs) refers to those set by the provincial government. AACs are as of December 31 of the year listed (the starting year of fiscal years).

16. Volume committed and apportioned is from MFR annual reports.

17. Woodlot licence data are based on allowable annual cuts. For 1993/94 onward, Woodlot licences are included in small operators (<25,000 m^3).

18. "Small business licences" are under the Small Business Enterprise Program (later renamed Small Business Forest Enterprise Program). This program was introduced in

1980 to recognize the importance of and make timber available to small operators, to maintain a balance between small and large operators in the industry, and to enable new entrants into the industry. Data up to 1992/93 are from the MFR annual report "volume billed" statistics for each year. The SBFEP ended in 2001/2002. BC Timber Sales (BCTS) was established in 2002/2003, with a mandate that is not restricted to small business.

19. Beginning in 1993/94, volumes apportioned to "major licences" (mostly tree farm licences and forest licences) in MFR's Apportionment System and sale volumes under small business licences (and later under BCTS) were tracked with sufficient accuracy to enable reporting by size of licensee and licence, respectively. Some operators may have two small business licence (or BCTS licence) which, if combined, would place them in a higher size category. Note that apportionment and sale volumes (for 1993/94 onward) are determined before harvest, while volume billed (used for years up to 1992/93) is determined after harvest and may be more or less than the apportionment or sale volume.

20. Sale volume data for BCTS in 2005/06 are as of January 16, 2006, and understate volume for the fiscal year.

21. Community forest agreements were first issued in 2000/01. Data are from status reports that include short-term AAC increases for two licences in mountain pine beetle infested areas. Of the 11 CFAs issued by the end of 2005/06, 8 have long-term AACs under 25,000 m^3 per year, and only 3 have long-term AACs of 25,000–100,000 m^3. Five CFAs were issued in 2006/07, the largest with an AAC of 25,000 m^3. All CFAs were included in small operators <25,000 m^3.

22. The forest reserve provides about 1,000,000 m^3/year of unallocated timber that is used for various minor, short-term licences, and is therefore included in the under 25,000 m^3/year category.

Indicator 13 – Timber Harvest

Sources

B.C. Ministry of Forests and Range. Annual Reports.
http://www.for.gov.bc.ca/mof/annualreports.htm (Indicator 13-1, 13-2)

B.C. Ministry of Forests and Range, Forest Analysis and Inventory Branch. AAC database (available only in the ministry).
http://www.for.gov.bc.ca/hts/tsr.htm (Indicator 13-2)

B.C. Ministry of Forests and Range, Forest Analysis and Inventory Branch.
http://www.for.gov.bc.ca/hts/tsr.htm (Indicator 13-3, 13-4)

Notes

Indicator 13-1:

1. Harvest figures are by calendar year for 1945–1979 and fiscal year (April 1 to March 31) for 1980/81 onward, listed as 1980 onward.

2. All timber harvested from public and private land is included.

3. The allowable annual cuts (AACs) referred to are those set by the provincial government. AACs are as of December 31 of the year listed (the starting year of fiscal years).

Indicator 13-2:

4. See Note 1 for Indicator 13.

5. Timber harvested is from public and private land that is regulated by allowable annual cuts (AACs) set by the provincial government.

6. See Note 3 for Indicator 13.

7. In 1981, public sustained yield units (PSYUs) were replaced by timber supply areas (TSAs).

Indicator 13-3:

8. For TSAs and TFLs, data for 2000–2004 are from the report *The State of British Columbia's Forests–2004*. For 2005–2150, data are from base cases in the most recent timber supply analyses. Many of these include verified higher growth rates. Estimated effects of anticipated higher growth rates are shown separately for management units where higher growth rate have not yet been verified.

9. For woodlots and community forest agreements, actual AAC data are used for 2000–2005. The 2005 level of AAC is projected to 2006–2150.

Indicator 13-4:

10. Data for 2000 are from the report The *State of British Columbia's Forests–2004*. For 2050, data are from base cases in the most recent timber supply analyses. Many of these include verified increases in growth rates. Estimated effects of unverified increases in growth rates are not included.

11. Recent increases in the Fraser and Golden Timber Supply Areas (TSAs) are included, as are adjustments reflecting the 2003 fire season in the Kamloops TSA.

12. The 12% threshold was chosen because the sum of timber supply in 2000 for all TSAs and TFLs was 12% higher than the average harvest in TSAs and TFLs in the 1990s. This suggests that a decrease of up to 12% would not prevent, at a provincial level, the level of harvest and related economic activity achieved in the 1990s.

Indicator 14 – Silviculture

Sources

B.C. Ministry of Forests and Range. *Annual reports*.
http://www.for.gov.bc.ca/mof/annualreports.htm (Indicator 14-1, 14-3, 14-4)

B.C. Ministry of Forests and Range. *Annual reports*. (area harvested, area planted, NSR change tables)
http://www.for.gov.bc.ca/mof/annualreports.htm (Indicator 14-2)

B.C. Ministry of Forests and Range. Seed Planning And Registry system (SPAR).
http://www.for.gov.bc.ca/hti/spar/index.htm (Indicator 14-3, 14-4)

B.C. Ministry of Forests, Forest Practices Branch. 2001. Revised performance measures for assessing investment benefits in the backlog and enhanced forestry program. 26 pp.
http://www.for.gov.bc.ca/hfp/silstrat/provinfo/performance indicators package_010214.pdf (Indicator 14-4)

Notes

Indicator 14-1:

1. Partial cutting systems cut selected trees and leave desirable trees for various objectives including tree regeneration, visual screens and wildlife habitat; traditionally it was used primarily in dry areas of the Interior as a method for ensuring regeneration. Variable retention is a relatively recent variation of partial cutting, with a focus on trees or areas to retain, to ensure a range of structure and ecological functions such as those provided by wildlife trees. Variable retention can be combined with traditional partial cutting systems such as shelterwood or selection. Clearcutting with reserves also retains trees or groups of trees to provide habitat for stand-level biological diversity.

2. The areas for 1970 are estimated using the ratio of volumes harvested in 1970 and 1971, applied to the areas harvested in 1971.

Indicator 14-2:

3. Area harvested on public (Crown) land is provided for comparison. Partial cutting includes seed tree, selection, shelterwood and coppice harvesting methods. Data are from ministry annual reports for 1971 onwards. The area for 1970 was estimated using the ratio of volumes harvested in 1970 and 1971, applied to the areas harvested in 1971.

4. Area planted on public (Crown) land is provided for comparison. It includes replanting, fill planting and areas where restocking subsequently failed. Data are from ministry annual reports for 1973 onwards; areas for 1970–1972 were estimated.

5. Disturbances or "Additions to NSR" are areas that become not satisfactorily restocked (NSR) with timber due to harvesting, fire, insects, diseases and other causes. Data for 1989/90 onwards are based on surveyed and reported changes to NSR areas of public (Crown) land, from ministry annual reports. For earlier years, estimates are based on areas harvested and planted, and estimated rates of losses to fires, insects, diseases and restocking failures.

6. Reforestation or "Reductions to NSR" are areas successfully reforested by natural regeneration or planting. Data for 1989/90 onwards are based on surveyed and reported changes to NSR areas of public (Crown) land, from ministry annual reports. For earlier years, estimates are based on areas harvested and planted, and estimated rates of natural regeneration, losses to fires, insects, diseases and restocking failures.

7. Reclassification of NSR status is based on new survey information. The large areas reclassified from NSR to non-productive (NP) forest land in the 1990s corrected earlier inclusion of marginal forest land in NSR statistics, based on overview surveys. The smaller areas reclassified in recent years reflect surveys providing more accurate data about productive land converted to permanent access roads.

Indicator 14-3:

8. Treatments shown here are generally made to improve the future quantity and value of timber, and they are generally not needed to ensure reforestation except in some circumstances (e.g., spacing very dense stands to prevent stagnation of growth).

9. Area of fertilizing, pruning and spacing treatments is from ministry annual reports.

10. The area successfully reforested (planted) with select seed was extracted from RESULTS for 1988 to 2002/03. Data for subsequent years were estimated based on seed request data in the sowing year (one year before planting) from the SPAR system, which closely track the RESULTS data for years that both are available.

Indicator 14-4:

11. Treatments shown here are generally made to improve the future quantity and value of timber, and they are generally not needed to ensure reforestation except in some circumstances (e.g., spacing very dense stands to prevent stagnation of growth). Pruning is not shown as it provides value gains, volume gains.

12. Cumulative volume gains were estimated for 65 years of growth using the following average annual rates per hectare:
    - 0.50 m^3 planting one to three years after logging (relative to satisfactory natural regeneration)
    - 2.93 m^3 backlog planting (relative to a NSR site, overgrown by competing vegetation)
    - 0.40 m^3 fertilizing
    - 0.25 m^3 spacing
    - 0.41 m^3 select seed (average gain in 2004/05, adjusted for lower and higher genetic quality in earlier and later years, respectively)

    The gains are from the ministry's 2001 report, except the gain for select seed was increased from the 0.38 m^3 in the report to 0.41 m^3 to reflect the provincial average based on growth and yield forecasts (using the TIPSY model) for predominant commercial species: coast Fdc, interior Pli/Sx.

13. The expected volume gain (genetic worth) of select seed ranges from 3% in 1994/05 to 11% in 2005/06. An estimated 3% gain is used for 1988/89–1993/94.

Indicator 18 – Jobs & Communities

Sources

Statistics Canada. Labour force survey.
http://www.statcan.ca/start.html (Indicator 18-1)

Tourism British Columbia. January 2005. Characteristics of the commercial nature-based tourism industry in British Columbia.
http://www.tourismbc.com/PDF/Characteristics of Commercial Nature-Based Tourism.pdf (Indicator 18-1)

BC Stats. August 2005. British Columbia's hunting, trapping and wildlife viewing sector.
http://www.bcstats.gov.bc.ca/data/bus_stat/busind/fish/wildlife.pdf (Indicator 18-1)

B.C. Wilderness Tourism Association.
http://www.wilderness-tourism.bc.ca/main.html (Indicator 18-1)

Statistics Canada. 2001 Census of Canada. (prepared by BC Stats)
http://www12.statcan.ca/english/census01/home/index.cfm (Indicator 18-2)

Tourism British Columbia. January 2005. Characteristics of the commercial nature-based tourism industry in British Columbia.
http://www.tourismbc.com/PDF/Characteristics of Commercial Nature-Based Tourism.pdf (Indicator 18-2)

Horne, Garry. 2004. British Columbia's heartland at the dawn of the 21st century: 2001 economic dependencies and impact ratios for 63 local areas. BC Stats, Ministry of Labour & Citizens' Services. Victoria, B.C.
http://www.bcstats.gov.bc.ca/pubs/econ_dep.asp (Indicator 18-3)

BC Stats. BC municipal population estimates, 1996-2005, sorted by name. http://www.bcstats.gov.bc.ca/data/pop/pop/estspop.asp (Indicator 18-3)

WorkSafeBC. Statistical Services Department. http://www.worksafebc.com/default.asp (Indicator 18-4)

BC Stats. Consumer Price Index. http://www.bcstats.gov.bc.ca/pubs/pr_cpi.asp (Indicator 18-4)

Notes

Indicator 18-1:

1. Data for Forestry & Logging, Wood Manufacturing, and Pulp & Paper are estimated monthly and averaged annually by Statistics Canada. From 1987 to 2004, data are considered reliable, and are based on the North American Industry Classification System (NAICS) categories and stable survey definitions (green shaded area in data table). Between 1976 and 1986, employment corresponds to the Standard Industrial Classification (SIC) categories, for which survey techniques changed somewhat from year to year. Data before 1976 are from Ministry of Forests files based on data from Statistics Canada. Comparisons of the early data with data from 1987 onward may not be reliable.

2. Data for cattle ranching are from Statistics Canada for 1987–2004.

3. Data for nature-based tourism are estimated from Statistics Canada data for 1987–2004 and other sources. Total direct employment in 2001 was 13,927 full-time equivalents (Table 3 in Characteristics of the Commercial Nature Based Tourism Industry in British Columbia). The number of full-time workers in the closest Statistics Canada industry sector averaged 78% (1987/04), and if we assume that part time is 3 months, then the FTE estimate converts to 13,927*(.78+.22*4)=23,119 persons. British Columbia's *Hunting, Trapping and Wildlife Viewing Sector* reports persons employed in several of the key nature-based tourism industries. This employment for 2001 was given an index value=1, and other years scaled proportionately. This index value for a given year was multiplied by the total person-year estimate for nature-based tourism to derive the annual employment.

4. The share of nature-based tourism that is forest-based involves identifying those activities that are explicitly addressed in forest management decisions (e.g. visual quality objectives), and those wilderness-based activities for which forests (directly) play a critical role. Based on revenue figures for 20 nature-based tourism industries, of which 6 were considered not forest-related, the forest-based share was estimated at 80% of nature-based tourism. This factor was applied to the nature-based tourism employment figures to find forest-based tourism employment.

5. Data for cattle ranching and nature-based tourism for 1970–1986 are based on the average for the years 1987–2004. It is conceivable that there was more ranching, hunting and fishing in the early years, however, there was also less wilderness tourism (the B.C. Wilderness Tourism Association reports that wilderness tourism represented 10% of the B.C. tourism industry revenue as of 1999, and is growing at 9-10% per year). The net effect is therefore equally likely to have been no significant change in the sum of these industries.

Indicator 18-2:

6. For Forestry and Logging, Wood Manufacturing, and Pulp and Paper: The 2001 *Census of Canada*, reported total labour income by industry, earned by respondents in the year 2000.

7. For Cattle Ranching: Average employment income is based on dividing employment income by the number of persons with employment income (full-time, part-time and those unemployed at the time of the census). It is therefore less than the average income of someone employed full-time.

8. For Nature-Based Tourism: The labour force statistics (for selected subsectors that amounted to 80% of total nature-based tourism) are from Indicator 18-1. These were multiplied by the average income reported in Census 2001, yielding an estimated aggregate income of $285 million from nature-based tourism that is forest-based. This is reasonably consistent with the income of $321 million for all nature-based tourism found by a survey taken in 2001, reported in *Characteristics of Commercial Nature-Based Tourism in British Columbia*.

9. There is no basis at this time to estimate aggregate employment income from non-timber forest products.

Indicator 18-3:

10. The Forest Vulnerability Index (FVI) in 2001 *Economic Dependencies and Impact Ratios* for 63 Local Areas indicates the vulnerability of each local area to potential downturns in the forest sector (specifically, timber-based industries). A community is likely to be vulnerable to potential downturns if its basic income dependence on the sector is high and its diversity of basic incomes is low. The index is calculated by multiplying each local area's basic income dependence on the timber-based sector by (100 – its diversity index), and then normalizing the products for all local areas so that the highest vulnerability is assigned 100 and the lowest is 0.

11. The income dependency rankings are based on the premise that each dollar of basic community income is uniquely allocated either to one of the basic industries or to a non-employment income source. Thus the industry definitions are quite broadly defined to include not only resource extraction, but also any downstream processing that occurs locally, and also any indirect activities that are purchased locally.

12. Population counts and municipal boundaries for each community are as of July 1st, 2001. The data includes an estimate of net census undercount.

    Type of Community:
    C = City, T = Town, VL = Village, DM = District Municipality, IM = Island Municipality

Indicator 18-4:

13. The Forestry industry includes the following subsectors: logging and related (7030), wood mills (7140) and "classification units" (a unit within a subsector): log towing (732024), helicopter logging (732043) and log hauling (732044).

14. Benefits include all claim costs except health care and rehabilitation costs. The claims count includes claims accepted in the year regardless of year of injury. Health-care-only claims are not included in the count. The days lost include all days lost in the year regardless of the year of injury.

15. One person-year is the equivalent of 52 paid weeks of employment, whether worked by one individual or several. Estimates of person-years are based on gross payrolls submitted by employers and on matching wage rate data. In the past, the wage rate data was based on Statistics Canada information published for the 1980 Standard Industrial Classification. Wage rate data is now partly based on Statistics Canada information published on the NAICS (North American Industry Classification System) basis, and partly on the wage rates of STD claimants (including short term disability, long term disability and fatal).

16. The *Workers Compensation Amendment Act*, (No. 2), 2002 (Bill 63) expanded coverage in 1994 by adding about 10% to the covered workforce. The non-forestry fatality rates for 1987-1993 have been adjusted to approximate the 'including Bill 63' basis and so are approximately comparable to the non-forestry fatality rates for 1994-2005.

17. Injury rates are commonly expressed as 'per 100 personyears', but because fatalities occur less frequently, fatality rates are often expressed as 'per 10,000 personyears.'

Indicator 19 – First Nations Involvement

Sources

B.C. Ministry of Forests and Range. First Nations Tenure Information (FNTI) database (available only in the ministry). (Indicator 19-1)

Statistics Canada. Employment data for 1981,1991 and 2001 (custom data request). (Indicator 19-2)

BC Stats. 2001 Census Profile, British Columbia.
http://www.bcstats.gov.bc.ca/data/cen01/profiles/csd_txt.htm (Indicator 19-2)

B.C. Ministry of Forests and Range. Aboriginal Affairs Branch. Agreements with First Nations.
http://www.for.gov.bc.ca/haa/FN_Agreements.htm (Indicator 19-3)

Indian and Northern Affairs Canada. First Nations profiles.
http://sdiprod2.inac.gc.ca/FNProfiles/FNProfiles_home.htm (Indicator 19-4)
For bands in B.C.:
http://sdiprod2.inac.gc.ca/FNProfiles/FNProfiles_List.asp?Province1=BC (Indicator 19-4)

Notes

Indicator 19-1:

1. Volumes of timber tenures shared with others are prorated for the share held by First Nations.

2. Volumes are prorated over the term of the tenure.

3. Volumes are based on permitted harvest, not actual harvest.

4. Data for 1980 to 2003 are as of February 9, 2003. Data for 2005 include all licences active in 2005.

Indicator 19-2:

5. Aboriginal employment data presented in Indicator 19-2 are based on ethnic origin, including North American Indian, Métis and Inuit.

6. The high growth rates in the aboriginal population and its components are partly a result of increasing self-identification by aboriginals as being of aboriginal identity or aboriginal ethnic origin.

7. Census data on the aboriginal population are available for: 1) aboriginal identity (individuals identify themselves as aboriginal); and 2) aboriginal ethnic origin (an individual's ancestry includes one or more aboriginals). Both include North American Indian, Métis and Inuit. Aboriginal identity data are available only for the 1996 and 2001 censuses, and ethnic origin data are more comparable with previous censuses. To

provide data for a longer time period, Indicator 19-2 uses data based on aboriginal ethnic origin.

8. In recent years, most references to aboriginal population use aboriginal identity. In 2001, the aboriginal population of British Columbia was 170,025 (4.4% of the total population) based on aboriginal identity, and 222,335 (5.7% of the total population) based on ethnic origin. North American Indians are the largest component of the aboriginal population, with 118,290 (3.1% of the total population) based on aboriginal identity and 174,500 (4.5% of the total population) based on ethnic origin. Almost all of the remaining aboriginal population is Métis.

Indicator 19-3:

9. Forest and Range Agreements, introduced in 2003, provide for revenue-sharing and forest tenure opportunities for First Nations. The timber volume comes from unlogged timber from existing forest licences and from timber that will be made available once the province-wide timber reallocation process is completed. The ministry's approach to negotiating Forest and Range Agreements is outlined in the Strategic Approaches to Accommodation Policy.
http://www.for.gov.bc.ca/haa/Docs/Accomodation_Policy_final_draft_10.pdf

10. An amendment to the *Forest Act* in May 2002 allowed the Minister of Forests to invite First Nations to apply for forest licenses without competition. The timber volume for these licences comes from beetle-killed and fire-damaged timber as well as from unlogged timber from other forest licences. Details of the mandate and process are set out in the ministry's Direct Award Policy.
http://www.for.gov.bc.ca/haa/Docs/Interim_Direct_Award_Policy_Oct_31_2002.pdf

11. The number of agreements and number of First Nations with a type of agreement do not add to the totals reported as of March 31, 2006, in the main report. The data table includes agreements after that date. Also, one agreement may involve more than one First Nation and one First Nation may have more than one agreement.

Indicator 19-4:

12. Indian and Northern Affairs Canada (INAC) maintains a public database that identifies individual bands and provides general information about each band.

13. For 1990,1995 and 2000, populations for individual bands are based on 1999 data from INAC and later data for a few bands not included in the 1999 data. For 2003, populations are from INAC data for December 31, 2002, and (for one band) March 31, 2003.

14. Chart points for other years were estimated by straight-line interpolation.

Indicator 21 – Law

Sources

Association of British Columbia Forest Professionals. 2004. Forest Legislation and Policy Reference Guide 2004. Vancouver, BC. (Indicator 21-1).

Association of British Columbia Forest Professionals. 1998. Our First 50 Years: http://www.rpf-bc.org/forestpract/forestpract.html (Indicator 21-1)

Various public inquiries. See annex “Related Publications.” (Indicator 21-1)

B.C. Ministry of Forests, Compliance and Enforcement Branch. Annual Reports. http://www.for.gov.bc.ca/hen/ (Indicator 21-2, 21-3)

B.C. Ministry of Environment. Unpublished data. (Indicator 21-3)

B.C. Ministry of Forests and Range, Forest Practices Branch. Forests and Range Evaluation Program.
http://www.for.gov.bc.ca/hfp/frep/ (Indicator 21-4)

Notes

Indicator 21-1:

1. This selection of changes in British Columbia's forest law highlights milestones relevant to the evolution of a legal framework that supports sustainable forest management. It is not intended to be a comprehensive overview of British Columbia's forest law.

Indicator 21-2:

2. An inspection is an examination of activities or practices, and is used to determine whether the forest practices are carried out in compliance with statutory requirements. Inspections cover the obligations of both the licensees and the government. Inspections may or may not find violations of the law.

3. Reporting periods are mid-June to mid-June for 1995/96–1997/98; mid-June to March 31 for 1998/99 (9.5 months); and April 1 to March 31 for 1999/00–2005/06.

4. Data for 1997/98, 1998/99 and 1999/2000 were corrected as of June 2, 2004.

Indicator 21-3:

5. Reporting periods are mid-June to mid-June for 1995/96–1997/98; mid-June to March 31 for 1998/99 (9.5 months); and April 1 to March 31 for 1999/00–2005/06.

6. From 1995/96 to 1999/00, B.C. Ministry of Forests (MoF) Compliance and Enforcement Annual Reports reported on alleged contraventions that occurred within the year. Starting in 2000/01, they reported on enforcement actions within the year — a more accurate and thorough approach, since investigations into alleged contraventions sometimes reveal additional contraventions, clarify the nature of the contravention and may change the enforcement decision from that intended before the investigation.

7. Enforcement actions are used when an official determines that legislation requirements have been contravened and a formal sanction is warranted. Parties subject to enforcement actions have an avenue to challenge or appeal the action.

8. Compliance actions are used when an official has reasonable grounds to believe a contravention has occurred or may be about to occur, but that the situation does not warrant enforcement actions.

9. Stop Work Orders are not considered formal findings of contravention. Seizures and Forfeitures are not necessarily considered findings of contravention.

10. One contravention may result in more than one formal enforcement action. Alternatively, several contraventions may be addressed through a single formal enforcement action.

Indicator 21-4:

11. The information presented is a summary of the work of the B.C. Ministry of Forests and Range, Forests and Range Evaluation Program to March 31, 2007.

12. Reports on monitoring protocols and evaluation results are publicly available.

Indicator 24 – Certification

Sources

Canadian Sustainable Forestry Certification Coalition. 2006. Certification Status Report, December 19 2006.
http://www.certificationcanada.org/english/status_intentions/canada.php
(Indicator 24-1 to 24-4)

B.C. Ministry of Forests and Range, Forest Analysis and Inventory Branch. AAC database (available only in the ministry).
http://www.for.gov.bc.ca/hts/tsr.htm (Indicator 24-1 to 24-4)

B.C. Ministry of Forests and Range, Resource Tenures and Engineering Branch. Apportionment reports.
http://www.for.gov.bc.ca/hth/apportionment/apportionment.htm (Indicator 24-1 to 24-4)

Canadian Sustainable Forestry Certification Coalition. 2004. Certification Status Report, June 9 2004. (Indicator 24-2, 24-3)

Canadian Sustainable Forestry Certification Coalition. 2005. Certification Status Report, December 20 2005. (Indicator 24-2, 24-3)

Notes

Indicator 24-1:

1. Organizations that set forest certification standards used in B.C.:
   CSA = Canadian Standards Association
   FSC = Forest Stewardship Council
   SFI = Sustainable Forestry Initiative
   The organization that sets the environmental management system certification standard used in B.C.:
   ISO = International Organization for Standardization
   Many operations certified under CSA and SFI also have ISO certification.

2. The primary source is a compilation prepared for the Canadian Sustainable Forestry Certification Coalition. Adjustments were made for a few operations using B.C. Ministry of Forests and Range (MFR) information. A few areas are estimated.

3. Forest operations certified under more than one certification standard are counted only once in summaries of more than one standard.

4. Areas recorded by the primary source generally include the forest and non-forest land base (gross area). For tree farm licences with allocations of AAC to the licence holder, BCTS and future reallocation, MFR volume allocation information was used to proportionally estimate the area certified by the TFL holder.

5. Certification data are for forest operations certified as of December 2006.

6. Area available for certification is estimated using protected areas as of December 2002 (Indicator 11-2) and areas converted for agricultural, urban and other development estimated for 2000 (Indicator 1-1).

Indicator 24-2:

7. See Note 1 for Indicator 24.

8. See Note 2 for Indicator 24.

9. See Note 3 for Indicator 24.

10. See Note 4 for Indicator 24.

11. Certification data are compiled in three time periods, based on forest operations that were certified as of June 2004 (for January 1999 to June 2004), December 2005 (for July 2004 to December 2005) and December 2006 (for January 2006 to December 2006). Individual operations are added in the month of certification. Changes in data are recorded as beginning in the month of subsequent re-certification. Operations that discontinued their certification status during a period are not included for the whole period.

12. See Note 6 for Indicator 24.

Indicator 24-3:

13. See Note 1 for Indicator 24.

14. The primary source is a compilation prepared for the Canadian Sustainable Forestry Certification Coalition. Adjustments were made for a few operations using B.C. Ministry of Forests and Range (MFR) information. A few volumes are estimated.

15. See Note 3 for Indicator 24.

16. Volumes recorded by the primary source differ slightly from corresponding MFR information for some operations. For tree farm licences with allocations of AAC to the licence holder, BCTS and future reallocation, MFR volume allocation information was used for the volume certified by the TFL holder.

17. See Note 11 for Indicator 24.

18. The provincial allowable annual cut (AAC) includes all government-set AACs (timber supply areas, tree farm licences, woodlot licences and community forests) as of December 31 in each year.

Indicator 24-4:

19. See Note 1 for Indicator 24.

20. See Note 14 for Indicator 24.

21. See Note 3 for Indicator 24.

22. See Note 16 for Indicator 24.

23. See Note 11 for Indicator 24.

24. See Note 18 for Indicator 24.

Abbreviations

AAC	allowable annual cut
ABCFP	Association of British Columbia Forest Professionals
AT	Alpine Tundra Zone
BBS	North American Breeding Bird Survey
B.C. (or BC)	British Columbia (as part of another acronym or name)
BCFS	British Columbia Forest Service
BEC	biogeoclimatic ecosystem classification
BEI	broad ecosystem inventory
BG	Bunchgrass Zone
BTM	baseline thematic mapping
BCTS	BC Timber Sales
BWBS	Boreal White and Black Spruce Zone
CBM-CFS2	Carbon Budget Model of the Canadian Forest Sector
CCFM	Canadian Council of Forest Ministers
CDC	Conservation Data Centre
CDF	Coastal Douglas-fir Zone
C&E	compliance and enforcement
CFA	community forest agreement
CFS	Canadian Forest Service
CO_2	carbon dioxide
CORE	Commission on Resources and the Environment
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CSA	Canadian Standards Association
CSFCC	Canadian Sustainable Forestry Certification Coalition
CWH	Coastal Western Hemlock Zone
DFO	Department of Fisheries and Oceans (Canada)
ESSF	Engelmann Spruce – Subalpine Fir Zone
FDP	forest development plan
FL	forest licence
FRPA	*Forest and Range Practices Act*
FREP	Forest and Range Evaluation Program
FSC	Forest Stewardship Council
FSP	forest stewardship plan
GDP	gross domestic product
ha	hectare
ICH	Interior Cedar–Hemlock Zone
IDF	Interior Douglas-fir Zone
ILMB	Integrated Land Management Bureau
ISO	International Organization for Standardization
IUCN	World Conservation Union
IWMS	Identified Wildlife Management Strategy
LRDW	land and resource data warehouse
LRMP	land and resource management plan
m^3	cubic metre
MARR	Ministry of Aboriginal Relations and Reconciliation
MAL	Ministry of Agriculture and Lands
MH	Mountain Hemlock Zone
MFR	Ministry of Forests and Range

MoE	Ministry of Environment
MoF	Ministry of Forests
MP	The Montréal Process
MPB	mountain pine beetle
MS	Montane Spruce Zone
NFI	national forest inventory
NGO	non-government organization
NRCAN	Natural Resources Canada
NSR	not satisfactorily restocked
NTFP	non-timber forest product
PEFC	Programme for the Endorsement of Forest Certification
PP	Ponderosa Pine Zone
RESULTS	Reporting Silviculture Updates and Land status Tracking System
RISC	Resource Information Standards Committee
RPF	Registered Professional Forester
RSM	resource stewardship monitoring
SAR	species at risk
SBS	Sub-Boreal Spruce Zone
SBPS	Sub-Boreal Pine–Spruce Zone
SEE	BC Species and Ecosystems Explorer
SEI	sensitive ecosystems inventories
SFI	Sustainable Forestry Initiative
SFMP	sustainable forest management plan
SPAR	Seed Planning & Registry System
SRMP	sustainable resource management plan
SWB	Spruce–Willow–Birch Zone
THLB	timber harvesting land base
TFL	tree farm licence
TRIM	terrestrial resource information management
TSA	timber supply area
TSL	timber sale licence
UBC	University of British Columbia
UNCED	United Nations Conference on the Environment and Development
U.S.A.	United States of America
VRI	vegetation resources inventory
WLAP	Ministry of Water, Land and Air Protection (now MoE)
WTC	Wildlife Tree Committee

Glossary

Aboriginal rights

- Refer to practices, traditions or customs ("activity[ies]") which are integral to the distinctive culture of an aboriginal society and were practiced prior to European contact, meaning they were rooted in the pre-contact society (the date is no longer prior to 1846, the date British sovereignty was asserted in B.C.);
- Must be practiced for a substantial period of time to have formed an integral part of the particular aboriginal society's culture;
- Must be an activity that is a central, defining feature which is independently significant to the aboriginal society;
- Must be distinctive (not unique), meaning it must be distinguishing and characteristic of that culture;
- Must be based on an actual activity related to a resource: the significance of the activity is relevant but cannot itself constitute the claim to an aboriginal right;
- Must be given a priority after conservation measures (not amounting to an exclusive right);
- Must meet a continuity requirement, meaning that the aboriginal society must demonstrate that the connection with the land in its customs and laws has continued to the present day;
- May be the exercise in a modern form of an activity that existed prior to European contact;
- May include the right to fish, pick berries, hunt and trap for sustenance, social and ceremonial purposes (for example, ceremonial uses of trees and wildlife locations);
- May include an aboriginal right to sell or trade commercially in a resource where there is evidence to show that the activity existed prior to European contact "on a scale best characterized as commercial" and that such activity is an integral part of the aboriginal society's distinctive culture;
- May be adapted in response to the arrival of Europeans if the activity was an integral part of the aboriginal society's culture prior to European contact;
- Do not include an activity that solely exists because of the influence of European contact; and
- Do not include aspects of aboriginal society that are true of every society such as eating to survive.

Aboriginal rights arise from the prior occupation of land, but they also arise from the prior social organization and distinctive cultures of aboriginal peoples on that land. Treaty negotiations will translate aboriginal rights into contemporary terms.
(MARR, Glossary of Treaty-Related Terms. http://www.gov.bc.ca/arr/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 MFR, Glossary of Forestry Terms.
http://www.for.gov.bc.ca/hfd/library/documents/glossary/)

At risk

A wildlife species is deemed "at risk" when an evaluation shows some likelihood of extinction or extirpation given the current circumstances.
(Adapted from COSEWIC.
http://www.cosewic.gc.ca/eng/sct0/assessment_process_e.cfm#tbl5)

Backlog planting
Planting that is overdue. In general, planting is considered backlog planting if more than 7 years have elapsed since a site was cleared (by harvesting, fire, insects or disease) in the Interior, and more than 3 years have elapsed on the Coast of British Columbia.
(Adapted from MFR, Glossary of Forestry Terms.
http://www.for.gov.bc.ca/hfd/library/documents/glossary/)

Current operational use of the term "backlog" or "backlog planting" is usually restricted to areas harvested before 1988 that are of Good or Medium site productivity. This is based on the *Forest Practices Code of British Columbia Act* of 1995, which re-defined a backlog area as "an area from which the timber was harvested, damaged or destroyed before October 1, 1987; and, which in the district manager's opinion, is insufficiently stocked with healthy, well-spaced trees of a commercially acceptable species."

Biogeoclimatic zone
A geographic area having similar patterns of energy flow, vegetation and soils as a result of a broadly homogenous macroclimate.
(MFR, Glossary of Forestry Terms. http://www.for.gov.bc.ca/hfd/library/documents/glossary/)

British Columbia's low-elevation biogeoclimatic zones are :
- Coastal Douglas-fir (CDF)
- Coastal Western Hemlock (CWH)
- Bunchgrass (BG)
- Ponderosa Pine (PP)
- Interior Douglas-fir (IDF)
- Interior Cedar–Hemlock (ICH)
- Sub-Boreal Spruce (SBS)
- Boreal White and Black Spruce (BWBS)
- Sub-Boreal Pine–Spruce (SBPS)
- Montane Spruce (MS)

The high-elevation zones are:
- Mountain Hemlock (MH)
- Engelmann Spruce – Subalpine Fir (ESSF)
- Spruce–Willow–Birch (SWB)
- Alpine Tundra (AT)

Descriptions of each zone are at
http://www.for.gov.bc.ca/hre/becweb/resources/classificationreports/provincial/index.html.
An interactive map showing all zones is at
http://www.for.gov.bc.ca/hfd/library/documents/treebook/biogeo/biogeo.htm.

Biomass
The total mass of living organisms in a given area or volume. Forest biomass consists primarily of above-ground and below-ground tree components (stems, branches, leaves, and roots); other woody vegetation; and mosses, lichens, and herbs. Animal biomass typically comprises only a very small portion of total forest biomass.
(Canadian Forest Service. Carbon Budget Model of the Canadian Forest Sector.
http://carbon.cfs.nrcan.gc.ca/cbm/index_e.html)

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.
http://www.fao.org/docrep/004/y1997e/y1997e1m.htm#bm58)

Brushing
A silvicultural activity done by chemical, manual, grazing, or mechanical means to control competing forest vegetation and reduce competition for space, light, moisture, and nutrients with crop trees or seedlings.
(MFR, Glossary of Forestry Terms. http://www.for.gov.bc.ca/hfd/library/documents/glossary/)

Clearcutting
The process of removing all trees, large and small, in a stand in one cutting operation.
As a silvicultural system, clearcutting removes an entire stand of trees from an area of one hectare or more, and greater that two tree heights in width, in a single harvesting operation. A new even-aged stand is obtained by planting, natural or advanced regeneration or direct seeding. The opening size and dimensions created are generally large enough to limit significant microclimatic influence from the surrounding stand.
(Adapted from MFR, Glossary of Forestry Terms.
http://www.for.gov.bc.ca/hfd/library/documents/glossary/)

Clearcutting with reserves
A variation of the clearcutting silvicultural system in which trees are retained, either uniformly or in small groups, for purposes other than regeneration.
(Adapted from MFR, Glossary of Forestry Terms.
http://www.for.gov.bc.ca/hfd/library/documents/glossary/)

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.
(MFR, Glossary of Forestry Terms. http://www.for.gov.bc.ca/hfd/library/documents/glossary/)

Community forest
Specifically, a “community forest agreement” is a tenure agreement under the *Forest Act* that describes an area of Crown forest land to be managed by a community, under general supervision of the Forest Service, for a sustainable timber harvest as determined by an allowable annual cut.

More generally, community forest may refer to any forestry operation managed by a local government, community group or First Nation 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.
(Adapted from MFR, Community Forests. http://www.for.gov.bc.ca/hth/community/)

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.
http://www.fao.org/docrep/004/y1997e/y1997e1m.htm#bm58)

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)

Dead organic matter (DOM)
A generic term for all dead organic compounds in the ecosystem. These include standing dead trees, downed trees, coarse and fine woody debris, litter, soil carbon, and peat.
(Canadian Forest Service. Carbon Budget Model of the Canadian Forest Sector. http://carbon.cfs.nrcan.gc.ca/cbm/index_e.html)

Direct employment
Jobs in a particular industry of interest, such as the forest industry or the ranching industry.

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)

In British Columbia, ecoregion is defined differently, and used with the term ecosection:

An ecoregion is an area with major physiographic and minor macroclimatic or oceanographic variation. There are 43 ecoregions in British Columbia of which 39 are terrestrial. Ecoregions are meant to be mapped at 1:500,000 for regional strategic planning.
(MoE, Ecoregions of British Columbia. http://www.env.gov.bc.ca/ecology/ecoregions/index.html)

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 MoE, Ecoregions of British Columbia. http://www.env.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.
(MFR, Glossary of Forestry Terms. http://www.for.gov.bc.ca/hfd/library/documents/glossary/)

Effective population size
The size of an ideal population, which when contrasted to the population under study, would possess the same rate of increase in inbreeding, or decrease in genetic diversity due to genetic drift.
(Dunster, Julian A. 1996. Dictionary of natural resource management. UBC Press: Vancouver)

Endangered
A wildlife species facing imminent extirpation or extinction.
(COSEWIC. http://www.cosewic.gc.ca/eng/sct0/assessment_process_e.cfm#tbl5)

Ex situ
Transfer of organisms (plant or animal) from one site (eg., in the wild) to another site (e.g., seed banks, zoos), for the purpose of maintenance or breeding as a means of conserving the organism.
(Dunster, Julian A. 1996. Dictionary of natural resource management. UBC Press: Vancouver)

Extinct
A wildlife species that no longer exists.
(COSEWIC. http://www.cosewic.gc.ca/eng/sct0/assessment_process_e.cfm#tbl5)

Extirpated
A wildlife species no longer existing in the wild in B.C., but occurring elsewhere.
(Adapted from COSEWIC.
http://www.cosewic.gc.ca/eng/sct0/assessment_process_e.cfm#tbl5)

Fertilizing
The addition of fertilizer to promote tree growth on sites deficient in one or more soil nutrients. Also used to improve the vigor of crop trees following juvenile spacing or commercial thinning.
(MFR, 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.
(MARR, 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.
http://www.fao.org/docrep/004/y1997e/y1997e1m.htm#bm58)

Forest-associated
A forest-associated species has a measurable dependence on a forest ecosystem(s) for any aspect of its life history, including indirect dependence, such as consuming forest-based or forest-derived resources. A forest-associated species may be:

(1) forest dependent and forest dwelling: A species requiring forest conditions for all or part of its requirements for food, shelter or reproduction.
(2) forest dependent but not forest dwelling: A species not using or living in forest habitats, but that is significantly affected by disturbance or changes in adjacent forests.
(3) forest using but not forest dependent: A species that is not forest dependent, but makes marginal use of forest habitats.
(4) known to be forest-associated, but information is insufficient to categorize it as (1), (2) or (3).

(Adapted from a workshop for the National Status 2005 report on criteria and indicators. Canadian Council of Forest Ministers. http://www.ccfm.org/)

Genetic diversity
Genetic diversity refers to differences at the gene level among individuals of the same species. Genetic diversity can be observed at several levels, such as: 1. differences between trees within a local area, and 2. differences between areas or stands of trees across the species range.
(Adapted from Genes Trees and Forests, Brochure 9. 1983. MFR, Research Branch. http://www.for.gov.bc.ca/hfd/pubs/Docs/Bro/Bro09.htm and Yanchuk, A.D., M. Carlson, and J. Woods. 1992. Genetic Diversity in Forest Management. Information Leaflet. B.C. Min. For., Res. Br., Victoria, B.C.)

Genetic gain
An improvement in the mean genotypic value of a selected character, obtained as a result of breeding. The gain is the product of the degree of heritability and the selection differential for that character.
(Dunster, Julian A. 1996. Dictionary of natural resource management. UBC Press: Vancouver)

Genetic resource archive
For genetic conservation: *Ex-situ* collections of germplasm.
(The Forest Genetics Council of British Columbia, Glossary of Forest Genetics Terms. http://www.fgcouncil.bc.ca/index.html)

Greenhouse Gases
Greenhouse gases are those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere, and clouds. This property causes the greenhouse effect. Water vapour (H_2O), carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), and ozone (O_3) are the primary greenhouse gases in the Earth's atmosphere. Moreover there are a number of entirely human-made greenhouse gases in the atmosphere, such as the halocarbons and other chlorine- and bromine-containing substances, dealt with under the Montréal Protocol. Besides CO_2, N_2O, and CH_4, the Kyoto Protocol deals with the greenhouse gases sulfur hexafluoride (SF_6), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs).
(Intergovernmental Panel on Climate Change Third Assessment Report, Glossary of Terms. http://www.ipcc.ch/pub/syrgloss.pdf)

Heterozygosity
An individual having two different alleles or forms of the same gene in all diploid cells. Different alleles determine alternative characteristics of inheritance, so an organism with different alleles in a pair of genes (e.g. Aa, rather than the same alleles, AA or aa) can pass on either of the two genes (A or a). Consequently, it may not always breed true to type and maintains higher genetic diversity than an organism with the same alleles.
(Adapted from: Dunster, Julian A. 1996. Dictionary of natural resource management. UBC Press: Vancouver)

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)

Indirect employment
Jobs in other businesses or industries supplying goods and services to a selected industry that provides direct employment. Jobs providing goods and services to the direct employees and indirect employees, known as induced employment, are not included. For example, a sawmill providing direct employment in the forest industry also provides indirect employment

to retailers, accountants and various trades for special jobs which the sawmill employees are not trained to handle, to produce the direct outputs of the sawmill. The directly and indirectly employed workers buy goods and services for their own use, creating induced employment. Induced employment is not included in indirect employment, to avoid double-counting.

In situ

Maintaining the genetic variability of a population in approximately the same geographic and ecological conditions under which it evolved through on site retention, with the use of artificial or natural regeneration.
(Adapted from State University of New York College of Environmental Science and Forestry. Faculty of Forestry. Forest Genetics Glossary.
http://www.esf.edu/for/maynard/GENE_GLOSSERY.html#Germplasm%20conservation and Dunster, Julian A. 1996. Dictionary of natural resource management. UBC Press: Vancouver)

Interim measures agreements

These include Forest and Range Agreements and other similar agreements between the Ministry of Forests and Range and eligible First Nations designed to provide for "workable accommodation" of aboriginal interests that may be impacted by forestry decisions during the term of the agreement, until such time as those interests are resolved through treaty. These agreements provide the Ministry with operational stability and assist First Nations to achieve their economic objectives by providing revenue and direct award of timber tenure.
(MFR, Aboriginal Affairs Branch.
http://www.for.gov.bc.ca/haa/Docs/Public_Q&A_Oct27_2004.htm#general1)

IUCN categories of protected areas

The International Union for Conservation of Nature and Natural Resources (IUCN, now 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).

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#action)

Keystone species
Species that are dominant in function and possibly (but not necessarily) in structure within any one ecosystem. They hold a crucial role in supporting the integrity of the entire ecosystem, and therefore affect the survival and abundance of many other species in the same ecosystem.
(Dunster, Julian A. 1996. Dictionary of natural resource management. UBC Press: Vancouver)

Large organic debris
Also called large woody debris. Entire trees, or large pieces of trees, found on the forest floor or within stream channels. Large organic debris in stream channels typically have a diameter greater than ten centimetres and longer than one metre, and provide channel stability and/or create fish habitat diversity.
(Dunster, Julian A. 1996. Dictionary of natural resource management. UBC Press: Vancouver)

Managed forest land
Forest land that is being managed under a forest management plan utilizing the science of forestry.
(MFR, Glossary of Forestry Terms. http://www.for.gov.bc.ca/hfd/library/documents/glossary/)

In British Columbia, private land classified as "managed forest land" under the *Assessment Act* is given favourable tax treatment to encourage private landowners to manage their lands for long-term forest production. To maintain the classification, management of the land must meet the requirements under the *Private Managed Forest Land Act*.
(Private Managed Forest Land Council, Managed Forest Program. http://www.pmflc.ca/program.html)

Merchantable
A tree or stand of trees is considered to be merchantable once it has reached a size, quality, volume, or a combination of these that permits harvesting and processing. Merchantability is independent of economic factors, such as road accessibility or logging feasibility.
(Dunster, Julian A. 1996. Dictionary of natural resource management. UBC Press: Vancouver)

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. http://www.fao.org/docrep/004/y1997e/y1997e1m.htm#bm58)

Natural disturbance
A change in forest structure and composition caused by fire, insects, wind, landslides and other natural processes.
(Adapted from MFR, Glossary of Forestry Terms. http://www.for.gov.bc.ca/hfd/library/documents/glossary/)

Natural regeneration
The renewal of a forest stand by natural seeding (on-site or from adjacent stands; seeds may be deposited by wind, birds or mammals), sprouting, suckering, or layering.
(Adapted from MFR, Glossary of Forestry Terms. http://www.for.gov.bc.ca/hfd/library/documents/glossary/)

Non-timber forest products
Botanical and mycological products and associated services of the forest other than timber, pulpwood, shakes or other wood products. Examples include wild mushrooms, floral greenery, craft products, herbs, ethnobotanical teaching and forest tourism.
(Royal Roads University, Centre for Non-Timber Resources, 2006. http://www.royalroads.ca/programs/faculties-schools-centres/non-timber-resources/ntfp/)

Not satisfactorily restocked
Productive forest land that has been denuded and has failed, partially or completely, to regenerate either naturally or by planting or seeding to the specified or desired free growing standards for the site.
(MFR, 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.
(MFR, 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. http://www.fao.org/docrep/004/y1997e/y1997e1m.htm#bm58)

Partial cutting
Refers generically to stand entries, under any of the several silvicultural systems, to cut selected trees and leave desirable trees for various stand objectives. Partial cutting includes harvest methods used for seed tree, shelterwood, selection, and clearcutting with reserves systems.
(MFR, Glossary of Forestry Terms. http://www.for.gov.bc.ca/hfd/library/documents/glossary/)

Planting
Establishing a forest by setting out seedlings, transplants or cuttings in an area.
(Adapted from MFR, Glossary of Forestry Terms. http://www.for.gov.bc.ca/hfd/library/documents/glossary/)

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 MFR, Glossary of Forestry Terms.
http://www.for.gov.bc.ca/hfd/library/documents/glossary/)

Provenance
The geographical area and environment to which the parent trees and associated vegetation are native, and within which their genetic constitution has been developed through natural selection.
(Adapted from MFR, Glossary of Forestry Terms.
http://www.for.gov.bc.ca/hfd/library/documents/glossary/)

Provincial forest
Forest land designated under Section 4 of the *Forest Act*. The Lieutenant Governor in Council may designate any forest land as a provincial forest. The uses of provincial forests include timber production, forage production, forest recreation, and water, fisheries and wildlife resource purposes.
(MFR, Glossary of Forestry Terms. http://www.for.gov.bc.ca/hfd/library/documents/glossary/)

Pruning
The manual removal, close to or flush with the stem, of side branches, live or dead, and of multiple leaders from standing, generally plantation-grown trees. Pruning is carried out to improve the market value of the final wood product by producing knot-free wood for the improvement of the tree or its timber.
(MFR, Glossary of Forestry Terms. http://www.for.gov.bc.ca/hfd/library/documents/glossary/)

Ranking
Ranking is the process of assigning a risk of extinction “score” (i.e., rank) to each species. The purpose is to identify species most at risk, as well as to establish baseline ranks for each.
(MoE, Species Ranking in British Columbia.
http://wlapwww.gov.bc.ca/wld/documents/ranking.pdf)

In British Columbia, the Conservation Data Centre ranks species into three lists:
RED = extirpated, endangered or threatened in B.C. (red-listed species and sub-species have, or are candidates for, official Extirpated, Endangered or Threatened Status in B.C.),
BLUE = special concern,
YELLOW = not at risk.
http://www.env.gov.bc.ca/atrisk/red-blue.htm#purpose

Resilience
The ability of an ecosystem to recover and maintain the desired condition of diversity, integrity, and ecological processes following disturbances.
(Dunster, Julian A. 1996. Dictionary of natural resource management. UBC Press: Vancouver)

Riparian area
An area of land adjacent to a stream, river, lake or wetland that contains vegetation that, due to the presence of water, is distinctly different from the vegetation of adjacent upland areas.
(MFR, 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, Julian A. 1996. Dictionary of natural resource management. UBC Press: Vancouver)

Seed planning unit (SPU)
Seed planning units are geographically distinct areas that form the basis for gene resource management, including: tree improvement (breeding, orchard crop production), seed transfer (areas of use), monitoring and gene conservation. SPUs are based on species, ecological zone, elevation and, in some cases, latitude band.
(Adapted from MFR, Tree Improvement Branch. http://www.for.gov.bc.ca/hti/speciesplan/index.htm)

Select seed
Seed that exhibits a higher level of one or more desired genetic traits (such as growth rate, form, wood density, and resistance to insects and disease) than wild seed collected from an average natural stand. This includes seed from tested parents growing in seed orchards and seed collected from natural stand superior provenances. Vegetative material for propagation, from production facilities using tested parents and from superior provenances, is included in the term select seed.

Silvicultural system
A planned program of treatments throughout the life of the stand to achieve stand structural objectives based on integrated resource management goals. A silvicultural system includes harvesting, regeneration and stand-tending methods or phases. It covers all activities for the entire length of a rotation or cutting cycle.
(MFR, Glossary of Forestry Terms. http://www.for.gov.bc.ca/hfd/library/documents/glossary/)

Silviculture
The art and science of controlling the establishment, growth, composition, health and quality of forests and woodlands. Silviculture entails the manipulation of forest and woodland vegetation in stands and on landscapes to meet the diverse needs and values of landowners and society on a sustainable basis.
(MFR, Glossary of Forestry Terms. http://www.for.gov.bc.ca/hfd/library/documents/glossary/)

Site preparation
Any action, related to reforestation, to create an environment favourable for survival of suitable trees during the first growing season. It may alter the ground cover, soil or microsite conditions, using biological, mechanical, or manual clearing, prescribed burns, herbicides, or a combination of methods. Both natural regeneration and planting may be improved through site preparation.
(Adapted from Dunster, Julian A. 1996. Dictionary of natural resource management. UBC Press: Vancouver)

Spacing
The removal of undesirable trees within a young stand to control stocking, to maintain or improve growth, to increase wood quality and value, or to achieve other resource management objectives.
(MFR, Glossary of Forestry Terms. http://www.for.gov.bc.ca/hfd/library/documents/glossary/)

Special management zones
A land use designation used to identify areas where enhanced levels of management are required to address sensitive values such as fish and wildlife habitat, visual quality, recreation and cultural heritage features, etc. The management intent is to maintain or enhance these values while allowing compatible human use and development.
(Adapted from the Glossary definition for "special management area" in the Ft. St. John Land and Resource Management Plan.
http://ilmbwww.gov.bc.ca/lup/lrmp/northern/ftstjohn/plan/appc.htm#r

Species
A singular or plural term for a population or series of populations of organisms that are capable of interbreeding freely with each other but not with members of other species. Includes a number of cases:

endemic species: a species originating in, or belonging to, a particular region. Both "endemic" and "indigenous" are preferred over "native."

exotic species: a species introduced accidentally or intentionally to a region beyond its natural range. "Exotic" is preferred over "alien," "foreign" and "non-native.'

subspecies: a subdivision of a species. A population or series of populations occupying a discrete range and differing genetically from other subspecies of the same species.

(MFR, Glossary of Forestry Terms. http://www.for.gov.bc.ca/hfd/library/documents/glossary/)

The species counts in the Species diversity indicator are for naturally occurring species and subspecies found in B.C. or now presumed extirpated in B.C. Extinct species are counted separately. Distinct populations are not counted as separate species. The species counts are generally consistent with COSEWIC's use of the term "wildlife species", limited to B.C.:
"A species, subspecies, variety or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years."
(COSEWIC. http://www.cosewic.gc.ca/eng/sct0/assessment_process_e.cfm#tbl5)

Species diversity
An assessment of the number of species present, their relative abundance in an area, and the distribution of individuals among the species.
(Adapted from Dunster, Julian A. 1996. Dictionary of natural resource management. UBC Press: Vancouver)

Stand
A community of trees sufficiently uniform in species composition, age, arrangement, and condition to be distinguishable as a group from the forest or other growth on the adjoining area, and thus forming a silvicultural or management entity.
(MFR, Glossary of Forestry Terms. http://www.for.gov.bc.ca/hfd/library/documents/glossary/)

Tenure
The relationships established among humans regarding their various rights to own, use, and control land, or the resources on that land.
(Dunster, Julian A. 1996. Dictionary of natural resource management. UBC Press: Vancouver)

The holding, particularly as to manner or term (i.e., period of time), of a property. Land tenure may be broadly categorized into private lands, federal lands, and provincial Crown lands. The *Forest Act* defines a number of forestry tenures by which the cutting of timber and other user rights to provincial Crown land are assigned.
(MFR Glossary of Forestry Terms. http://www.for.gov.bc.ca/hfd/library/documents/glossary/)

Terrestrial vertebrate
A member of the subphylum Vertebrata, a primary division of the phylum Chordata that includes fishes, amphibians, reptiles, birds, and mammals, all of which are characterized by a segmented spinal column and a distinct well-differentiated head, whose primary habitat for growth, reproduction, and survival is on or in the land.
(Adapted from "Terrestrial" in: Dunster, Julian A. 1996. Dictionary of natural resource management. UBC Press: Vancouver)

Threatened
A wildlife species likely to become endangered if limiting factors are not reversed.
(COSEWIC. http://www.cosewic.gc.ca/eng/sct0/assessment_process_e.cfm#tbl5)

Timber Harvest Land Base (THLB)
The portion of the total area of a management unit considered to contribute to, and be available for, long-term timber supply. The harvesting land base is defined by reducing the total land base
according to specified management assumptions.
(MFR, Glossary of Forestry Terms. http://www.for.gov.bc.ca/hfd/library/documents/glossary/)

Timber supply area (TSA)
An area of public (provincial Crown) land designated under the *Forest Act* that is managed for sustainable timber harvest, as determined by an allowable cut. TSAs were originally defined by an established pattern of wood flow from management units to the primary timber-using industries.
(Adapted from MFR, Annual report 2003/04.
http://www.for.gov.bc.ca/hfd/pubs/docs/mr/annual/ar_2003-04/for.pdf and
MFR, Glossary of Forestry Terms. http://www.for.gov.bc.ca/hfd/library/documents/glossary/)

Traditional ecological knowledge
Indigenous peoples' knowledge of their environment, its processes, and interrelationships.
(Clayoquot Sound Scientific Panel. 1995. Report 3: First Nations' Perspectives Relating to Forest Practices Standards in Clayoquot Sound. p. 11)

Traditional use
A use of land or water that is associated with the beliefs, customs and practices passed down through the generations of a community of indigenous people. Traditional use is usually identified with a site. The site may lack physical evidence of human-made artefacts or structures, yet maintain cultural significance to a living community of people, for example:

- A location associated with traditional beliefs of an aboriginal group about its origins, cultural history or world view;
- The location of a trail, sacred site or resource gathering site such as berry grounds;
- A location where a community has traditionally carried out economic, artistic or other cultural pursuits important to maintaining its identity; or
- The traditional home of a particular cultural group.

(Adapted from Ministry of Forests.1996. Traditional Use Study Program: Funding Proposal Instructions.)

Tree farm licence (TFL)
An agreement under the *Forest Act* that describes an area to be managed, under general supervision of the Forest Service, for a 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: MFR Glossary of Forestry Terms.
http://www.for.gov.bc.ca/hfd/library/documents/glossary/)

Variable retention
A relatively new silvicultural system that follows nature's model by always retaining part of the forest after harvesting. Standing trees are left in a dispersed or aggregated form to meet objectives such as retaining old growth structure, habitat protection and visual quality. Variable retention retains structural features (snags, large woody debris, live trees of varying sizes and canopy levels) as habitat for a host of forest organisms. There are two types of variable retention:

Dispersed retention - retains individual trees scattered throughout a cutblock,
Aggregate (group) retention - retains trees in clumps or clusters.

The main objectives of variable retention are to retain the natural range of stand and forest structure and forest functions. With retention systems, forest areas to be retained are determined before deciding which areas will be cut. This system offers a range of retention levels. The system also provides for permanent retention of trees and other structures after regeneration is established. Variable retention can be implemented with a range of harvesting systems and can be combined with traditional silvicultural systems such as shelterwood or selection.
(MFR, Glossary of Forestry Terms. http://www.for.gov.bc.ca/hfd/library/documents/glossary/)

Vascular plant
Plants having well-developed vascular components (xylem and phloem) capable of transporting water, sugars, nutrients, and minerals between the absorbing tissue in the roots and the photosynthesizing tissue in the leaves.
(Dunster, Julian A. 1996. Dictionary of natural resource management. UBC Press: Vancouver)

Wildlife tree
A tree or group of trees that are identified in an operational plan to provide present or future wildlife habitat. A wildlife tree is a standing live or dead tree with special characteristics that provide valuable habitat for the conservation or enhancement of wildlife. Characteristics include large diameter and height for the site, current use by wildlife, declining or dead condition, value as a species, valuable location and relative scarcity.
(MFR, Glossary of Forestry Terms. http://www.for.gov.bc.ca/hfd/library/documents/glossary/)

Woodlot licence
An agreement under the *Forest Act* that describes an area to be managed, under general supervision of the Forest Service, for a sustainable timber harvest as determined by an allowable annual cut. It is similar to a tree farm licence, but on a smaller scale, and typically combines public (provincial Crown) land with private land. A woodlot licence has a term not exceeding 20 years.
(Adapted from: MFR Glossary of Forestry Terms.
http://www.for.gov.bc.ca/hfd/library/documents/glossary/)

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http://www.for.gov.bc.ca/mof/annualreports.htm

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http://www.for.gov.bc.ca/hth/apportionment/apportionment.htm

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http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

BC Forest Safety Council.
http://www.bcforestsafe.org/index.asp

BC Parks – Parks and Protected Areas Branch, Ministry of Environment.
http://www.env.gov.bc.ca/bcparks/

BC Stats – Ministry of Labour and Citizen's Services.
http://www.bcstats.gov.bc.ca/

BC Treaty Commission.
http://www.bctreaty.net/

BC Wilderness Tourism Association.
http://www.wilderness-tourism.bc.ca/

BEC – Biogeoclimatic Ecosystem Classification. Ministry of Forests and Range.
http://www.for.gov.bc.ca/hre/becweb/resources/classificationreports/provincial/index.html

BEI – Broad Ecosystem Inventory. Ecosystems Information Section, Ministry of Environment.
http://www.env.gov.bc.ca/ecology/bei/index.html

BTM – Baseline Thematic Mapping. Integrated Land Management Bureau, Ministry of Agriculture and Lands.
http://ilmbwww.gov.bc.ca/cis/initiatives/ias/btm/index.html

C&E – Compliance and Enforcement Branch, Ministry of Forests and Range.
http://www.for.gov.bc.ca/hen/

CBM-CFS2 – Carbon Budget Model of the Canadian Forest Sector. Canadian Forest Service, Natural Resources Canada.
http://carbon.cfs.nrcan.gc.ca/cbm/index_e.html

CDC – Conservation Data Centre. Ministry of Environment.
http://www.env.gov.bc.ca/cdc/

Chief Forester's Standards for Seed Use – Ministry of Forests and Range.
http://www.for.gov.bc.ca/code/cfstandards/

COSEWIC – Committee on the Status of Endangered Wildlife in Canada. Government of Canada.
http://www.cosewic.gc.ca/

CSFCC – Canadian Sustainable Forestry Certification Coalition.
http://www.certificationcanada.org/

Disturbances – Natural Disturbance Database. Canadian Forest Service, Natural Resources Canada.
http://cfs.nrcan.gc.ca/subsite/disturbance

Ecoregions of B.C. – Ecosystems Information Section. Ministry of Environment.
http://www.env.gov.bc.ca/ecology/ecoregions/index.html

E-Flora BC – Electronic Atlas of the Plants of British Columbia. University of British Columbia.
http://www.eflora.bc.ca/

Forest Analysis – Forest Analysis and Inventory Branch, Ministry of Forests and Range.
http://www.for.gov.bc.ca/hts/

Forest Appeals Commission – Province of British Columbia.
http://www.fac.gov.bc.ca/

Forest legislation – Ministry of Forests and Range.
http://www.for.gov.bc.ca/tasb/legsregs/comptoc.htm

Forest Legislation and Policy Reference Guide – Association of BC Forest Professionals.
http://www.abcfp.ca/practice_development/continuing_education/policy_seminars.asp

Forest Management Certification – Ministry of Forests and Range.
http://www.for.gov.bc.ca/het/certification/

Forest Practices Board – Province of British Columbia.
http://www.fpb.gov.bc.ca/

Forest Science – Forest Science Program. Ministry of Forests and Range.
http://www.for.gov.bc.ca/forsci/

FREP – Forest and Range Evaluation Program. Ministry of Forests and Range.
http://www.for.gov.bc.ca/hfp/frep/

ILMB – Integrated Land Management Bureau. Ministry of Agriculture and Lands.
http://ilmbwww.gov.bc.ca/

Indian and Northern Affairs Canada.
http://www.ainc-inac.gc.ca/index_e.html

Integrating NTFPs – Forest Practices Board. 2004. Special report: *Integrating Non-Timber Forest Products into Forest Planning and Practices in British Columbia.*
http://www.fpb.gov.bc.ca/special/reports/SR19/SR19.pdf

IUCN – The World Conservation Union.
http://www.iucn.org/

IWMS – Identified Wildlife Management Strategy, Version 2004. Ministry of Environment.
http://www.env.gov.bc.ca/wld/frpa/iwms/index.html

Log Exports – Log Exports - Administration. Economics and Trade Branch, Ministry of Forests and Range.
http://www.for.gov.bc.ca/HET/Export/index.htm

LRDW – Land and Resource Data Warehouse. Integrated Land Management Bureau, Ministry of Agriculture and Lands.
http://www.lrdw.ca/

Ministry of Aboriginal Relations and Reconciliation.
http://www.gov.bc.ca/arr/

MPB – Mountain Pine Beetles in British Columbia. Forest Practices Branch, Ministry of Forests and Range.
http://www.for.gov.bc.ca/hfp/mountain_pine_beetle/

MPB Initiative – Mountain Pine Beetle Initiative. Canadian Forest Service, Natural Resources Canada.
http://mpb.cfs.nrcan.gc.ca/index_e.html

NatureServe.
http://www.natureserve.org/

NFI – National Forest Inventory. Forest Analysis and Inventory Branch, Ministry of Forests and Range.
http://www.for.gov.bc.ca/hts/nfi/index.html

Parks Canada – Government of Canada.
http://www.pc.gc.ca/

Private Managed Forest Land Council.
http://www.pmflc.ca/program.html

Range maps – Range maps and conservation status of BC tree species. Centre for Forest Gene Conservation, University of British Columbia.
http://genetics.forestry.ubc.ca/cfgc/range-maps.html

Recovery Planning – Environmental Stewardship Division. Ministry of Environment.
http://www.env.gov.bc.ca/wld/recoveryplans/rcvry1.htm

Resource Tenures – Resource Tenures and Engineering Branch, Ministry of Forests and Range.
http://www.for.gov.bc.ca/hth/

RESULTS – Reporting Silviculture Updates and Landstatus Tracking System. Ministry of Forests and Range.
http://www.for.gov.bc.ca/his/results/

RISC – Resource Information Standards Committee. Ministry of Environment.
http://ilmbwww.gov.bc.ca/risc/index.htm

SAR – Species At Risk. Environment Canada.
http://www.speciesatrisk.gc.ca/default_e.cfm

SEE – BC Species and Ecosystems Explorer. Ministry of Environment.
http://www.env.gov.bc.ca/atrisk/toolintro.html

SeedMap – *SeedMap* Web Map and Reporting System. Tree Improvement Branch, Ministry of Forests and Range.
http://www.for.gov.bc.ca/hti/seedmap/index.htm

SEI – Sensitive Ecosystems Inventories. Ministry of Environment.
http://www.env.gov.bc.ca/sei/

Silviculture – Forest Practices Branch, Ministry of Forests and Range.
http://www.for.gov.bc.ca/hfp/silviculture/index.htm

Site Productivity – Site Productivity Working Group, Ministry of Forests and Range.
http://www.for.gov.bc.ca/hre/topics/siteprod.htm

SPAR – Seed Planning And Registration System. Tree Improvement Branch, Ministry of Forests and Range.
http://www.for.gov.bc.ca/hti/spar/index.htm

Statistics Canada.
http://www.statcan.ca/

Strategic Land Use Planning – Regional Land Use Plans and Land and Resource Management Plans (LRMPs) in BC, Ministry of Agriculture and Lands.
http://ilmbwww.gov.bc.ca/lup/lrmp/index.html

Survey of Labour and Income Dynamics – Statistics Canada.
http://www.statcan.ca/cgi-bin/imdb/p2SV.pl?Function=getSurvey&SDDS=3889&lang=en&db=IMDB&dbg=f&adm=8&dis=2

Timber Tenures – Timber Tenure System Publications. Resource Tenures and Engineering Branch, Ministry of Forests and Range.
http://www.for.gov.bc.ca/hth/timten/brochures.htm

Tourism BC.
http://www.tourismbc.com/

Trade Database – Canadian International Merchandise Trade Database, Statistics Canada.
http://www.statcan.ca/trade/scripts/trade_search.cgi

VRI – Vegetation Resources Inventory. Forest Analysis and Inventory Branch, Ministry of Forests and Range.
http://www.for.gov.bc.ca/hts/vri/index.html

Wild BC – Province of British Columbia.
http://www.hctf.ca/wild.htm

WorkSafeBC.
http://www.worksafebc.com/

WTC – Wildlife Tree Committee. Forest Practices Branch, Ministry of Forests and Range.
http://www.for.gov.bc.ca/hfp/values/wildlife/WLT/

Related Publications

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

The Forestry Revitalization Plan; 2003
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)

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