SUSTAINABLE FOREST MANAGEMENT NETWORK
RÉSEAU DE GESTION DURABLE DES FORÊTS
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Relationships between Protected Areas and Sustainable Forest Management: Many Shades of Green

Yolanda F. Wiersma | Peter N. Duinker | Wolfgang Haider | Glen T. Hvenegaard
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A STATE OF KNOWLEDGE REPORT

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Relationships between Protected Areas and Sustainable Forest Management: Many Shades of Green

Yolanda F. Wiersma, Department of Biology, Memorial University
Peter N. Duinker, School for Resource and Environmental Studies, Dalhousie University
Wolfgang Haider, School of Resource and Environmental Studies, Simon Fraser University
Glen T. Hvenegaard, Geography and Environmental Studies, University of Alberta
Fiona K. A. Schmiegelow, Department of Natural Resources, University of Alberta

with contributions from
Shahzma Haji, University of Western Ontario
Linda McDougall, University of Western Ontario
Anne Munier, Memorial University
Mike Wood, University of Western Ontario

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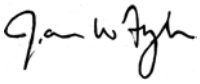
Foreword

The State of Knowledge program was launched by the Sustainable Forest Management Network (SFMN) to capture the knowledge and wisdom that had accumulated in publications and people over a decade of research. The goal was to create a foundation of current knowledge on which to build policy, practice and future research. The program supported groups of researchers, working with experts from SFMN partner organizations, to review literature and collect expert opinion about issues of importance to Canadian forest management. The priority topics for the program were suggested by the Network's partners in consultation with the research theme leaders. Each State of Knowledge team chose an approach appropriate to the topic. The projects involved a diversity of workshops, consultations, reviews of published and unpublished materials, synthesis and writing activities. The result is a suite of reports that we hope will inform new policy and practice and help direct future research.

The State of Knowledge program has been a clear demonstration of the challenges involved in producing a review that does justice to the published literature and captures the wisdom of experts to point to the future. We take this opportunity to acknowledge with gratitude the investment of time and talent by many researchers, authors, editors, reviewers and the publication production team in bringing the program to a successful conclusion.



Jim Fyles
Scientific Director

Fraser Dunn
Chair of the Board

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Executive Summary

Historically, protected areas and industrial forest management have had an antagonistic and uncertain relationship. Proponents of protected areas have seen forest management for timber harvesting as a threat to biodiversity values that protected areas are purported to protect. Similarly, forest managers have often viewed protected areas as a constraint on their operations.

Recent changes to forest management practices in Canada have created opportunities for the two sides to move closer together. Management of the forested land base requires integration between different sectors and interest groups. Thus, there is a need for a closer investigation of the relationship between protected areas and sustainable forest management. However, how these two concepts can interact in a practical sense is fraught with uncertainty. Thus, a knowledge-synthesis project on this topic was identified as a research priority by partners of the Sustainable Forest Management Network.

One of the key challenges appears to be that most people conceptualize protected areas as *places*, and sustainable forest management as a *process* or approach. We compare the concepts of protected areas and sustainable forest management with the following statements:

> If the dominant value for which a forest ecosystem is delineated and managed is **biodiversity**, then **nature protection** is an appropriate paradigm for management of the ecosystem; an area to which this management is applied is termed a **protected area**. Protected areas are those areas **designated under legislation** and which fall under IUCN (International Union for the Conservation of Nature) classification, and can occur on different scales.
>
> If the dominant value for which a forest ecosystem is to be delineated and managed is **timber**, then **sustainable forest management** is an appropriate paradigm to be applied. **Timber-producing forests** are defined as areas where timber is cut and moved into the market for commercial purposes. Timber-producing forests can occur on different scales, from small woodlot operations to large industrial operations.

A forested landscape can contain both protected areas and timber-producing forests. Both are forms of managed areas, and in each case, management can be evaluated along a continuum of effectiveness in terms of achieving stated values.

Sustainable forest management is defined by the CSA (2008) as management "to maintain and enhance the long-term health of forest ecosystems, while providing ecological, economic, social, and cultural opportunities for the benefit of present and future generations". In the Canadian context, the term is generally used in relation to management of timber-producing forests, although it can be argued that the concept of sustainable forest management could also apply to other forms of forest management / the forest as a whole.

Sustainable forest management can be (and is) empirically evaluated within timber-producing forests. The Canadian Council of Forest Ministers has drafted a clear set of criteria and indicators for evaluating the effectiveness of the sustainable management of timber-producing forests. Strategies for evaluation have also been applied for evaluating the effectiveness of protected areas management in maintaining ecological integrity. However, these are not captured in national standards in the same way as the criteria and indicators framework for sustainable forest management.

Non-harvestable areas also form part of the landscape. Non-harvestable areas are portions of the forest (within and/or outside timber-producing forests) that are left unharvested due to the presence of unmarketable tree species, unmerchantable wood, or unworkable ground, or that are left as intentional reserves for rare species or as high-conservation-value forests. These "de-facto" protected areas are not formally protected, yet contribute similar ecological values as protected areas.

It is important to view protected areas, non-harvestable areas, and timber-producing forests not as discrete elements but as managed areas that occur along a continuum, and which all contribute social, economic and ecological values. The extent to which individual parcels contribute to each of these three sets of values will depend, to a large degree, on the management effectiveness within the parcel in question. However, their success in achieving management objectives may also be influenced by management of areas outside their borders (e.g., adjacent protected areas or timber-producing forests).

An improved understanding of the relationship between protected areas, timber-producing forests, and non-harvestable areas is not possible without an in-depth examination of the **values** that different sectors and individuals hold for these areas. Ecological, economic and social values have been cited as the three main groups of values associated with sustainability.

A framework for integrating values with objectives, indicators and targets for sustainable forest management is well developed in the Canadian Standards Association framework for forest certification. This framework could be expanded to include objectives, indicators and targets for protected areas alone as well as for protected areas in the context of other elements on the landscape (including timber-producing forests and non-harvestable areas).

Ecological values include values for biodiversity, ecosystem services (e.g., clean air, water), and ecological processes (e.g., carbon cycles). Protected areas may capture many of these values, but are unlikely to be successful without active interaction with neighbouring land holders (which may often include managers of timber-producing forests). Recent innovations in forest practices, including changes in harvest practices, and attempts to emulate natural disturbance patterns, mean that timber-producing forests may also contribute significant ecological values. Non-harvestable areas, including voluntarily set-asides within timber-producing forests (i.e., de facto protected areas), may also contribute ecological values.

Social values represented within both protected and non-harvestable areas include intangible values such as spiritual, aesthetic, recreational, cultural, identity and existence values. Timber-producing forests have social values in that they contribute to the social identity of individuals and the community as a whole, which are tied to the activities of timber harvesting.

Timber-producing forests have obvious **economic values** in terms of employment and revenue through the sale of forest products. Many legislated protected areas generate revenue through gate fees, campground fees and tourism facilities. However, protected areas, timber-producing forests and non-harvestable areas offer many other forms of economic value, such as ecological goods and services, use values, and non-use values. These values can be (and are) quantified using economic models to attach dollar values to non-extractive uses.

Effective integration of protected areas and sustainable forest management requires an effective legislative and policy framework. Unfortunately, no such framework to this end exists today in Canada. Forest legislation, policy and management guidelines are set provincially, and protected-areas legislation and policy exist at both the federal and the provincial/territorial levels. In addition, the responsibilities for managing protected areas and managing forests often falls within

different government ministries/departments within a single province, creating a "silo" effect that inhibits effective inter-agency collaboration.

Some **strategies** have been successfully developed to integrate protected areas and sustainable forest management. These include co-management strategies, the Canadian Model Forest and Forest Communities Programs, certification schemes, community forestry, Aboriginal-led initiatives and ecosystem-based management initiatives.

Key implications for effective integrated management of timber-producing forests and protected areas include breaking down the "silos" in government, developing clear and effective standards, criteria and indicators for evaluation of protected areas and sustainable forest management, and movement towards integrated land-use planning in forested ecosystems.

Key policy implications include the need for increased coordination at the national level, especially between forestry (e.g., Canadian Council of Forest Ministers, Canadian Institute of Forestry) and protected areas (e.g., Canadian Parks Council, Canadian Council on Ecological Areas) sectors. An effective policy framework to guide integration between protected areas and sustainable forest management should take a watershed/landscape approach. It should include local decision-making, transparent and open public consultation and explicit involvement of all overlapping jurisdictions.

More research is needed as well. Key gaps in the literature include interdisciplinary research linking the natural and social sciences, research on policy issues, research on the ecology of dynamic forest systems (particularly germane in Canada, where the majority of the forested land base is in the highly dynamic boreal forest), research on timber-harvest strategies and emulation of natural disturbance patterns, and research on values and perceptions related to forest ecosystems.

The amount of land under formal protection in Canada has increased dramatically in the past 20 years. At the same time, forest-industry practices have also improved. Although there is not yet a completely effective framework for integrating protected areas and sustainable forest management, we discovered cases where this is truly happening, and identified some of the elements necessary to move towards more-effective integration of the two concepts.

Forest management is much more of a participatory process than it was, and forest managers are charged with managing for a wide range of diverse values. In key areas of the country, agencies and individuals are pushing for better integration of protected areas and sustainable forest management despite the lack of an effective policy and regulatory framework to facilitate this.

Protected-area managers are acknowledging the importance of interacting with land managers outside their boundaries. Managers of timber-producing forests increasingly recognize the values contributed by both legislated protected areas and non-harvestable areas.

The historical conflicts between protected areas and timber-producing forests are slowly fading. Protected-area managers acknowledge the importance of interacting with land managers outside their boundaries to increase management effectiveness within the protected areas. Managers of timber-producing forests recognize that protected areas (both legislated and de facto) can contribute social, economic and ecological values to the process of management of timber-producing forests. We envision a future where integration between protected areas and sustainable forest management will continue to develop to promote sustainable ecosystems across the entire country.

1.0 Introduction

1.1 Issues and objectives

Historically, protected areas and industrial forest management have often had a fractious relationship. One does not have to go far back in Canadian history to see incidents of environmental activists blockading logging roads in an effort to halt forest harvesting in areas they felt held high value for biodiversity conservation. Forest practices have undergone some significant changes in recent years in response to market pressures and changes in forest policies and regulations. Yet there is still often tension in the relationship between protected areas and industrial forest management.

On the one hand, proponents of protected areas are often sceptical of timber-production practices and view them as threats to the integrity of sites with aesthetic, spiritual, recreational, and ecological values. Representatives of the forest-products industry, on the other hand, have tended to view protected areas as constraints to their operations. Protected areas are sometimes established immediately adjacent to, or even within the boundaries of, a forest company's overall management area. While some forest managers see value in having protected areas within their area of operation, they are often unsure how best to manage timber production around them.

More broadly, many forest companies are making management decisions to conserve areas identified as "biodiversity rich" in their planning and operations. These decisions are often voluntary and part of a sustainable forest management framework. Nevertheless, these are not recognized as contributing to a formal protected areas network.

Relationships between these two land uses are significant for historical reasons and also because of the prevalence and extent of both protected areas (Figure 1, Table 1) and forest management areas (Figure 2) across Canada, often in close proximity to each other.

We suggest that values of protected areas and adjacent timber-producing forests may in fact overlap and that relationships can be developed that are productive and mutually beneficial. It is important to examine more systematically the many ways in which the management of protected areas and adjacent timber-producing forests can be harmonized. Therefore, this project was initiated with the aim of clarifying the nature of the relationships between protected areas and sustainable forest management, and in response to interest expressed by partners of the Sustainable Forest Management Network and others. We undertook to investigate how protected areas fit into concepts of sustainable forest management, and how forests managed for timber production may affect or contribute to nature protection or conservation.

The project objectives were to:

- undertake a comprehensive review and synthesis of literature on concepts related to protected areas and sustainable forest management;
- engage interested members of the forest sector (e.g, Aboriginal communities, different levels of government, NGOs, industry, academia) from across Canada as partners to examine innovative approaches toward understanding the relationships between protected areas and sustainable forest management; and

Table 1 **Description and major goals of IUCN protected area categories, and Canadian coverage**

Category	% of Canada's protected area[1]	Major goals (IUCN short form)
Ia.	1.8	Science (Strict Nature Reserve)
Ib.	36.1	Wilderness protection (Wilderness Area)
II.	47.8	Ecosystem protection and recreation (National Park)[2]
III.	3.6	Conservation of specific natural features (Natural Monument)
IV.	1.2	Conservation through management intervention (Habitat/Species Management Area)
V.	0.2	Conservation and recreation (Protected Landscape/Seascape)
VI.	4.5	Sustainable use of natural ecosystems (Managed Resource Protected Area)
Unclassified	4.7	n/a

[1] Adapted from Environment Canada (2006); subject to change. Source included about 85 million hectares in total and excluded interim protected areas (mostly unclassified) and private and First Nations protected areas (latter two total less than a million hectares, according to CCEA 2009).

[2] Includes other government designated parks (e.g., provincial parks).

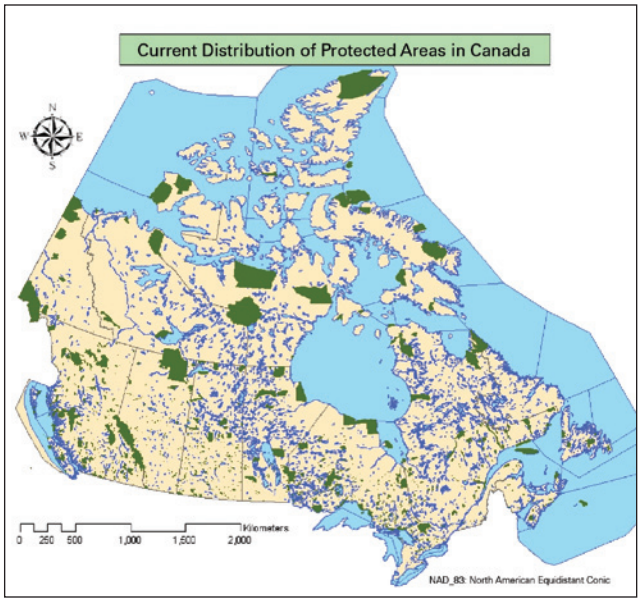

Figure 1. Protected area distribution across Canada as of 2008. All types of government-managed protected areas (national parks, provincial parks, federally and provincially administered wildlife areas, etc.) are included (dark green). Many additional protected areas are too small to be visible at this map extent.

Map sources: Alberta Tourism, Recreation, Parks and Culture Land Reference Manual (2007), BC Conservation Data Centre (2007), Government of Yukon (2007), Manitoba Conservation (2007), Natural Resources Canada (2007), Service New Brunswick (2007), Newfoundland and Labrador Parks and Natural Areas Division (2007), Nova Scotia Department of Natural Resources (2007), Nunavut Protected Areas Internet Data Resources Library (2008), Northwest Territories Centre for Geomatics (2007), Ontario Ministry of Natural Resources, Land Inventory (2008), Prince Edward Island Government (2007), Quebec Protected Areas, Internet Data Resources Library (2008), Saskatchewan Ministry of Environment (2007).

Figure 2. Commercial forest tenures across Canada (red outlines). Tenure arrangements and terminology differ in different parts of the country. For example, in British Columbia the polygons refer to Forest License Chart areas, in Alberta as Forest Management Units (FMUs), in Saskatchewan as Forest Management Areas (FMAs). In some provinces, the polygons include forest concessions in addition to forest tenures. The boreal region is shown in green. Source: Global Forest Watch Canada (2009).

- draw on the different knowledge systems embodied by our partners to articulate the differences that various sectors have about terms, concepts and values around protected areas and sustainable forest management.

BOX 1

The shared land base

There are between 300-400 million ha of land in Canada that have been defined as "forested". Exact figures are difficult to come by, since it depends on the definition of "forested", but estimates range from 310 million ha (Natural Resources Canada 2007a) to 417 million (Global Forest Watch 2003). The approximate division of the land base between protection and timber-production is as follows:

Protected areas: Over 90 million hectares of land in Canada have been formally designated as protected areas (CCEA 2009). The total is about equally split between federal and provincial/territorial areas. In the year 2000, approximately 32 million ha were within the forested land base (Drushka 2003).

Timber-producing forests: According to Natural Resources Canada (2007a), 230 million ha of forested land are actively "managed", but "management" is only generally defined. Global Forest Watch (2003) identified 235 million ha as "commercial forest" that is, managed for all types of forest products, of which 119 million ha are managed for timber purposes.

Scope of the project

Our initial literature survey was international in scope. In this report, we focus on the Canadian situation, although some of our findings and reflections may be more broadly applicable.

We prepared a review of the issue for Central Europe as a supplement to our main report; the region has similar economies and governance to Canada, but some quite different forest ecosystems and land-management history and strategies. (See Pröbstl et al. 2010.)

Throughout the project, we heard about the need to consider protected areas in the context of wider resource issues, not just sustainable forest management for timber production. In some parts of the country, oil and gas development is proceeding at a much faster pace than commercial timber development. However, an in-depth investigation of protected areas and the broader resource-management sector was beyond the scope of this project.

Spatial scale

In Canada, some protected areas cover thousands or even millions of hectares of forest land. Similarly, forest management areas held in tenure by forest companies for timber production may cover hundreds of thousands or millions of hectares. Our spatial considerations in this report will generally (though not exclusively) be oriented to forest landscapes on the order of tens of thousands, hundreds of thousands, and even millions of hectares.

1.2 Policy context

Management of forest land for timber production

Forest management in Canada is generally a matter of provincial jurisdiction under the British North America Act of 1867 and the Constitution Act (1982). A 1982 amendment to the natural resources clause 92(A) strengthened those powers.

Each province and territory has its own set of forest legislation, policies and regulations regarding forest management for timber production on Crown (i.e., government-owned) lands. These are influenced by the federal government, conservation groups, business and industry, international agreements, and the public at large. The Canadian Forest Service (under Natural Resources Canada) is tasked with undertaking research in support of forest management.

Federal legislation and policies governing national parks, First Nations, fisheries, migratory birds and endangered species can influence provincial and territorial forest policy and legislation.

For instance, Parks Canada policy calls for the national parks to participate in planning for ecosystem-based management outside of park boundaries. In this context, ecosystem-based management refers to recognition that national parks are embedded in a wider ecosystem, and that effective management of the park for conservation will be enhanced when management of surrounding lands is as co-operative and complementary to park goals as possible. Where neighbours include timber harvesters, Parks Canada will actively engage in sustainable forest management planning and thereby engage with provincial forest management policy.

The federal Species at Risk Act (2002) and North American Migratory Birds Convention Act (1994) also speak to the management of certain wildlife species on any forest lands, regardless of jurisdiction.

The Canadian Council of Forest Ministers (CCFM), which was formed in 1985 and is composed of federal, provincial and territorial ministers, supports collaboration and communication among ministers across Canada. The CCFM works to influence the sustainable management of Canada's forests, but has no legislative or regulatory authority beyond that of the individual participating jurisdictions.

The CCFM drafted science-based criteria and indicators (C&I) for sustainable forest management in 1995 and updated them in 2003. These have been widely applied across the country, and are reflected in certification schemes such as the CSA forest-certification standard Z809 (CSA 2008). As well, CCFM members, along with representatives from woodlot-owner groups, the forest-products industry, professional forester associations, universities and environmental organizations, are signatories to the Canada Forest Accord, which includes a formal commitment to sustainable forest management. The CCFM recently released a 10-year plan for the future of forestry in Canada (CCFM 2008).

Management of forested land in protected areas

Similar to forestry jurisdiction, each province and territory has its own protected areas agency with corresponding policy and legislation. Most provincial and territorial jurisdictions have parks and/or protected areas legislation and associated policies that provide guidance for the establishment and management of protected areas, and stipulate allowable activities. However, these acts and policies generally do not contain explicit guidelines for management beyond protected areas boundaries. At the federal level, Parks Canada is the main agency with jurisdiction over protected areas; in addition, Environment Canada oversees National Wildlife Areas and Migratory Bird Sanctuaries.

Different "silos"

In many jurisdictions, the government agencies responsible for commercial forest management and protected areas are housed in separate ministries or departments. This "silo effect" hampers inter-agency cooperation between civil servants in charge of protected areas and those in charge of managing timber-producing forests. It also creates the potential for internal political conflict as different agencies compete for limited budget resources at the provincial or federal cabinet table.

In many jurisdictions, the government agencies responsible for commercial forest management and protected areas are in separate ministries or departments.

1.3 Methods

We conducted a literature review and developed a database of over 275 entries (Excel file, available on the website of the project's Principal Investigator), together with an annotated bibliography of 80% of these entries (report by AppleSeed Consulting 2008, also on website). Some of that literature is summarized herein.

Our initial literature survey investigated a wide array of global literature on protected areas and sustainable forest management, including the developed and the developing world. We looked at published, peer-

reviewed and "grey" literature. Forest use and protection throughout Canada were our main interest, although some international studies with strong relevance to the topic were also included.

A database of relevant literature and an annotated bibliography are available online.

When searching for relevant documents on protected areas, we considered a range of relevant land-management strategies beyond those of national or provincial parks and reserves. Similarly, the concept of sustainable forest management can apply to myriad forms of forest resource use. For our purposes, various forms of forest use that confer some type of economic advantage to the user and are done in ways that avoid ecological degradation (e.g., sustainable timber harvest, non-timber forest production, ecotourism, household or commercial/industrial forest use) were included as potential examples. We also looked for literature on initiatives to steer commercial forest management toward maintenance of ecological integrity through ecosystem-based management, forest certification, and applications of criteria and indicators for sustainable forest management.

Literature searched included journal articles, research reports, land-use strategies, workshop proceedings, books, theses, newspaper/newsletter articles, forest management plans, and working documents. We accessed these through databases such as those of the Science and Management of Protected Areas Association (SAMPAA), the Sustainable Forest Management Network (SFMN), the National Aboriginal Forestry Association (NAFA), the Canadian Model Forest Network, and the World Conservation Union (IUCN), through university libraries, the Theses Canada Portal, and collections held by Canadian government agencies and conservation organizations. We also appealed to project partners and other contacts to supply relevant documents, particularly those of limited public access.

In addition to the literature review, we had formal exchanges with project partners and interested parties along a number of fronts: through our inaugural workshop in Ottawa in January 2008 (~50 participants), a survey carried out by a student team at University of Western Ontario, a follow-up workshop in Halifax in September 2008 (~15 participants), and a mini-workshop in Prince George, BC, in December 2008 (~28 participants). In addition, the project's Principal Investigator carried out small-group consultations, and made presentations in person and via teleconference with representatives from protected area agencies, First Nations, environmental non-government organizations (ENGOs), and industry (~185 individuals contacted).

2.0 Findings

2.1 Conceptual framework

Early in our research we realized that protected areas are seen as **places** while sustainable forest management is often seen as a **process** or **approach** to management of forest ecosystems. Also, people have different perceptions of what is meant by the term "protected area", and whether the term "sustainable forest management" applies only to forests managed for timber production or to other forests as well.

In Canadian forestry, the term "sustainable forest management" is generally used in relation to forests designated for timber production. We follow this convention here, although in theory any forest could be said to be managed sustainably (or not).

For instance, in Canadian forestry the term "sustainable forest management" is generally applied to management of forests designated for current or future timber harvest (see below). We follow this convention here, although in theory any forest could be said to be managed sustainably (or not).

In short, the terminology can be confusing. Thus in this section we discuss definitions and conceptual frameworks in some depth. See also Duinker et al. (2010) for further discussion on conceptual frameworks.

The following statements came to encapsulate our thinking on how to describe and compare the concepts of sustainable forest management and protected areas:

> If the dominant value for which a forest ecosystem is delineated and managed is **biodiversity**, then **nature protection** is an appropriate paradigm for management of the ecosystem; an area to which this management is applied is termed a **protected area**. Protected areas are those areas **designated under legislation** and which fall under IUCN (International Union for the Conservation of Nature) classification, and can occur on different scales.
>
> If the dominant value for which a forest ecosystem is to be delineated and managed is **timber**, then **sustainable forest management** is an appropriate paradigm to be applied. **Timber-producing forests** are defined as areas where timber is cut and moved into the market for commercial purposes. Timber-producing forests can occur on different scales, from small woodlot operations to large industrial operations.

Each of these statements requires further explanation. We outline below what we feel are the dominant uses of these terms in the current Canadian context, and/or how they are used in this report. Before we contrast terminology around the two statements above on protected areas and sustainable forest management, two key concepts that apply to both must be defined.

A **forest value** is a characteristic, component, or quality considered by someone to be important in relation to a specific forest area or to the concept of forested landscapes in general. In this context, forest values may be things (e.g., moose), processes (e.g., carbon sequestration), states of a forest (e.g., ecological integrity), or intangibles such as natural beauty or a place for retreat/reflection. Not all forest values are objectively measurable. A wide range of forest values are important in determining people's attitudes and behaviours in relation to forest management and policy (Moyer et al. 2008).

An **ecosystem** is a defined community of organisms (including people) interacting with each other and their non-living environment (Tansley 1935). Ecosystems exist at all spatial extents, for example from the minute level of a water droplet to the planetary level (i.e., the entire biosphere). Any three-dimensional space in the biosphere can be bounded and defined as an ecosystem. The appropriateness of the boundaries of any specific ecosystem can only be judged in the context of the specific functions for which the ecosystem has been defined. We use the term ecosystem in this report to be synonymous with "**geographic space**" as it is used in the definition of "protected area" below. An ecosystem may be said to have **ecological integrity** when it is deemed "characteristic for its natural region, including the composition and abundance of native species and biological communities, rates of change and supporting processes" (Parks Canada Agency 2000).

2.1.1 Terms related to protected areas

The dominant value is ecological: **Ecological values** for protected areas include biodiversity (which can be defined as the range of species, ecological communities and/or genetic variation in a particular place), as well as other ecosystem components, functions and values.

Ecological values include here, for example, conservation of ecosystem condition and productivity, soil, water, and global ecological cycles such as the carbon cycle. When we say "dominant value", we do not mean that it is the only value. Protected areas are often delineated and managed also for social and cultural values such as recreation and commemorative heritage, in addition to ecological values.

Nature protection is the appropriate paradigm: For our purposes, **nature protection** is taken to mean delineation of specific ecosystems where ecological values are to be protected. We might as easily have used a term like "ecosystem conservation", or "nature conservation", or even "ecosystem-based management" rather than "nature protection". The reason we are not calling this **ecosystem-based management**, even if it is, is that in the literature and in practice, this term has come to mean ecologically sensitive management of any kind of ecosystem, whether "protected" or not.

Nature protection occurs along a continuum of effectiveness. In protected areas, it is carried out mainly by prohibiting industrial activities such as logging, mining, and hydroelectric development, and through management of other commercial activities such as tourism, hunting, and fishing. The degree to which specific restrictions on access/activities are applied depends on the management strategy of a specific site, but must be consistent with the overarching goals for that site.

Protected area: The International Union for the Conservation of Nature (Dudley 2008) defines a protected area as:

> "A clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values".

We use the term "protected areas" to refer to officially designated or legislated protected areas (e.g., national or provincial parks).

In this report we restrict the term "protected area" to sites that have their boundaries and designation entrenched in law. That is, for the purposes of this report, the term "protected areas" shall refer to officially designated or legislated protected areas (e.g., national or provincial parks, other nature reserves), as opposed to "de facto" protected areas such as non-harvestable zones (e.g., riparian buffers or those areas

voluntarily set aside by industry) in areas otherwise subject to timber harvest. We discuss these types of unofficial protected areas in further detail below.

Can trees be cut in protected areas? Indeed they can and are, but in general these trees are felled primarily for the purpose of protecting/conserving ecological and socio-cultural values. That such cut trees might be moved into markets is incidental, and may just reflect prudence in trying to recover the costs of cutting the trees.

Protected areas effectiveness

Protected areas can be viewed along a continuum of effectiveness (Figure 3), in terms of protecting ecological values. The IUCN designations (categories I-VI; Table 1) indicate the degree to which long-term conservation of nature and ecosystem services is prioritized against other values (e.g., recreation, commemorative value, extractive harvest).

Protected areas vary in their effectiveness at conserving biodiversity. IUCN categories highlight to what degree long-term conservation of nature and ecosystem services is prioritized, but IUCN classification does not comment on management effectiveness.

IUCN classifications do not comment on management effectiveness (CCEA 2008), and there can be considerable variation in the types and intensity of management activities even within protected areas of the same IUCN category. A wide body of literature documents the threats to ecological integrity faced by protected areas in Canada (e.g., Gurd and Nudds 1999, Parks Canada Agency 2000, Wiersma et al. 2004), some sites face more of these threats (e.g., high visitor density, high degree of human-built infrastructure) than others.

2.1.2 Timber-producing forests and sustainable forest management

The dominant value is economic: In timber-producing forests the primary aim is to grow and harvest timber for industrial processing into lumber, pulp/paper, and energy materials, although non-timber values may also be economically important. Roads are built, trees cut, areas scarified and planted, and stands thinned, to name but a few interventions.

Sustainable forest management is the appropriate paradigm: We will use the CSA (2008) definition of sustainable forest management, i.e., management

> "to maintain and enhance the long-term health of forest ecosystems, while providing ecological, economic, social, and cultural opportunities for the benefit of present and future generations".

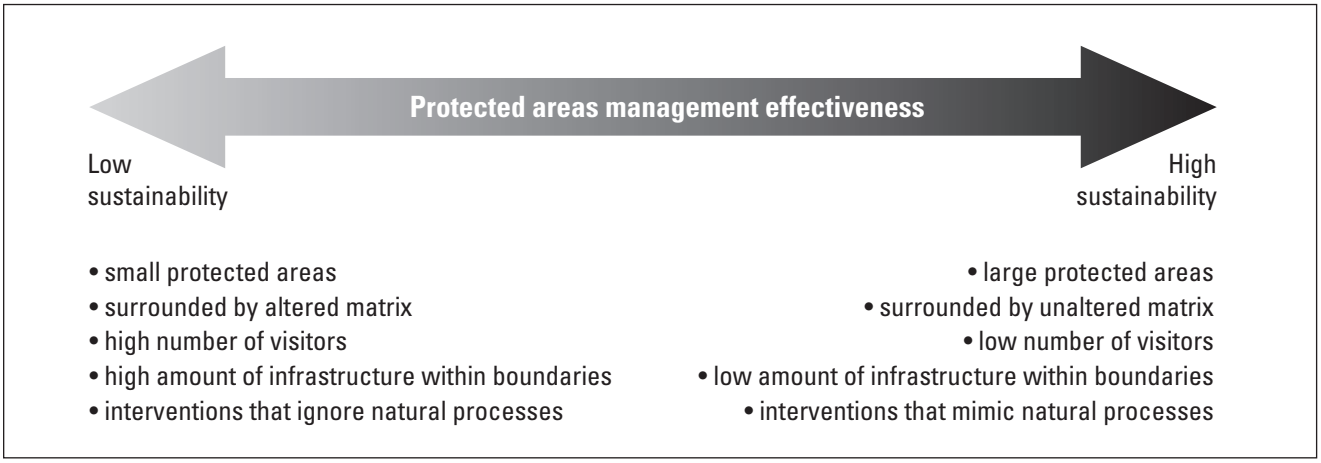

Figure 3. A continuum of effectiveness and ecological sustainability for protected areas. Individual protected areas will fall at different places along this continuum, depending on the management strategies applied within them, as well as the management and land use outside their boundaries (i.e., the "matrix").

This definition does not specify in any way that timber must be harvested for commercial use. Indeed, one could argue that the definition could also be applied to the management of forests in protected areas, or of forested landscapes as a whole.

In Canada, the concept of sustainable forest management was initially adopted for use (and further refined and applied) in the context of forest management for timber production. Development and use of the concept of sustainable forest management was a way to make management for timber much more sensitive to protection or conservation of a wide range of non-timber forest values. Ongoing improvements in the application of sustainable forest management focus largely on increasing that sensitivity without making it impossible to harvest timber economically.

Again we could also have used the term "ecosystem-based management". Our examination of the literature reveals that the main principles of ecosystem-based management are also the main principles of sustainable forest management. In our view, it would be fair to say that sustainable forest management is ecosystem-based management applied to forests. However, we will not use the term ecosystem-based management here to avoid confounding our conceptualization of protected areas, to which the paradigm of ecosystem-based management can be, and also is, applied.

Timber producing forests: We could find no unambiguous and commonly used term in the literature for forests where timber is harvested for commercial use. We considered "industrial forests", but this term hardly seemed applicable in the case of timber-producing woodlots nestled within either agricultural/pastoral or non-harvested forest landscapes. We considered "working forest", but that term calls into question "working for whom?".

We chose to use the term "timber-producing forest" because it is clear that in such forests, timber is cut and moved into the market for commercial use. Also, we believe that the Sustainable Forest Management Network Partners Committee wanted us to examine how to describe and improve the management interface between protected ecosystems and timber-producing ecosystems in Canada's forest landscapes.

Effectiveness of sustainable forest management

Like protected areas, "timber-producing forests" can be viewed along a continuum (Figure 4). Similarly, the nature and intensity of management interventions can vary within and across timber-producing forests.

In some cases, individual timber-producing forests may in fact provide more biodiversity values than protected areas that face a high degree of human use and other anthropogenic impacts.

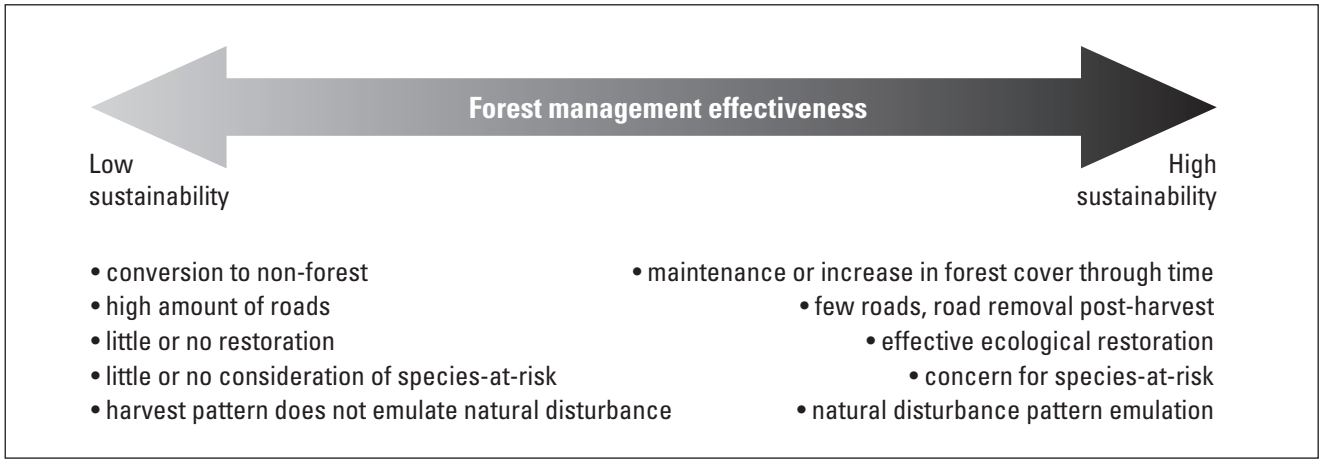

Figure 4. A continuum of effectiveness and ecological sustainability for timber-producing forests. Individual forest tenures will fall at different places along this continuum, depending on the management strategies applied within them.

Some timber-producing forests include tree farms or single-species plantations; others may be more complex second and third-growth forest ecosystems subject to differing harvest intensities. Thus "timber-producing forests" can look very different across Canada, and indeed around the world. Evaluations of the degree to which a sustainable forest management paradigm is applied, and of its success in meeting criteria for sustainability, provide a structure to facilitate comparisons between sites.

In some cases, individual timber-producing forests may in fact provide more biodiversity values than protected areas that face a high degree of human use and other anthropogenic impacts.

Where two adjacent parcels of land, one under formal protection, and one under sustainable forest management, fall at similar points along the continuum of ecological integrity, conflict is predicted to be minimal. Where parcels are at opposite ends of the spectrum, increased conflict is expected.

2.1.3 Non-harvestable areas

In most timber-producing forests in Canada, not every tree-covered site can or will experience a timber harvest. In addition, some forest areas are left unharvested simply because they are not currently managed or used for timber production.

We will use the term "non-harvestable" to include forests (or portions of forests) where trees are not currently harvested, despite being outside any legislated protected areas.

We will use the term "non-harvestable" to include forests (or portions of forests) where trees are not currently harvested, despite being outside any formally legislated protected area.

Not harvesting timber on specific sites or areas results from a range of reasons.

Sometimes certain portions of the forest are left unharvested due to the presence of unmarketable tree species, unmerchantable wood (e.g., trees with a high proportion of rot or other internal defects), or unworkable ground (e.g., slopes, rocky terrain, wetlands). Some areas or trees may be left as intentional reserves or deferrals of commercial timber for possible future harvest. In such cases, the trees are (as yet) unharvested, but they are not designated as "non-harvestable" or off-limits in a permanent way.

Sometimes parts of a timber-producing forest may be explicitly designated as off-limits to harvest for ecological and/or other reasons. They may be set aside to protect non-timber values, or to render a forested landscape more similar to naturally disturbed areas (e.g., to retain residual structures, or to protect critical habitats, recreational values, Aboriginal sacred sites, and watersheds).

These latter types of sites or areas are delineated in forest management plans. They are often designated with terms such as "Areas of Concern", and forest managers may face fines if they take timber out of such areas.

However, such areas are not formally "protected" as per the definition of protected areas given above, which refers to lands legally removed from the managed forest land base). Such "de facto" protected areas are best categorized as "**non-harvestable areas**".

As described by Huggard (2004: 2), non-harvestable areas are areas

> "created by the many regulatory and operational constraints on forest harvesting. Examples of non-harvestable forest include … riparian areas, inoperable areas, …, old-growth management areas, and areas with no harvesting because of environmental sensitivity, visual quality or watershed protection".

Non-harvestable forest may also include High Conservation Value Forests (HCVF) designated under Forest Stewardship Council (FSC) certification.

2.1.4 Shared landscapes, overlapping values?

Protected areas, non-harvestable areas, and timber-producing forests share many attributes (including biophysical and management/land use attributes), and at times these attributes may be similar to each other. For this project, we examined how protected areas, non-harvestable areas and timber-producing forests interact both ecologically and in terms of management similarities. Our focus was on how these interactions could be improved to move towards enhanced sustainability. Protected areas and timber-producing forests are often thought of as embodying distinct and mutually exclusive values and management strategies. In reality they exist on a continuum, each contributing to various extents to ecological or other values.

A protected area may be managed for a range of values in addition to biodiversity protection.

Sustainable management of timber-producing land may also contribute to non-timber values including biodiversity.

Both official protected areas and forests managed for timber production under sustainable forest management are managed for a range of values, and some of these values may overlap (e.g., social values associated with recreation, cultural values associated with Aboriginal traditional uses).

In other words, a protected area may be managed for a range of values in addition to biodiversity protection, and sustainable management of timber-producing land may also contribute to non-timber values including biodiversity.

The key difference is that within most protected areas, the removal of large patches of forest cover is generally prohibited, whereas it may be permitted in timber-producing forests outside of protected areas boundaries.

Given the continuum between sustainably managed timber-producing forests and legislated protected areas, it is not surprising that some of their specific management activities may be identical and/or may overlap. Trees may sometimes be removed from protected areas for public safety or habitat management. Parts of the timber-producing forest may be left unharvested to provide critical habitat for species-at-risk (Figure 5).

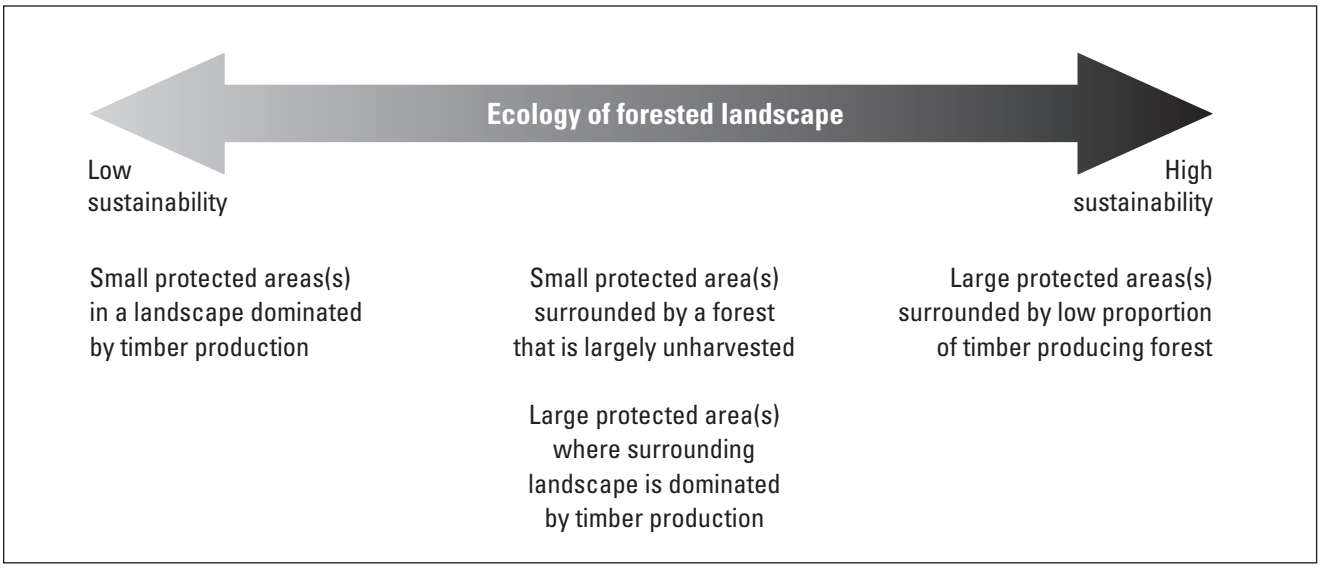

Figure 5. A continuum of sustainability for the forested landscape. The forested landscape as a whole can be considered to be functioning along a continuum of sustainability depending on the specific configuration of protected areas, timber-producing forests, and non-harvestable areas, as well as the management effectiveness of those individual units (see Figures 3 and 4).

In certain cases, the lines become even more blurred. Protected areas in IUCN category V and VI (Table 1) specifically allow for sustainable use of natural ecosystems, including sustainable timber harvest. For instance in some category VI protected areas exploration and commercial extraction of resources are allowed as long as at least two-thirds of the area is in a natural condition, and the resource use is defined in legislation or in a management plan and is carried out in a manner compatible with protection and maintenance of biodiversity (CCEA 2008).

In Canada, IUCN category V and VI protected areas comprise a rather small proportion of the total protected area: under 5% in total compared to 85% in categories I and II (Table 1). In Europe, in contrast, a much greater proportion of the formally protected area falls under category V and VI (compared to categories I-IV), illustrating the continuum between protected area and timber-producing forest (see supplement by Pröbstl et al. 2010 for more details).

Spatial contexts

Our spatial considerations in this report are generally oriented to forest landscapes on the order of tens of thousands, hundreds of thousands, and even millions of hectares. We are also interested in local interactions at smaller spatial extents, for instance between protected and unprotected forest stands (e.g., tens of hectares), but only in the context of nature conservation across large forest landscapes.

Protected areas and timber-producing forests frequently occur in close proximity to one another. This means they may interact in terms of their ecology, and management of one area may influence conditions in the other.

A common situation across Canada is one where large protected areas occur adjacent to large timber-producing forests. However, we can also find smaller protected areas within large timber-producing forests, and sometimes small timber-producing forests (e.g., woodlots) occur within large protected areas. Various spatial configurations can be found; all are relevant to this project.

Shared values

In summary, a forested landscape can include legislated protected areas (e.g., parks, nature reserves), timber-producing forests under tenure to one or more forest companies (including some non-harvestable areas), and other forests or land uses. All these areas may be managed to some degree, and each may vary in its effectiveness in promoting ecological integrity.

In addition, a forest landscape may include non-forest land uses, such as settlements, transportation and utility corridors, agriculture, mining, and oil or gas developments. These other uses may also interact with protected areas and timber-producing forests, but such interactions are beyond the scope of this project.

Protected areas, non-harvestable areas, and timber-producing forests share some attributes, and at times complement each other. For this project, the focus is on how protected areas, non-harvestable areas and timber-producing forests interact from a sustainability point of view.

In essence, we feel that sustainable management of forests should conceive of the forested landscape as a whole. Although parcels of land will be managed individually, sustainability will be more effectively achieved if management of the landscape acknowledges that non-harvestable areas, timber-producing forests, and protected areas (as defined above) interact ecologically (and as a consequence of management strategies) within a forest landscape (Figure 6). This concept of parcels of land under different management does occur in real-world forest management planning (Figure 7).

2.2 Literature and case studies

In this section we indicate what is covered in the literature (including "grey" literature), some findings, and an indication of gaps in the literature. We also provide an overview of case studies where research and/or management have considered protected areas and sustainable forest management in an integrated way.

2.2.1 The literature: an overview

Large bodies of literature on protected areas and sustainable forest management span most disciplines (ecological, social, economic). Less work investigates

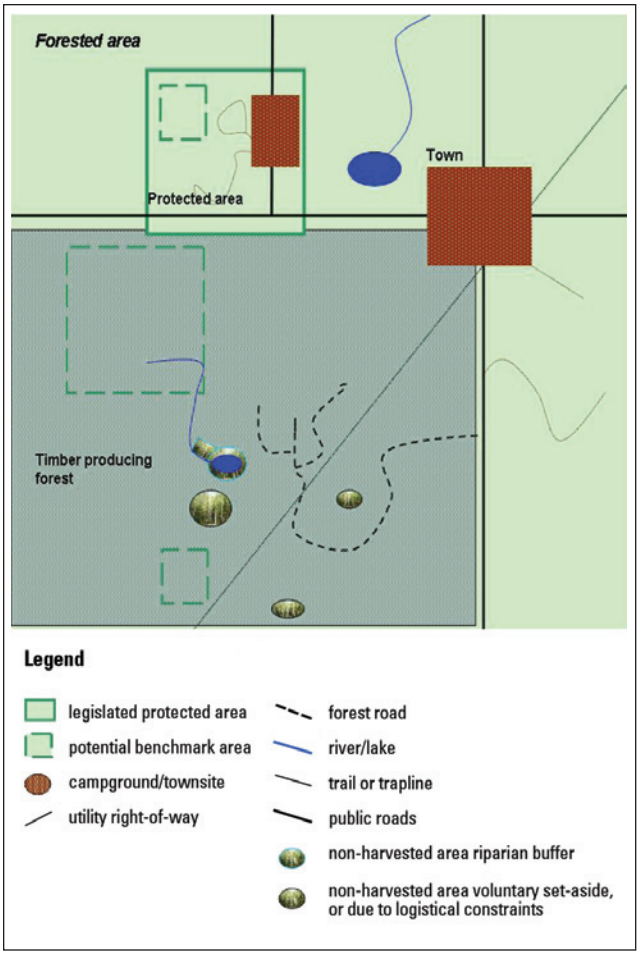

Figure 6. A forested landscape showing various land uses. Here a legislated protected area (including roads and other infrastructure) is located adjacent to a timber-producing forest under sustainable forest management. Note that the timber-producing forest includes some non-harvestable areas, e.g., riparian buffers, off-limits to harvest. It also includes areas that may be harvested in future but are not being harvested at present. The surrounding land may be under tenure to another forest company. In Canada, both individual protected areas and forest management areas can be vast in scale, up to tens of thousands of square kilometers.

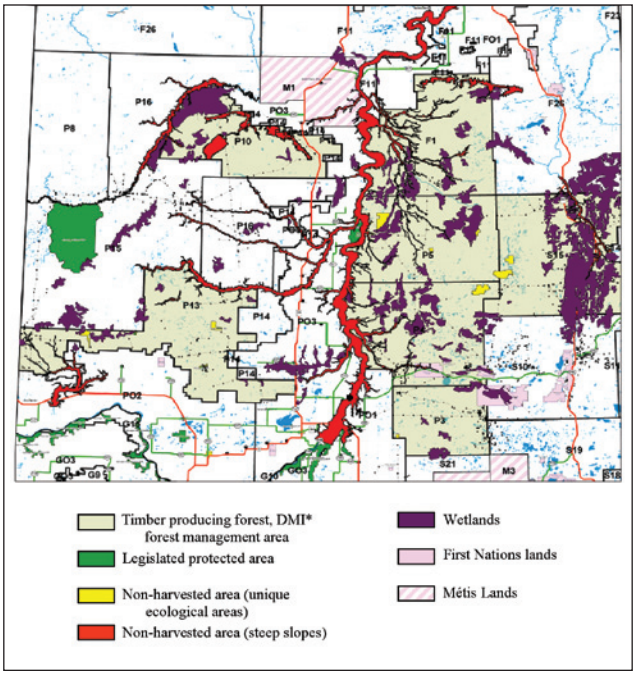

Figure 7. A forested landscape in northwestern Alberta (Peace River area), showing timber-producing forests and other land designations.

Map courtesy Daishowa-Marubeni International.
*DMI, forest management area under tenure to Daishowa-Marubeni International (tan/grey shading). Unshaded blocks includes areas under tenure to other forestry companies, unallocated areas, or other land uses.

the relationship between the two, although the literature is still substantial. Where work integrates the two topics, it can generally be characterized as one of the following types:

- Ecological research;
- Social science research;
- Research on forest certification;
- Research related to benchmarks;
- Research on case studies.

Ecological research

Ecological research has investigated the impact of land use and land management (particularly forest management activities) outside of legislated protected areas on the ecological integrity of the protected area.

Ecological and conservation literature emphasize that land use and land management outside of protected areas can affect the ecological integrity of the protected areas. Too much habitat change outside of protected areas can lead to insularization and species loss (Gurd and Nudds 1999, Wiersma and et al. 2004), as well as disturbances to natural processes (Parks Canada Agency 2000). This literature also proposes, describes, and evaluates ecosystem-based management strategies (Box 2).

Table 2 **Attributes of successful ecosystem management**

Acknowledgement that humans are embedded in nature[1]
Collaborative stewardship[2, 3]
Consensus group approach[3]
Economic incentives[3]
Flexibility for organizational change[1]
Focus across scales/hierarchies[1]
Inclusive public involvement[3]
Interagency cooperation[1,2]
Integration of human values[1]
Integrated and balanced goals[3]
Integrated scientific information[2]
Managing for ecological integrity[1]
Monitoring and adaptive management[1, 2, 3]
Multidisciplinary data[1, 2, 3]
Stakeholder influence[3]
Sustainability[2]

Sources: [1] Grumbine (1994), [2] Bulter and Koontz (2005), [3] Keogh and Blahna (2006).

BOX 2

Ecosystem-based management and protected areas

Ecosystem-based management acknowledges that managers of protected areas must consider the wider ecoregion beyond protected area boundaries. Protected areas managers should engage with adjacent landowners and managers to ensure that land uses outside of legislated protected areas do not compromise the conservation values held within the boundaries.

In Canada, forest management for timber production is a common activity outside many legislated protected areas, particularly in the boreal region. Therefore an ecosystem-based management framework is useful when trying to define a workable relationship between protected areas and sustainable forest management.

The concept of ecosystem-based management can also be (and is) applied to sustainable forest management in timber-producing forests, in some cases to address values that are similar to those held for protected areas. It is already used by Parks Canada (see 2.2.2) and in Labrador District 19 (see 2.3.6). Several papers highlight key elements and attributes of a successful ecosystem management framework as they might be applied to management of protected areas and timber-producing forests; these are summarized in Table 2.

Social science research

Research on the human dimensions of forest management and land-use planning includes investigations of how local communities, and in particular Aboriginal communities, can become involved in and benefit from forest management activities. These papers tend to focus on relatively small geographic regions, in contrast to ecological research, which often examines broader regions.

More of these papers address forest-management issues than they do protected area issues. However, local and Aboriginal communities have goals for both ecological and economic sustainability, and protected areas can contribute to ecological sustainability in the forests around a given community.

Numerous studies from around the world document Indigenous peoples' involvement in forest-management activities. Many focus on non-extractive activities and non-timber forest products, in addition to timber harvest.

The research emphasizes the ingredients necessary for successful community and Aboriginal involvement in protected areas management and in sustainable forest management activities. Some requirements are summarized in Table 3.

Table 3 **A selection of requirements that may be necessary for effective community and Aboriginal/Indigenous involvement in protected areas management and sustainable forest management activities**

Requirement	Source
Adequate data and knowledge	Mitchell-Banks (2003), Ramakrishnan (2007), Smith et al. (1995), Streade et al. (2002)
Adequate resources for enforcement where necessary	Dourojeanni (1999)
Alignment of management to community values	Roberts and Gautam (2003), Smith et al. (1995)
Clear objectives for management	Brewster (2005)
Contractual agreements between communities, scientists, governments	Davis and Wali (1993)
Co-management clearly articulated	Grainger et al. (2006)
Development of value-added industries	Dourojeanni (1999)
Direct economic benefits	Roberts and Gautam (2003), Streade et al. (2002)
Education and capacity in community	Acharya (2002), Grainger et al. (2006), Reed and McIlveen (2006)
Effective institutional structures	Grainger et al. (2006), Korber et al. (2001)
Extensive and ongoing consultation	Beckley et al. (2006)
Involvement of all community members (e.g., elders, women, youth)	Poffenberger (1999)
Markets for non-timber forest products	Morris et al. (2004a,b)
Monitoring and evaluation in an adaptive management framework	Grainger et al. (2006), Karjala et al. (2003), Natcher and Hickey (2002), SIFC (1996)
Ongoing consultations among parties	Forsyth et al. (2003)
Resolution of land claims and treaty rights	Curran and M'Gonigle (1999), Davis and Wali (1993), McManus (2004)
Trust between parties	Fullerton (2005), Grainger et al. (2006)
Use of traditional knowledge	Herrmann (2006), Korber et al. (2001), Maltais (2006), Ramakrishnan (2007)

Research on forest certification

Movement towards forest certification has increased in response to market pressures. Several academic papers have evaluated forest certification schemes such as those of the Canadian Standards Association (CSA 2008), the Forest Stewardship Council (FSC 2004), and Sustainable Forestry Initiative (SFI 2004).

Publications on forest certification include "how-to" guides (e.g., Collier et al. 2002), and articles describing and evaluating governance structures for certification schemes (e.g., Gulbrandsen 2004), particularly for Aboriginal people and community-based forest issues (e.g., Bombay 1996, Irvine 1999, Molnar 2003).

Findings include the following observations:

- Initial examination of applications of certification to community and Aboriginal forests suggests that certification may, in theory, benefit small-scale forest operations. In practice, however, certification has been applied overwhelmingly to industrial-scale forest management.
- Irvine (1999) found that certification did not initially open up markets for community-based forest products. More recent work, evaluating a decade of certification activities, suggests that communities have indeed benefited, but high costs and regulatory constraints have limited the ability of some communities to engage in certification (Molnar 2003).
- Several articles have suggested that certification schemes lack biological relevance, or that more rigorous ecological guidelines need to be integrated with certification standards (e.g., Bennett 2000, Ghazoul 2001, Putz and Romero 2001). However, there is a paucity of empirical work that directly evaluates the impacts of forest certification schemes on forest ecosystems. This paucity may be due to the relative newness of certification schemes.
- One paper (Gullison 2003) suggests that forest certification is one of several options for conserving high-conservation-value forests. Other options include protected areas, trade barriers for certain types of wood under the Convention on International Trade in Endangered Species, and purchase of timber rights for the purposes of conservation. The paper examined certification schemes around the world and concluded that certification contributes to improved management of existing forest practices, but mainly in North America and Europe, and not in developing countries (Gullison 2003). Certification leads to increases in the amount of de facto protected areas and other conservation initiatives that forest companies undertake. However forest certification does not prevent deforestation, nor does it necessarily reduce pressure on high-conservation-value forests.
- Recent work (Tikina and Innes 2008) has suggested that certification has been successful as a process for problem solving but that its effectiveness at changing behaviour can not yet be rigorously evaluated. Costs of certification vary by forest type and other factors, and markets for certified forest products vary around the world.
- In many tropical forests, markets for certified forest products are not yet well developed, and the costs of certifying outweigh the perceived benefits. While the situation may be similar in most temperate forests, certification proceeds nevertheless in pursuit of corporate-image benefits.

Research on or using benchmarks in protected areas or non-harvestable areas

Legislated protected areas are sometimes seen as experimental controls against which effects of forest management for timber production can be compared. Several papers discuss the role of protected areas as ecological baselines, including questions about how to set a reference point in time for a benchmark in an area that has already undergone substantial anthropogenic change (Arcese and Sinclair 1997, Davis et al. 2004, Wiersma 2005). Parks Canada has identified ways in which Canada's national parks may act as ecological benchmarks (Parks Canada Agency 2000).

It is also possible to use non-harvested areas in timber-producing forests as benchmarks. In some cases, these may even function as better benchmarks for forest management because they are not confounded by protected area management activities (e.g., development and maintenance of trails, campsites, relocation of problem animals, and especially the use or suppression of fire) and visitor use. For example:

- In a project in the White River Forest in Ontario, the Canadian Forest Service is experimentally harvesting within riparian buffer strips in a timber-producing forest, using unharvested strips as benchmarks against which to evaluate the effects of timber harvest (Kreutzweiser and Holmes, no date).
- In Alberta, Daishowa-Marubeni International has developed a framework to identify and maintain components of a continuous reserve network within its forest management area (Witiw 2006). Part of the company's motivation in voluntarily setting aside part of its tenure area is to promote landscape connectivity so as to have better benchmarks against which to compare the timber-producing landbase (Witiw 2006).

Other examples of cases where either protected areas or non-harvestable areas have been explicitly identified as having benchmark value are listed in Table 4. (Benchmarks issues are discussed further in sections 3 and 4.)

Table 4 **A sample of cases in Canada where protected areas and/or non-harvestable areas have been explicitly identified as having benchmark values and are incorporated as such into forest management planning. Some of these projects are ongoing, while some are no longer operational.**

Location	Company/Agency/ Community	Benchmark site(s)	Reference
Canada wide: FERNS (Forest Ecosystem Research Network of Sites)	Natural Resources Canada – Canadian Forest Service	Network of sites for research in forest ecosystems and silvicultural practices aimed at sustainable forest management. Some sites are managed within a forest company's forest management area, others are managed by universities or government agencies.	Canadian Forest Service (no date)
Canada wide: Model Forests	Canadian Forest Service and partners	A network of 14 model forests across the country, each of which includes a working forest adjacent to a protected area (usually a national or provincial park) as well as associated local partners. The main purpose of the Model Forests is research to improve our understanding for sustainable forest management.	Natural Resources Canada (2007b)
Southeast Yukon	Champagne and Aishihik First Nations	Kluane National Park	CATT 2004
John Prince Research Forest, north-central British Columbia	Tl'azt'en Nation and University of Northern British Columbia (UNBC)	A working forest (13,000 ha) which integrates research and education and is jointly managed by the Tl'azt'en Nation and UNBC.	Grainger et al. 2006
Muskwa-Kechika Management Area, northeastern British Columbia	Muskwa-Kechika Management Board and Government of British Columbia	Extensive protected areas, special wildland zones, and special management zones act as benchmarks against which the effects of various resource activities (oil/gas, forestry, recreation) can be assessed.	Muskwa-Kechika Advisory Board 2004
Al-Pac Forest Management Area, northeastern Alberta	Al-Pac	High Conservation Value Forests (HCVF); "Ecological benchmarks are protected areas free of industrial activity that are used as reference areas to compare natural processes with harvested landscapes."	Dyer 2004

Location	Company/Agency/ Community	Benchmark site(s)	Reference
Peace River, north central Alberta	Daishowa-Marubeni International (DMI)	Existing protected areas, and High Conservation Value Forests (HCVF) identified within the Forest Management Area.	Witiw 2006
Mistik Management Area, northwestern Saskatchewan	Mistik Management Ltd.	HCVF (6-10% of Forest Management Area) protected from forest practices as benchmarks, together with over 645,000 ha of legislated protected areas within and adjacent to the Forest Management Area. Mistik's Forest Management Plan states that it will "(d)emonstrate maintenance of landscape-level undisturbed areas (in relation to forestry impacts) within woodland caribou ranges with connectivity of various habitat types throughout and between woodland caribou ranges and adjacent protected areas."	Balisky 2007
Dog River Matawin Forest, northwestern Saskatchewan	AbitibiBowater, Ontario Ministry of Natural Resources, Ontario Parks, Lakehead University	Quetico Provincial Park is a benchmark area next to a managed forest. The Legacy Forest is an experimental forest for long-term study of the impacts of intensive forest management on the values and goals associated with sustainable forest management.	Legacy Forest Visions 2002
Whitefeather Forest, Pikangikum, northwestern Ontario	Whitefeather Forest Management Cooperation, Pikangikum First Nation and Ontario Ministry of Natural Resources	"[Dedicated protected areas] can support future comparison of ecological processes and cultural activities… with those in areas where forestry, mineral sector and hydro activities are allowed."	Whitefeather Forest Management Corporation 2006

Research on case studies

Although most research is still conducted within either a protected areas framework or a sustainable forest management framework, some attempts have been made to bridge the divide through research and management that considers protected areas and sustainable forest management in an integrated way. They are documented primarily in the grey literature, although a few have been evaluated in scholarly articles. Some examples are presented briefly below and in 2.3.6.

2.2.2 Case studies linking protected areas and sustainable forest management

We provide here an overview of projects or other instances where research and/or management have considered both protected areas and sustainable forest management in an integrated way. Such case studies vary in terms of the spatial scale and the groups involved. We have grouped them by leading agency:

- Government-led initiatives
- Aboriginal-led initiatives
- Industry-led initiatives
- Multi-sectoral initiatives led by non-governmental organizations

We discuss some of these examples elsewhere in the report as well.

Government-led initiatives

Many projects linking protected areas and sustainable forest management are government-led. This is particularly the case in and around protected areas where managers apply ecosystem-based management to the "matrix" (e.g., timber-producing forest outside a protected area), as well as within the protected area itself, to enhance the ecological integrity of the protected area (Slocombe and Dearden 2009).

For instance, Canada's national parks are explicitly mandated to engage in an ecosystem-based management approach. Parks Canada staff engage with land managers, owners, stakeholders and interest groups (public and private) outside park boundaries to coordinate management activities. The intent is to ensure that the ecological integrity of the park is not adversely affected by activities outside the park itself. Some such ecosystem-based management involves collaboration between the parks and with the forest sector; in other cases parks are bounded by agricultural areas or other ecosystems.

Canada's national parks are mandated to engage in an ecosystem-based management approach. This may include collaboration with the forest sector and other groups.

Some Parks Canada's ecosystem-based management projects are documented in peer-reviewed journals, others through conference proceedings and government reports (Freedman et al. 1999, Zorn et al. 2001, McLean 2003, Ross et al. 2003, Theberge 2003, Anderson and VanDusen 2003, External Advisory Committee 2005, Olthof and Pouliot 2005). Some parks have made further progress in such planning initiatives than others. Fundy National Park, for instance, is considered a leader in engaging in ecosystem-based management; see Woodley and Freedman (1995) for details.

Government has also taken the lead on the Model Forests initiative. These are working-scale forest-based landscapes that involve local partnerships and a larger network, working together to develop, test, and share solutions to local challenges in sustainable forest management. Model forests are designed to act as giant laboratories; techniques of forest management that incorporate ecosystem health, cultural values and economics are researched, developed, applied, and monitored, serving as models of sustainable forest management across Canada (Natural Resources Canada 2006).

Aboriginal-led initiatives

Other initiatives have been led by Aboriginal communities. Here, the focus is generally within an individual traditional territory. Case studies include at least two types:

- Aboriginal-led forest management plans (e.g., Forsyth et al. 2003, CATT 2004, Whitefeather Forest Management Corporation 2006);
- Aboriginal-led initiatives to establish and manage their own, community-based protected areas (e.g., Bussières 2005, Grainger et al. 2006).

We discuss some such initiatives in more detail in Section 2.4. Aboriginal groups are also involved in some of the examples mentioned under other categories, e.g., the Muskwa-Kechika Special Management Area referred to later.

Industry-led initiatives

Some initiatives have been led by forest companies. For instance in Alberta, Al-Pac (Dyer 2004, Farr et al. 2004) and Daishowa-Marubeni International (Witiw 2006) have established de facto protected areas within the areas where they have harvest rights. This has been done through voluntary set-aside of high-conservation-value forests and by establishing or maintaining other non-harvestable areas, some set aside expressly to serve as ecological benchmarks.

Multi-sectoral initiatives led by non-governmental organizations

Some initiatives involve projects led largely by a non-government organization but involve other sectors or stakeholders. Examples include:

- the Muskwa-Kechika Special Management Area (Mitchell-Banks 2003, Shultis and Rutledge 2003, McManus 2004) (discussed in 2.3.5 and 2.4);

- the Colin Stewart Forest Forum, facilitated by the Nova Forest Alliance (Nova Forest Alliance, no date); and
- the Canadian Boreal Initiative (Canadian Boreal Initiative 2005).

The driving force behind the above projects was usually biodiversity or nature conservation. They generally aimed for integration between sectors to maximize environmental, economic and social sustainability. The focus was often on a larger region, and included other land uses beyond timber production.

2.2.3 Gaps in the literature

One challenge of the literature review was to unearth the full range of protected areas and sustainable forest management activities taking place, and the different perspectives and knowledge held about them.

Some initiatives are not well represented in the available literature (e.g., work that doesn't involve academic or government partners). This speaks to the importance of other modes of information sharing.

Projects that include academic partners often have readily accessible project reports. Government research often produces reports available on the internet, as does research conducted by larger environmental and social organizations.

However, volunteer-led, community-based grassroots organizations and Aboriginal communities are not as well represented in the available literature, unless their work includes academic or government partners.

Documentation exists about innovations carried out by industry, but is often not readily accessible to the public. We were able to access some internal industry reports and plans through liaison with our partners. These documents suggest that while industry is certainly thinking about these issues, the internal literature is not well integrated with the broader scholarly literature.

The gaps in our compilation of knowledge relating to protected areas and sustainable forest management in Canada speak to the importance of other modes of information sharing, such as workshops and meetings.

Information gaps on specific topics also exist; areas where additional research is needed are identified in the "recommendations" section of this report.

2.3 Perspectives of practitioners and other experts

Expert consultations yielded insights not captured in the literature. These were shared through workshops, round table discussions, and in responses to presentations given by the project's Principal Investigator. We present some of these below:

- General perspectives: survey results;
- Key issues and uncertainties;
- Groups and factors driving closer integration;
- Value frameworks;
- Policy and regulatory frameworks;
- Strategies used for successful integration of protected areas and sustainable forest management.

2.3.1 How do protected areas and sustainable forest management relate? a survey

We used a survey of practitioners, conducted by three graduate students at the University of Western Ontario (AppleSeed Consulting 2008), to assess current thinking among practitioners/partners on the relationship between protected areas and sustainable forest management. The survey was distributed to project partners and interested parties in March 2008.

One of the goals of the survey was to determine whether project partners were comfortable adopting a broader definition of "protected area" beyond the IUCN concept (defined above). We also sought to examine perspectives from practitioners on the ways in which protected areas could interact with sustainable forest management.

Of 64 distributed surveys, 15 people responded. These included protected areas managers, government forest managers, industry representatives, representative from NGOs, and members of First Nations.

Protected areas: The majority of respondents agreed with the definition of a protected area as a legislated set-aside that was protected in perpetuity. When respondents were asked to consider other types of land designations, such as those encapsulated under the definition of non-harvestable areas (e.g., section 2.1.3), responses were more equivocal. Most people felt that to be called a protected area, there had to be a sense of permanency and legislative authority.

Sustainable forest management: Survey participants were queried on their knowledge and perceptions of the concept of sustainable forest management. While most accepted the CSA definition of sustainable forest management given above (2.1.2), some felt the definition should also refer to natural capital, adaptive management processes, and how decisions should be prioritized where economic and ecological values conflict.

All respondents included commercial timber harvest in their conceptions of sustainable forest management. In reality, sustainable forest management can include forest management for a plethora of values, including non-extractive ones; however, this was not the focus of those who responded to our survey.

Relationships between protected areas and sustainable forest management: Most respondents agreed that the concepts of a protected area were reasonably well aligned with the concept of sustainable forest management. The main arguments in support of this view included the notion that protected areas could act as ecological benchmarks, and the idea that they could serve as a "safety net" for species and genetic diversity, should other land management practices fail. Formal, legislated protected areas were also perceived as an integral component of the landscape in order to have forests certified as sustainably managed.

Compatibility between sustainable forest management practices and protected areas values: When asked specifically to describe sustainable forest management practices compatible with the values of protected areas, respondents referred to practices such as prescribed burning, non-commercial tree removal (to control disease, or for safety issues), and retention of coarse woody debris and snags after forest harvest in certain stand types. They also mentioned timber harvest that mimics natural disturbance patterns, and sustainable forest management practices to maintain forest biodiversity, and soil and water quality.

A few respondents felt that sustainable forest management practices were incompatible with protected areas, mainly because they considered it impossible to have truly sustainable management practices in the context of forest management for timber production.

2.3.2 Key issues and uncertainties

Consultations and workshops were held with partners, practitioners and others. Participants noted several key issues and challenges concerning relationships between protected areas and sustainable forest management:

- **Uncertainty on protected areas configuration in time and space**. There was uncertainty on the question of whether protected areas can change their size and location across time and space and still achieve their goals. Some literature suggests that, at least theoretically, for some highly dynamic ecosystems, a "floating reserve" (Cumming et al. 1996, Donner et al. 2008, Rayfield et al. 2008) system might be part of an effective biodiversity conservation strategy.
- **The lack of a suitable framework** for how protected areas and timber-producing forests interact, both spatially and in terms of policy and management. There is a desire for more sophisticated frameworks to help conceptualize, describe, and guide relationships between protected areas and sustainable forest management. Ideally these would consider many variables, for example, recreation intensity, non-timber forest products, effectiveness in reaching goals, state of ecosystem (e.g., naturalness), intensity of management, and governance.
- **IUCN designation** and the need to evaluate management effectiveness in achieving sustainability goals. Simply defining protected areas based on IUCN designation is unsatisfactory because IUCN categories do not comment on management effectiveness.
- **Uncertainty about how to achieve integration**. There was general recognition of the need to integrate management of protected areas and sustainable forest management, but uncertainty about how to do this.

- **The need for frameworks to have a clear intent.** The intent of any framework must be confirmed at the start; this will affect any jurisdiction's approach to allocating land to various uses (including protected areas, timber production, and other land uses).
- **Broad respect across sectors**. Some groups stressed that the relationship between protected areas and sustainable forest management should focus on respect of all sectors' activities, knowledge systems, values, and goals.
- **Perceived value** of protected areas to sustainable forest management or of sustainable forest management to protected areas. Some groups saw formal, legislated protected areas as being an essential component within sustainable forest management of a forested landscape. The reverse was not true, however. Outside of industry, most people did not see how sustainable forest management of timber-producing forests might contribute positively towards management of legislated protected areas.

2.3.3 What's driving closer integration?

In some regions, protected areas are already being considered in the context of sustainable forest management of the overall forest landscape. Project partners and workshop participants were asked to identify the groups, underlying factors and motivations that were driving the initiatives they were engaged with. These included:

- Environmental non-governmental organizations (ENGOs) (e.g., Canadian Boreal Initiative, which has established a target of 50% protected areas in boreal forest; other ENGOs seeking to establish protected areas where commercial forestry is in decline);
- Aboriginal Peoples (e.g., motivated by issues around settled and unsettled land claims, official ownership of forest resources, land uses, alternative paradigms);
- Consumers (e.g., by granting industry social license to operate through certification systems and thereby placing value on ecosystem services);
- Science (e.g., through evaluating boreal forests as carbon sources or sinks);
- Government (e.g., through identification and support for species at risk; using protected areas as part of a larger "green" strategy);
- Local communities (e.g., motivated by a desire for job security, economic stability);
- Industry (e.g., motivated by society and consumers to adapt and improve best practices);
- Presence of other competing user groups (e.g., recreation, oil and gas, mining, hydroelectric development who are also motivated to have access to the land base);
- Leadership and motivation provided by individuals.

Finally, a lack of communication and integration between these groups and their (sometimes conflicting) motivations was also seen as a driver for initiatives to consider protected areas in the context of sustainable forest management. Other factors are listed in Table 5.

Table 5 **Factors identified by experts from a variety of sectors (NGO, Industry, First Nations, government) as contributing to successful integration of protected areas and sustainable forest management**

- Minimal turnover of individuals participating in development of agreements or programs
- Local representatives
- A sense of decision-making power achieved via legal agreement
- All parties have the necessary capacity to participate
- Trust between all parties
- Respect for local/traditional knowledge
- Integration of sound science
- Open communication, transparency
- Financial incentives
- Efficiencies in regulatory planning process
- Effective coordination between government agencies involved in protected areas and forestry policy and management
- Ecologically-based strategies that focus on "natural disturbance" are used as the central, common, start-point foundation for modeling landscape management
- Public awareness and involvement
- Advice and recommendations taken into consideration in planning by government
- Adequate resources for inventory, monitoring, database maintenance and development
- Effective policy framework to facilitate integration of protected areas with sustainable forest management
- Network governance structures (e.g., certification schemes, Model Forests Network)

2.3.4 Values: a key consideration

It is important to consider a range of values when discussing protected areas and sustainable forest management. Many of the past conflicts between proponents of protected areas and the resource sector have hinged on issues of values. Also, public values are eventually expressed in government policy; thus the values held for forested areas are also important in a policy context.

We discuss, in the context of protected areas and forest ecosystems, the three types of values cited as the three elements of sustainability (Young 1997):

- ecological values,
- social values, and
- economic values.

Values may also be conceptualized as the "benefits" that society and/or individuals receive from forested ecosystems. These benefits may include direct benefits such as timber and non-timber forest products, such as mushrooms, greens, medicinal plants (e.g., Cocksedge 2006), and "ecosystem services", such as clean air and water (e.g., Kulshreshtha et al. 2000, Anielski and Wilson 2005, Patterson and Coelho 2009, Anderson et al. 2010). Other benefits may be less tangible, such as a spiritual retreat, a place for recreation, or a site for traditional/family activities that contribute to social cohesion and well-being.

A challenge when articulating values/benefits is indeed their potential intangibility. The CSA has developed a framework (VOIT) for examining how values, objectives, targets and indicators interact in the context of forest management (CSA 2008); see Figure 8. This approach may assist with developing a framework to describe and assess some of the intangible values associated with protected areas and non-harvestable areas. In Table 6 we provide a summary of an exercise that was carried out at our Halifax workshop to try to develop a VOIT framework for this purpose.

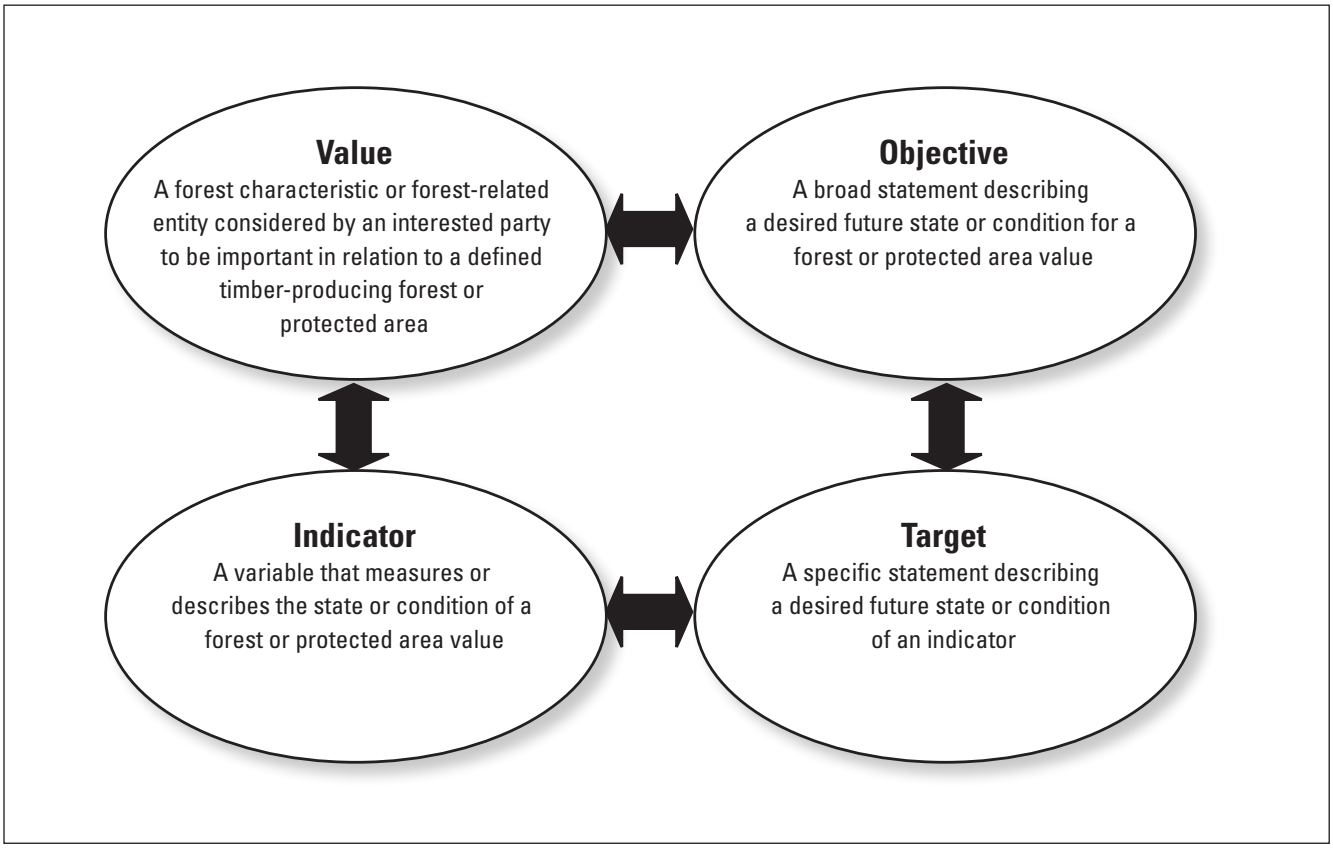

Figure 8. Relationships among values, objectives, indicators and targets (adapted from CSA 2008).

Table 6 **Examples of social and economic values and corresponding objectives and indicators for protected areas, as developed in group discussions**

1) Value: Recreation	
Objective:	To provide safe, accessible, "wild", clean opportunities for hiking, biking, camping, canoeing, etc.
Indicators:	i) Number of participants in recreational opportunities ii) Number of complaints at a site iii) Number of inquiries about recreation opportunities iv) Mean length of stay at a site v) Carrying capacity
2) Value: Spiritual/Inspiration	
Objective:	To provide access to spiritually inspirational sites/areas
Indicators:	i) Quality of spiritual experience (visitor surveys, comparative views) ii) Absence of obstructions/constraints to spiritual experience
3) Value: Human health/wellness	
Objective:	To ensure nature-based opportunities for humans to achieve health and wellness benefits
Indicators:	i) Number of recreational opportunities provided ii) Reported health effects (rates of disease, stress levels)
4) Value: Non-use (beneficiary)	
Objective:	Non-use values continue to be appreciated by Canadians in general
Indicators:	i) Willingness-to-pay analyses ii) Public awareness of protected areas/sites ii) Other measures of appreciation of natural forested ecosystems (e.g., purchases of books, art, music related to natural forested environments)

Ecological values

Protected areas: perceived roles and limitations

Protected areas are widely perceived to conserve ecological values, due to their mandates to promote conservation of ecosystems and species and their legislative permanence. However, protected areas in and of themselves are not sufficient to conserve biodiversity, as identified by the Parks Canada Panel on Ecological Integrity (Parks Canada Agency 2000) and a myriad of scientific papers.

Many protected areas are too small to contain fully functioning landscapes, or to include sufficient area for the home ranges of some species (Wiersma et al. 2004, Gaston et al. 2008, Timko and Innes 2009). Management of many protected areas includes practices (e.g., fire suppression, wildlife relocation, tourism promotion, roads and facilities) that compromise their ecological integrity. Also, despite being considered protected areas under IUCN classification, some parks or sections of parks were not initially established with ecosystem conservation as the prime priority, and/or have not been managed optimally for conservation.

Managing the matrix: timber-producing forests and protected areas

Management of the matrix outside the boundaries of protected areas has been identified as critical for protected areas to achieve their mandate for ecosystem conservation (Schmiegelow et al. 2006). (E.g., see 2.2.1 and 2.2.2 discussions of ecosystem-based management.)

Thus, non-harvestable areas outside "official" protected areas can contribute significant ecological

values to protected areas, and to the landscape as a whole. Harvest and other activities in timber-producing forests may also contribute to ecological values, especially when considered over long periods.

Removal of timber from the landscape may not at first appear to promote ecological values. However, the boreal forest in particular has always been highly dynamic and subject to frequent large disturbances (e.g., fire, insect outbreaks).

There are also situations where forested areas within protected areas no longer represent naturally functioning ecological systems; for example, where fire suppression has been the norm for many decades. In areas where such processes no longer function naturally, it may be possible to restore them, such as through the initiation of prescribed burns (which have been conducted within protected areas; e.g., Šrůtek et al. 2008).

Recent developments in forest practices that attempt to emulate natural disturbance patterns may result in landscapes over large spatial and temporal extents that better represent naturally functioning forest ecosystems (e.g., Drever et al. 2006, Lauzon et al. 2006).

In addition, some forest companies are engaging in innovative practices intended to support or restore the ecological integrity of the managed landbase. Some of these activities contribute to a similar suite of ecological values (e.g., soil and water conservation, maintenance of ecological processes, etc.) as do protected areas. (See Table 7).

Table 7 **Activities undertaken by managers of timber-producing forests that may contribute to values similar to those contributed by protected areas**

- **Ecologically-based management landscape strategy** based on a natural-disturbance model (values addressed: ecological, hydrological, soils, aesthetic, social, economic/market, human understanding)
- **Voluntary exclusion of special geographic features/lands** from timber supply to address sensitive values, for example eagle-osprey-heron-owl-hawk nests [size varies with species], 30-90 m slope-dependent water quality reserves, riparian buffers, 120 m reserve on moose aquatic feeding areas, special prescriptions for species at risk, 400 m no road zone for remote trout lakes (values addressed: ecological, hydrological, soils, aesthetic, social, economic/market, human understanding, recreational)
- **Variable-retention harvest design practices** at 15% average landscape target, within-block retention, merchantable representative, positive feature buffers (values addressed: ecological, hydrological, soils, aesthetic, social, economic/market, human-understanding)
- **Supply of all forest types to remain within bounds of natural variation over a 100 yr projection:** forest types must remain within 75% of projected natural level for each forest type in each 10 year term. Natural is today's forest allowed to change with fire and succession, but no harvesting (values addressed: ecological, aesthetic)
- **Supply of habitat for focal species:** to remain within bounds of natural variation, e.g. core habitat for marten, caribou (values addressed: ecological, aesthetic, social)
- **Retention of individual trees:** (values addressed: ecological)
- **Old-growth targets:** % of old growth left on the landscape as per policy guidelines (values addressed: ecological, aesthetic)
- **Self-monitoring for compliance** with government and company performance standards (values addressed: ecological, hydrological, soils, aesthetic, social, economic/market)
- **Research collaboration** to support adaptive management (values addressed: ecological, hydrological, soils, social, economic/market, human understanding)
- **Third-party audits** to support continual improvement and sustainable forest management credibility (values addressed: social, economic/market)
- **Collaboration in supporting designated recreation:** campground sites, fisheries, interpretive trails (values addressed: ecological, aesthetic, social, economic/market, human understanding, recreational)
- **Collaboration in local public awareness education** (values addressed: social, human understanding, recreational)

The concept of dynamic reserves

Some researchers have proposed the concept of dynamic reserves that are reallocated spatially over time to provide suitable habitat for key species as forest composition and age structure changes (Cumming et al. 1996, Donner et al. 2008, Rayfield et al. 2008).

This concept of a spatially dynamic reserve is very much at odds with the widely held perception of protected areas as prescribed areas set aside in perpetuity (despite the fact that many older parks were not set aside with conservation as the main priority). The concept also entails many operational challenges.

However, such reserves may be appropriate as part of a conservation strategy for dynamic ecosystems such as the boreal forest.

Shared and overlapping values

These examples suggest that the apparent dichotomy perceived by many to exist between protected area and sustainable forest management is somewhat artificial. We suggested earlier (section 2.1) that protected areas and timber-producing forests can both be viewed as occurring along a continuum of values in terms of ecological sustainability (Section 2.1, Figure 5). Other values (e.g., social, economic) may be shared as well, though of course in some cases that is not the case. Similarly, certain management activities may contribute to similar values (Table 7).

Social values

Protected areas represent a range of social values. These include intangible values such as spiritual, aesthetic, recreational, cultural, identity ("sense of place") and existence values (Outspan Group 2000a, Harmon 2004).

Non-harvestable areas outside of protected areas may also hold some of these values. Non-harvestable areas on Aboriginal lands, in particular, are very much tied to identity and well-being values of the local communities that use these lands (e.g., Parlee et al. 2005, Whitefeather Forest Management Corporation 2006).

Timber-producing forests have social values in that they contribute to the social identity of individuals and the community as a whole that are tied to the activities of timber harvesting.

Economic values

Timber-producing forests have obvious economic value in terms of employment and sale of forest products. Similarly, many legislated protected areas generate revenue through gate fees, campground fees, and tourism facilities in gateway communities. All of these can create employment opportunities for local people.

Both protected areas and timber-producing forests offer many other forms of economic value, such as ecological goods and services, use-values (recreation, traditional use) and non-use (intrinsic) values, albeit to varying degrees. Some protected areas have been identified as having economic value in terms of carbon sequestration (Kulshreshtha et al. 2000). Non-extractive (intrinsic) values of protected areas can be quantified using appropriate economic models (e.g., Outspan Group 2000b, Mulrooney et al. 2003). In a similar vein, economic valuation of non-market values of non-harvestable areas can also be carried out. Thus, it is important to consider economic valuation and indicators for timber-producing forests beyond the revenues generated from cutting timber (Leake et al. 2002, Veeman and Luckert 2002, Anielski and Wilson 2005, Anderson et al. 2010).

2.3.5 Policy and regulatory frameworks

In Canada, surprisingly little legislation or policy explicitly addresses the relationship between protected areas and timber-producing forests. Some jurisdictions have enacted legislation promoting an integrated approach to land-use planning (for instance the Muskwa-Kechika Management Area Act in British Columbia, Box 3), but such examples are rare.

Although innovative, the Muskwa-Kechika process has not been without challenges; some of these are highlighted below (2.4), and the process of negotiating the management of this large area of land is ongoing.

Some forest-management agencies are currently reviewing and updating policy and guidelines to reflect current understanding and knowledge. For example, Ontario is updating its forest management guidelines for landscape, site and stand levels.

However, integration of forest management guidelines with protected areas management guidelines is largely

BOX 3

The Muskwa-Kechika Management Area

The Muskwa-Kechika Management Area Act (Government of BC 1998) is an innovative piece of legislation that addresses a range of land uses within a holistic framework. This act created the Muskwa-Kechika Special Management Area and sets out prescriptions for management, governance, and funding, outlines general regulations, and provides guidelines for planning.

The Special Management Area is not in its entirety a protected area, but the Act governing it facilitates collaborative planning and coordination among different sectors with interests in the area.

absent. This is presumably mostly due to the "silo mentality" in which protected area and forest-management agencies work.

2.3.6 Strategies used for successful integration

In the absence of specific policy and regulatory frameworks, successful integration among protected areas, non-harvestable areas and timber-producing forests has followed a range of strategies, often used in combination. These have included:

- Ecosystem-based management,
- Co-management strategies,
- Community forestry,
- Aboriginal-led initiatives,
- Model Forests and the Forest Communities Program, and
- Certification and related initiatives.

We outline such strategies below. (See also section 2.2 for related literature.)

Ecosystem-based management (EBM)

This strategy promotes the integrated management of land, water, and living resources to support conservation and sustainable use in an equitable way (Grumbine 1994, Plotkin 2004, Vaillancourt et al. 2009). It is increasingly advocated and used in Canada and globally.

As previously discussed, EBM has been applied to both protected areas and sustainable forest management. The concept can be useful for facilitating effective relationship between protected areas and sustainable forest management.

It was included as the first objective towards sustainable forest management in the 2003-2008 commitments of the National Forest Strategy (National Forest Strategy Coalition, 2003). An example of EBM implementation is currently underway in central Labrador (District 19), using indicators of EBM developed jointly by the Sierra Club and the Innu Nation of Labrador (Plotkin 2004). Another is the use of EBM strategies by Parks Canada Agency discussed earlier (2.2.2).

Co-management strategies

For our purposes, co-management is defined as the sharing of responsibilities among partners (such as government, local communities, local First Nations, industry, and other stakeholders) for land and resource management (Smith 2007).

Aspects common to various co-management initiatives include local participation in decision-making and management responsibilities, integration of western and traditional environmental knowledge, and consensus-based decision-making.

Some examples (not exclusively for forest management) are given by Armitage et al. (2007), and there are a number of legislated protected areas in Canada under co-management with Aboriginal peoples (e.g., Gwaii Haanas National Park (Hawkes 1996), Stein Valley Provincial Park).

Community forestry

Community forests often incorporate multiple forest uses and are managed by local communities or governments to promote long-term ecological health and community benefits (Teitelbaum et al. 2006).

Members of local communities have substantial influence over the decisions that result from the management process, and benefits are kept locally. Teitelbaum et al. (2006) identified 116 community forests across Canada, mostly located in Quebec, Ontario, and British Columbia. Of these, 60% are on Crown land, and the remainder are on land owned by local governments.

While community forests contribute a relatively small proportion of the total wood cut in the country, interest in community forestry is growing among members of First Nations, local communities, and non-government organizations.

Aboriginal-led initiatives

Aboriginal forestry has been defined as "sustainable forest land use practices that incorporate the cultural protocols of the past with interactions between the forest ecosystem and today's Aboriginal people for generations unborn" (Parsons and Prest 2003).

Approximately 80% of First Nations communities in Canada are located within commercial forest zones. Aboriginal communities have demonstrated a strong interest in gaining more control over resources in traditional territories across the country. This could contribute towards a more holistic approach to management and use of forest resources as the forest and cultural values of Aboriginal peoples are increasingly recognized (Berkes and Davidson-Hunt 2006).

Model Forests and the Forest Communities Program

Model Forests are working-scale forest-based landscapes that involve local partnerships and a larger network to develop, test, and share solutions to local challenges in sustainable forest management. They are designed to act as giant laboratories where techniques of forest management that incorporate ecosystem health, cultural values and economics are researched, applied, and monitored, serving as models of sustainable forest management to other forests across Canada.

The Canadian Model Forest Network was recently integrated with a new program of the Canadian Forest Service, the Forest Communities Program. The latter is intended to be broader in scope and to address innovations to forest resource sustainability and sector transition issues, while also being delivered through community-based partnership organizations. The Canadian Model Forest Network is a well-established collaborative entity that has recently become independently incorporated (Natural Resources Canada 2007b).

Certification and related initiatives

Forests can be certified to demonstrate to consumers that production of forest-based goods conforms to defined standards of environmental and social sustainability.

Three main types of bodies are involved in certification: the standards development organizations that produce the standards to be upheld; the forest-products companies that choose to certify their products and carry out their forest management to the standards set by the certification system; and the third-party auditors that verify that standards are being met in the forest.

Three forest certification systems are applied in Canada, one each associated with the Canadian Standards Association, the Forest Stewardship Council, and the Sustainable Forestry Initiative. Together these three programs have certified approximately 145.7 million hectares of Canadian forests (FPAC 2009).

As noted earlier, non-harvestable areas may be set aside within timber-producing forests as part of requirements for certification, and these may fulfill some ecological functions similar to those of legislated protected areas. (Sections 2.1.3, 2.2.2).

2.4 Current state of knowledge and thinking: a synthesis

Literature and case studies

Our literature review and early consultations suggested a great deal of uncertainty about how protected areas might relate to sustainable forest management in Canada. In some regions and sectors, the two are still perceived to be in conflict. In other areas of the country, the two sides are moving closer together.

A fairly extensive body of theoretical work examines ways to integrate management within and beyond protected areas boundaries (i.e., ecosystem-based management), but cases of "real-life" implementation are less numerous.

In most cases where integrated management has occurred, the focus has tended to be on either the establishment of a co-managed protected area (e.g., Wemindji Cree (Bussières 2005), John Prince Research Forest (Grainger et al. 2006)), or on management outside protected areas (Vaillancourt et al. 2009). A number of examples focus on the effects of external management on values within a protected area (e.g., ecosystem-based management plans for national parks). Only a few focus on the development of a comprehensive plan for timber-producing forests while at the same time acknowledging the need for protected areas. (Examples include the Whitefeather Forest, Muskwa-Kechika, District 19-Labrador, the CATT Forest Management Plan, Al-Pac, Louisiana-Pacific's Forest Management Plan in Manitoba and various model forests).

The Model Forests are an interesting group of cases in that they explicitly examine protected areas in the context of sustainable forest management, because most model forests include an existing, large protected area. Model forests exist primarily as vehicles for research on sustainable forest management practices and facilitate multi-partner cooperation on decision-making within a particular forest region. Model-forest initiatives seek to develop tools for sustainable forest management and put them into wider practice. Despite the extensive amount of research and publications produced by the Canadian Model Forest Program, many practitioners are still uncertain as to how to integrate protected areas with sustainable forest management.

Viewpoints on relationships

A plurality of views exists about the interaction between protected areas and sustainable forest management. Industry practitioners tend to view protected areas as a constraint on their operations, while many proponents of protected areas view industry with suspicion or hostility.

Some industry partners acknowledge that protected areas may play a role as ecological benchmarks. However, given the divergent disturbance histories within and outside of protected areas in many parts of the boreal, some forest ecologists question whether protected areas managed under decades of fire suppression, for instance, can function as adequate ecological benchmarks for a dynamic landscape. In addition, there may be disagreements between protected area and timber-producing forest managers about an appropriate reference state for an ecological benchmark. In contrast, most protected areas proponents do not feel that forest harvesting, no matter how sustainably it is practiced, can contribute any value to existing protected areas.

Above all, industry representatives want a high degree of certainty about land use and restrictions when they draft their operational plans. Protected area proponents want to ensure that biodiversity values are conserved. Aboriginal peoples want to maintain access to traditional land-based livelihoods, while not foreclosing opportunities to participate in resource-based economies. Other players, such as non-government organizations, local communities, researchers, and the general public, have interests and opinions on these issues as well.

Above all, industry representatives want certainty about land use and restrictions when they draft their plans.

Protected area proponents want to ensure that biodiversity values are conserved.

Aboriginal peoples, NGOs and others have interests and opinions as well.

What drives successful outcomes?

In places with successful integration between protected areas and sustainable forest management activities in Canada, participants have identified a range of factors that have contributed to positive outcomes. These are summarized in Table 5.

Successful cases sometimes appear to be driven largely by circumstance, and by the personalities and training of the individuals involved. Of the key elements and attributes emerging from our consultations, some are common across knowledge sectors, while others are more germane to certain groups.

Aboriginal and industry viewpoints

Aboriginal peoples in particular expressed specific requirements that must be met before they may consider co-management strategies as successful. This is true whether the co-management is for a protected area, a timber-producing forest, or both.

Key elements for Aboriginal peoples are a sense of trust and respect for their traditional knowledge, and a sense that their input will be integrated into decision-making.

Because the process of developing co-management strategies can take a long time, Aboriginal peoples become frustrated when there is high turnover among the government representatives they are dealing with, since it takes time to get a new representative up to speed on the issue. Similar frustration is felt by government and industry managers when faced with changes in Aboriginal community leadership (e.g., turnover among Chiefs and Councils).

Finally, forest industry representatives cite uncertainty as a key consideration in facilitating effective planning for sustainable forest management. They get frustrated when government policy impedes their desire to enact progressive policies or practices, or when they feel they are discouraged from "thinking outside the box".

Values, policy frameworks, and strategies

An in-depth examination of the values represented by forested areas (including protected areas and non-harvestable areas) and held by different individuals/sectors/groups helps to articulate where and why particular conflicts may occur. This can be a positive step in conflict resolution (Moyer et al. 2008).

Moreover, because values are eventually expressed in policy, it is important to think about why certain areas are valued, and examine innovative ways to quantify those values.

Economic valuation of intrinsic values held for protected areas and natural forested areas provides one framework for comparing sites managed primarily for biodiversity against sites primarily managed for timber harvest. Measures of intrinsic values can then be compared to more conventional economic valuation as measured in dollars per unit wood harvested or per person through a park gate, for instance for sites managed for biodiversity.

Current legislation and policy have not kept up with practices on the ground. Many agencies and groups are engaging with issues related simultaneously to protected areas and sustainable forest management, in spite of the lack of legislative or policy frameworks.

Many agencies and groups are engaging with issues related simultaneously to protected areas and sustainable forest management, despite a lack of legislative or policy frameworks.

Some of the current forest-management regulations (e.g., prescriptions on harvest around waterbodies) may help to create de facto protected areas, although some research (Huggard 2004, Kreutzweiser and Holmes no date) has suggested that unharvested areas can become unrepresentative of the dynamic boreal ecosystem over time.

In workshops and consultations, some representatives from industry feel that existing policy frameworks do assist with integration between various interests if the policies require broad representation across sectors on planning teams and associated broad input into development of forest management plans.

Lessons from the ground: Muskwa-Kechika and Whitefeather

The Muskwa-Kechika Management Area has been highlighted as a unique example of regional land-use planning. However, that process has not been without its challenges. Key challenges include:

- the large size of the region;
- the disconnect between general guidelines of land management and resource management plans;
- the need for specific direction for operational planning;
- the lack of public awareness of the Muskwa-Kechika Management Area; and
- conflicting expectations about what can and should occur within the Special Management Area.

Further challenges involve pending treaty agreements for the Kaska-Dene, that could change the governance structure and land tenure in the region.

A review paper (Mitchell-Banks 2003) identified five key needs associated with the Muskwa-Kechika Management Area, which might be useful for other integrated land-use planning exercises. These needs include:

- adequate data and knowledge;
- accurate and timely analysis and decisions;
- adequate funding;
- acknowledgement of and working within political systems and with political agendas; and
- definition of roles and responsibilities.

As a result, the jury is still out whether the Muskwa-Kechika Management Area will provide an effective framework for broad-scale land use and resource management (Shultis and Rutledge 2003).

Another example which has received considerable attention is the Whitefeather Forest Management Plan from the community of Pikangikum in northwestern Ontario. The plan was developed by a local Aboriginal community and seeks to find a locally-based solution to balancing economic needs with long-term community sustainability, without compromising traditional land-based activities such as hunting, fishing and trapping (Whitefeather Forest Management Corporation 2006).

The Whitefeather Forest Management Plan has received accolades for its comprehensiveness and its emphasis on traditional values. The Whitefeather plan is focused within a relatively small geographic region (O'Flaherty et al. 2008). This may be appropriate from a cultural standpoint, but in the wider context of planning for forest management and protected areas in northern Ontario (north of the current Area of the Undertaking), some danger exists that a community-by-community planning approach may result in a piecemeal aggregation of protected areas and forest-management strategies.

It is the responsibility of the Government of Ontario, under the Northern Boreal Initiative, and pending legislation associated with the Ontario Far North Initiative, to coordinate planning between communities, but to date, the community of Pikangikum is far ahead of other communities in the region in terms of forest management planning.

3.0 Implications and recommendations

3.1 Implications for management

Increase collaboration; manage the matrix, break down the "silos"

Managers of both protected areas and timber-producing forests have long been aware of the need to manage the landscape collaboratively.

Protected areas managers recognize the importance of the "matrix" – that is, they have recognized the need to work with land owners and land users outside protected area boundaries to ensure that the values of the protected area itself are not compromised.

Managers of timber-producing forests, for their part, wish to collaborate with protected areas managers on issues that affect the quality and quantity of their forested land base, such as managing risk of fire spread from protected areas via fuel abatement programs, including prescribed burning.

To facilitate this kind of collaboration, less bureaucracy is helpful. The current structure of government "silos" is cited as one of the key impediments to successful collaboration and management initiatives beyond protected areas boundaries (Kutas and Duinker 2010).

Standards, criteria and indicators

It would be helpful to have clear evaluative standards for both sustainable forest management and protected areas management, as well as standards to evaluate how protected areas management affect sustainable forest management and vice versa.

The Canadian Council of Forest Ministers developed science-based criteria and indicators for sustainable forest management (Duinker 2001, CCFM 2003). Several certification standards (CSA, FSC, SFI) now exist to encourage effective and sustainable management of timber-producing forests.

A similar framework is needed to evaluate effectiveness of protected areas, although Parks Canada has developed criteria and indicators for evaluating ecological integrity within park boundaries. These are developed at the regional offices, with specific indicators (including social and economic indicators) developed at each individual park (K. Tulk, pers. comm.). National coordination is through a set of guiding principles for monitoring (D. Kehler, pers. comm.). However, these criteria and indicator frameworks are for internal use and are not widely available to the public or to other sectors and/or interest groups.

The IUCN has developed a general framework to evaluate effectiveness of protected areas (Hockings et al. 2006, Dudley 2008). A specific set of criteria and indicators should be developed to evaluate protected areas in Canada. We suggest that this be rooted in an approach similar to the VOIT framework (Value-Objective-Target Indicator) in the CSA standard for sustainable forest management. It should also be consistent with international guidelines developed by the IUCN.

It would also be helpful to have standards to evaluate how protected areas management affect sustainable forest management of the landscape as a whole and how management of timber-producing forests can affect protected areas.

Benchmarks issues: considerations and criteria

The value of using protected areas as benchmarks against which to evaluate the effects of forest management was emphasized by partners and workshop participants throughout the project. The BEACONS project is completing a more rigorous evaluation of the issue of ecological benchmarks (Schmiegelow et al. 2006).

Benchmarks are an important element of an adaptive management framework, and we spent some time consulting with partners and participants as to appropriate criteria for effective ecological benchmarks.

Key points from our discussions are summarized in Table 8. We conclude that managers should think carefully about what they want from a benchmark before necessarily choosing a protected area as a benchmark against which to measure the effects of forest management. In some cases, existing protected areas may not be appropriate, and unharvested areas within timber-producing or unallocated forests may be required.

Recommendations

- Promote increased collaboration between managers of protected areas and other land users in adjacent areas; manage the "matrix".
- Support integrated land-use planning in forest ecosystems, such that the landscape is managed in ways that promote values associated with both biodiversity-conservation and sustainable-forest-management paradigms.
- Increase collaboration and communication among government entities responsible for protected areas and forest management for timber production.
- Develop and use criteria and indicators to evaluate protected area effectiveness:
  - Build on systems already in existence if possible (e.g., Parks Canada, IUCN);
  - Consider adapting the CSA's current VOIT framework (CSA 2008) to identify values, objectives, indicators and targets for protected areas as well as sustainable forest management (see NIPpaysage et al. 2008);

Table 8 **Criteria for effective ecological benchmarks, as identified through expert consultations.**

- Intrinsic ecological processes are intact and allowed to evolve over time
- Characteristic (i.e., representative) subset of the landscape as a whole
- Size should be appropriate to management goal(s)
- Realistic reference state
- Easy and economically efficient to monitor
- Resilient to human disturbance
- Sustainable
- Linked to management activity of interest
- Certainty of their endurance as an entity
- Some flexibility in space
- Not actively managed
- Replicated
- Similar history to managed sites
- Same ecological services as non-benchmark areas
- Matched ecological characteristics with non-benchmarks
- Presence of both fast- and slow-response indicators

  - Integrate evaluative systems for protected areas and sustainable forest management.
- Managers should carefully consider the objectives of benchmarks before considering whether protected areas can serve as adequate reference points. Research should assist with strategies for identifying benchmarks for sustainable forest management, including benchmarks within timber-producing forests.

3.2 Implications for policy

An in-depth examination of policy issues was beyond the scope of this project. What is clear is that the current policy environment is quite piecemeal. Each province and territory in Canada has a different set of policy guidelines for forestry, and policies for sustainable forest management and protected areas are not well coordinated. A more in-depth analysis of existing policy is needed.

We also need to develop strategies to streamline policies across government "silos".

More national-level coordination between the forest-management and protected area sectors would facilitate positive interactions and policy coordination.

The Canadian Council on Ecological Areas (CCEA) brings together senior civil servants from protected area agencies across the country (federal, provincial and territorial) on an annual basis, and sponsors workshops and research papers.

Similarly, the Canadian Institute of Forestry (CIF) meetings bring together forest practitioners from across the country to consult with each other and to collaborate on research, management and policy issues. Finally, the Canadian Council on Forest Ministers (CCFM) and the Canadian Parks Council (CPC) bring together individuals at the Ministerial level regarding forestry and protected areas issues respectively.

Occasional meetings that bring together these two sets of groups (i.e., the CIF and the CCEA, or the CCFM and the CPC) to discuss the ways in which protected areas interact with the forest sector would help bridge some of the current gaps in policy.

Recommendations

In our view, development of an effective policy framework to facilitate relationships between protected areas and sustainable forest management would include some or all of the following:

- Increase coordination at the national level through meetings between the Canadian Institute of Forestry and the Canadian Council on Ecological Areas, and between the Canadian Parks Council and the Canadian Council of Forest Ministers.
- Increase coordination at local levels through explicit guidelines for forest and protected area managers to implement integrated approaches.
- Carry out in-depth analysis of existing policy frameworks to identify best practices that support coordination.
- A policy framework that supports:
  - Consideration of a watershed or landscape approach,
  - Some aspect of local decision-making,
  - Simple and transparent public consultation,
  - Certification,
  - Open access to information,
  - Fulfillment of agreed-upon obligations, and
  - Explicit involvement of all overlapping jurisdictions (geographic, sectoral, and government/non-government).

3.3 Implications for research

Our project only scratched the surface of the myriad ways protected areas relate to sustainable forest management, and of possibilities for future interactions to the mutual benefit of biodiversity conservation and forest management. Future research should occur on multiple fronts, as suggested below.

Recommendations

- Promote interdisciplinary research that links social and natural sciences.
- Conduct research on policy issues (see 3.2 above).

- Conduct research on the ecology of dynamic forest systems, including :
  - landscape dynamics in Canada's forested regions,
  - biodiversity conservation and representation in this context,
  - how to set effective benchmarks, and
  - the "floating reserve" concept.
- Identify patterns of landscape connectivity, particularly in the boreal region.
- Investigate whether existing approaches, e.g., "Biolinks" (Mansergh and Cheal 2007), offer appropriate strategies for maintaining and restoring habitat connectivity across large regions.
- Develop and evaluate novel methods of forest harvest that emulate natural disturbance patterns.
- Conduct research on values and perceptions (e.g., issues around values of protected forest areas and other forested landscapes, and perceptions of protected areas and sustainable forest management).
- Develop models for socio-economic valuation of forest management and protected areas (i.e., develop models that incorporate intangible values of each land use, and quantify these values using monetary or preference values, in order to facilitate the development of integrated economic models).

4.0 Conclusions

Canadian forest management – what has changed in recent years?

Under the banner of sustainable forest management, what has actually changed in the way Canadian forests are managed? Critics who want faster and deeper improvements would argue "not much". However, many forest-industry insiders observe that practices are dramatically different today compared to the early 1990s.

To be sure, sustainable forest management has not yet been able to fulfill its ideals as embodied in the definition given earlier. Many challenges and issues remain to be satisfactorily addressed and resolved within the economic, ecological and socio-cultural arenas of Canadian forests. However, in our collective view, strong improvements have occurred in the following areas:

- **Participatory processes:** Few forest management and policy decisions are made today in Canada without some form of consultation with a broad spectrum of stakeholders;
- **Forest values**: Forest managers today are charged with managing explicitly to satisfy a wide array of values, with strong new emphasis on ecological and social values;
- **Forest practices**: Largely in response to public pressure and the need to satisfy ecological and amenity values, forest managers are significantly changing their field practices. In large part, the practices are moving toward more closely emulating natural disturbances and maintaining natural ecological legacies;
- **Increases in the overall amount of legislated protected areas:** Over the past 20 years, many jurisdictions have increased the amount of land set aside as formally protected. Across Canada, the amount of land under formal IUCN protected areas designation has nearly doubled in that period (Government of Canada 2006). Also noteworthy are recent and ongoing strategies to establish representative **protected areas networks** (e.g., NWT Protected Areas Strategy, Saskatchewan Representative Areas Network), and **recent commitments** by the premiers of Ontario and Quebec to protect half of the northern portion of their provinces in advance of intensive resource development.
- **Increases in amount of non-harvestable areas in the forest landscape**: More areas have been put off-limits to timber harvests, either as legislated protected areas with defined boundaries or as areas set aside as "non-harvestable" within timber-producing forests. While areas explicitly set aside for conservation within timber-producing forests are relatively small, the sum total of both non-harvestable areas and formally protected area combine to cover large areas. As such, they represent substantial advances in the protected areas systems of many regions of Canada.

Challenges in defining relationships, roles and terminology

Understanding the relationship between protected areas and sustainable forest management has proved

challenging. We found strong opinions on what the definitions for the terms of the debate mean. Part of the uncertainty lies in the fact that the term "protected area" generally refers to a specifically delineated site, while "sustainable forest management" is more commonly perceived as a way of doing things, and not tied to a specific place.

Although there is often an implicit assumption that protected areas do more for biodiversity conservation than sustainable forest management, this is not always valid when examined at an individual level. Many protected areas are small, and heavily affected by human activity, while some areas under sustainable forest management may have been subject only to natural disturbance and have high ecological integrity, even if forming part of a larger area managed for timber production.

Another key challenge with the general terminology is that descriptive classifications do not provide evaluative commentary on management effectiveness in achieving ecological sustainability, either for protected areas or sustainable forest management.

IUCN categories are often perceived to discriminate between sites that have biodiversity conservation as the top priority and sites that prioritize other uses (e.g., recreation). However the IUCN classifications do not indicate the degree to which a particular site realizes its goals.

The same can be said for forest certification. Different certification processes vary in their standards, and management strategies towards certification are applied to varying degrees by different companies (Gullison 2003).

Forest landscapes and land uses

We have suggested a framework for conceptualizing the forested landscape across large spatial extents. Those areas managed for timber production (timber-producing forests) are assumed to be managed on some continuum of sustainability. Protected areas are defined as areas delineated by a legislated boundary and protected in perpetuity. The effectiveness of this protection relative to natural features and processes is assumed to occur along a continuum as well.

Figure 6 summarizes how we envision these components interacting in a landscape. Legislated protected areas maintain an important role in the landscape, because they have a degree of permanence that non-harvestable areas outside protected areas do not.

Ecological benchmarks

It is quite common to use protected areas and/or non-harvestable areas as ecological benchmarks against which the activities of timber-producing forests can be compared (Table 4). However, frameworks for the identification and establishment of suitable benchmarks are still in development. Successful use of protected areas and non-harvestable areas as benchmarks for timber-producing forests has been due to the strength and expertise of participants in individual situations.

Improved integration; developing frameworks

Ideally, a national framework or strategy to improve integration of the management of protected areas, non-harvestable areas and timber-producing forests should be developed. Given the institutional arrangement of resource management in this country, this will be challenging. All of these land uses have social, economic, and ecological values to contribute. However, their values are rarely formally integrated into assessments or management of forested landscapes.

In developing a framework for integrating protected areas and sustainable forest management, it will be critically important to incorporate methods to evaluate the effectiveness of protected areas and timber-producing forests in terms of achieving stated values.

Our project examined a number of case studies, where individuals and agencies are pushing the boundaries for better integration of protected areas and sustainable forest management. We observed a dearth of policy and regulatory frameworks to facilitate this process at present. We envision a future where more innovative frameworks are developed to facilitate relationships between protected areas, non-harvestable areas, and timber-producing forests.

Research in support of better sustainable forest management has increased in recent decades, much of it supported by the Sustainable Forest Management Network. Similarly, much work has been undertaken on how to improve management within protected areas. Our research is an attempt to synthesize knowledge about the relationship between the two.

We found that the strength of the relationship varies, with different innovations in different parts of the country. More research explicitly aimed at understanding how landscapes function across different uses (protected areas, timber-producing forests, non-harvestable areas) will contribute to better management and policy development of forested landscapes across Canada.

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