

***Special section: Protected areas and sustainable forest management in Canada***

## **Balancing the Relationship Between Protection and Sustainable Management in Canada's Boreal Forest**

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### **Abstract**

Protection and sustainable forest management are related but unique, with protection focusing on minimising risk to ecosystems and sustainable management emphasising economic development. Given these distinct roles, a defining characteristic of the relationship between the two approaches is their relative abundance and distribution. The relationship is currently imbalanced, with only 12% of Canada allocated to protection, indicating that ecological values have historically been traded off in favour of resource production. The intactness of Canada's boreal forest provides an opportunity for a more holistic approach that conserves its globally significant environmental attributes while also supporting resource production. The Boreal Forest Conservation Framework proposes a balanced relationship that allocates land approximately equally between protection and sustainable management. It is a framework that has been endorsed by industry, Aboriginal, and conservation organisations, and is supported by conservation science. Recent commitments to comprehensive land-use planning at regional scales are consistent with the collaborative approach promoted by the Boreal Forest Conservation Framework, and suggest that conservation objectives are likely to receive increased attention in Canada's boreal region relative to recent history. Ensuring that land-use planning is proactive and balanced will be essential for forging a cooperative relationship between sustainable management and protection in the region.

**Keywords:** boreal region, Boreal Forest Conservation Framework, protection, sustainable management, ecological integrity, land-use planning, Plan Nord, Canada

### **INTRODUCTION**

In Canada, as elsewhere, the relationship between protection and development has historically been fraught with conflict. The desire for short-term economic growth and insufficient understanding of development's long-term ecological and socio-economic consequences has often led governments to promote resource development over conservation. Pro-development

policies in the absence of adequate land-use planning to balance development with conservation have resulted in large-scale impacts to ecosystems. Extreme examples include the clearing of over 85% of Canada's Carolinian forest in southwestern Ontario for agriculture and residential development (Reid 2002) and the conversion of much of Canada's native prairie to farmland (White et al. 2000). The consequences are predictable, including protected area networks of insufficient size and inappropriate location, degraded ecological and cultural integrity, and high potential for conflict because flexibility is insufficient to balance the full range of values.

In the face of environmental degradation, conservation organisations have advocated for the protection of the remnants of natural landscapes to maintain a sample of native biodiversity (Demarco and Bell 2000). Here, we interpret protection as management of a landscape with the primary objective of protecting ecological integrity and associated cultural values

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(i.e., IUCN categories I-IV; Dudley 2008). In contrast to calls from conservation organisations for increased protection, industry has focused on sustainable forest management or other forms of sustainable development (e.g., Forest Products Association of Canada 2005; Mining Association of Canada 2010; Canadian Association of Petroleum Producers 2011). Although definitions of sustainable forest management vary, the term generally refers to solutions that allow continued industrial resource development activities on the landbase, while attempting to minimise the loss of ecological integrity through improved resource management practices. The differing approaches of protection and sustainable forest management to maintaining ecological integrity result in contrasting strengths and weaknesses. Protection minimises risk to ecosystems by removing industrial impacts, but in doing so can reduce opportunities for economic development from natural resource extraction. Sustainable forest management maintains opportunities for economic development, but risks the loss of ecosystem elements and functions due to unavoidable or uncertain impacts of industrial activity. These opposing strengths and weaknesses suggest that, when sufficient intactness remains, rather than advocating for one or the other solution (i.e. protected areas versus sustainable management), a more successful strategy for conservation organisations, governments (Aboriginal, federal, and provincial), and industry should be to develop a cooperative model that balances protection and sustainable forest management on the landbase with regards to both quantity and distribution. Sustainable management can derive economic benefit at minimum ecological cost, while protected areas can maintain sensitive ecosystem components and provide insurance against uncertain impacts of sustainable management strategies. Further, both approaches can contribute to adaptive management, whereby the behaviour of managed ecosystems is compared to that of naturally functioning ecosystems (i.e., protected areas) to develop a deeper understanding of the ecosystem dynamics essential for sustainable forest management (Wiersma 2005).

An impressive example of the movement towards a more cooperative relationship between development and conservation interests is the Canadian Boreal Forest Conservation Framework (the Framework). To help facilitate a new path forward in boreal conservation, the Framework was developed and endorsed by the industrial resource companies, conservation groups, First Nations, and financial institutions that make up the Boreal Leadership Council. As part of this special section on the topic of 'the relationship between protected areas and sustainable forest management in Canada', we present the Framework as a conservation vision with broad support that calls for equal representation of the two paradigms across Canada's boreal region. Our perspective is that of participants of an initiative seeking to maintain values in Canada's boreal region in perpetuity. We contend that protection and sustainable management are distinct in their roles and, as a result, that relative abundance is the defining characteristic of their relationship. As such, we disagree with Wiersma et al.'s (This issue) belief that either sustainable forest

management or protected areas may be able to achieve a full set of values. We review recent trends in Canadian boreal land management relative to the Framework's vision, and discuss Quebec's Plan Nord as a case study. Although the area of land currently protected legislatively remains small relative to the area under sustainable forest management, we identify policy commitments to comprehensive land-use planning as a promising development. A more inclusionary approach to land-use planning, both in terms of the values considered and people involved, has the potential to achieve greater balance in the allocation of land to protection and sustainable forest management.

## CANADA'S BOREAL REGION

Canada's boreal forest region is the most ecologically intact of the planet's five remaining large 'frontier forests', harbouring an estimated 25% of the world's remaining intact forests (Aksenov 2002; Lee et al. 2003). The region supports abundant wildlife populations including billions of songbirds, millions of waterfowl and shorebirds, and the last strongholds for globally endangered species like the whooping crane (Blancher and Wells 2005; Wells and Blancher 2011). Also inhabiting the region are populations of large mammals that have been lost from much of their southern range, including caribou, bison, wolves, grizzly bears, and wolverines (Laliberte and Ripple 2004; Cardillo et al. 2006; Bradshaw et al. 2009). The region's natural capital is worth an estimated CAD 703 billion annually (Anielski and Wilson 2009) due to globally significant services such as the storage of over 200 billion tonnes of carbon (Carlson et al. 2010). These and other ecosystem goods and services are relatively unimpaired across much of the nearly 6 million sq. km region due to its high level of intactness.

Large tracts of intact boreal ecosystems remain not by design, but rather as the fortunate outcome of the boreal region being one of the last development frontiers on earth. Despite recent advances in protection, only 12.7% of the boreal region is under permanent or interim protection, a level similar to the national average of 12.2% (Lee and Cheng 2011). Loss and fragmentation of intact ecosystems is occurring as development proceeds northwards. Although northern portions of the boreal region such as the Taiga Plains ecozone are largely intact (78% of the ecozone consists of intact landscapes of 100 sq. km or larger), substantial disturbance has occurred in southern portions such as the Boreal Plains ecozone which is only 36% intact (Lee et al. 2006). Between 1990 and 2000 over 4,000 sq. km of the southern boreal forest of Saskatchewan and Manitoba and over 24,000 sq. km of the boreal forest of Quebec was disturbed by human-caused influences including forestry, road-building, hydroelectric facilities and reservoirs, and other infrastructure development (Stanojevic et al. 2006a,b). Cumulative anthropogenic disturbance in Canada's boreal region covers over 960,000 sq. km (Lee et al. 2010). Almost a third of the boreal region is tenured (leased) for forestry

(Canadian Boreal Initiative 2005), and 10,000 new oil and gas wells were drilled annually from 1999 to 2009 so that there are now over 155,000 active and 117,000 abandoned oil and gas wells (Wells et al. 2011). Eighty percent of Canada's mines occur within the boreal region (Canadian Boreal Initiative 2005), as do hundreds of hydroelectric dams (Lee et al. 2011). Clearing for agriculture is also prevalent in certain regions, such as portions of the Boreal Plains where deforestation rates can reach 1% per year (Hobson et al. 2003).

In recent years, economic, technological, and environmental shifts have made development of the boreal region increasingly feasible. This mounting pressure prompted a Canadian senate subcommittee in 1999 to describe the region as "under seige" (Subcommittee on Boreal Forest of the Standing Senate Committee on Agriculture and Forestry 1999). In addition to external stressors such as climate change, the senate subcommittee found that rapidly expanding forestry, mining, petroleum, and road development was transforming the region. Further, the senate subcommittee determined that management of these land uses was not living up to the government commitments towards sustainable management and ecosystem protection (e.g., Canada's Forest Accord and National Forest Strategies). Based on extensive research and consultation, the senate subcommittee concluded that new approaches were needed to balance conservation, traditional lifestyles, and economic development in Canada's boreal region. Among the senate subcommittee's recommendations were increased protection and adoption of sustainable management practices such as the establishment of industrial footprint thresholds. Perhaps most importantly, the senate subcommittee identified that recognition and protection of Aboriginal rights and participatory land-use planning were of fundamental importance to the region's future. In short, the senate subcommittee promoted a collaborative approach for achieving a suitable balance between sustainable management and protection in the region.

### **THE BOREAL FOREST CONSERVATION FRAMEWORK**

The senate subcommittee's report reflected a growing awareness that Canada's boreal region is a unique conservation opportunity due to its extensive intact forest landscapes and prospects for proactive land-use planning. It was against this backdrop that, in 2000, The Pew Charitable Trusts launched the International Boreal Conservation Campaign in collaboration with a number of international and Canadian conservation organisations and foundations (The Pew Charitable Trusts 2013). An early outcome of the campaign was the formation of the Canadian Boreal Initiative to act as a national convener for boreal conservation. In keeping with its mandate, one of the first actions of the Canadian Boreal Initiative was to convene the Boreal Leadership Council to develop an inclusive national conservation vision for the boreal region. The formation of the Boreal Leadership Council, and its subsequent development of the Framework, represent efforts

to replace conflict with collaboration. The Boreal Leadership Council's membership spans a range of organisations that have historically been at odds, including conservation organisations, First Nations, natural resource industry (forestry and energy), and financial institutions (Canadian Boreal Initiative 2013). While diverse, the organisations share an interest in the boreal region and a commitment to partnership in support of ecological, cultural, and economic sustainability. That commitment is expressed in the Framework, which articulates the vision that "Canada's Boreal Forest will become the world's best conserved forest ecosystem, while supporting Northern communities by developing leading sustainable management practices" (Boreal Leadership Council 2003). Supporting principles include maintaining ecological processes and intact landscapes; respecting the lands, rights, ways of life, and governance of Aboriginal peoples, and respecting their leadership role; ensuring sustainable economic benefits to Northern communities, and minimising the economic cost of environmental and social initiatives; and using scientific knowledge, traditional knowledge, and local perspectives to achieve the conservation of natural and cultural values while also adapting over time to meet changing natural conditions and evolving knowledge.

The Framework is comprehensive with respect to forest values by striving to maintain cultural, economic, and ecological values in perpetuity. As such, the Framework is consistent with Wiersma et al.'s (This issue) belief that a range of forest values can be achieved. Further, the Framework's endorsement by industry, conservation organisations, First Nations, and government is evidence that there is broad-based support for the concept of maintaining the full range of values in forest ecosystems. However, the Framework is not consistent with Wiersma et al.'s (This issue) contention that forest values may be achieved regardless of the primary management paradigm (i.e., sustainable management or protection). Rather, the Framework is explicit in identifying the distinct roles of sustainable management and protection, and the need to balance these management paradigms across boreal forest landscapes. To sustainably conserve cultural, economic, and natural values, the Framework calls for the protection of at least 50% of Canada's boreal region in a network of large interconnected protected areas, with ecosystem-based resource management practices in the remaining landscape. The role of protected areas is to "provide sufficiently intact habitat and ecological functions to ensure, in perpetuity, continued ecosystem integrity and viable and abundant fish and wildlife populations" (Boreal Leadership Council 2003). Sustainable management areas are needed to "foster healthy regional economies and communities that will receive tangible and lasting benefits from activities in their areas" (Boreal Leadership Council 2003).

### **BALANCING PROTECTION AND SUSTAINABLE MANAGEMENT**

The need for protection is consistent with the current understanding of the limits of sustainable management.

Sustainability has improved with ecosystem-based management, which attempts to reduce the ecological impacts of land use through the emulation of patterns induced by natural disturbance. However, emulation is limited by fundamental differences between land use and natural disturbance. As an example, forestry tends to reduce the abundance of late seral stands and the average age of the forest because harvest targets older stands (Kurz et al. 1998) and is additive to existing natural disturbance regimes (Didion et al. 2007). Species and ecological processes that are reliant on older forests are therefore impacted. Biotic carbon storage increases with forest age (Luyssaert et al. 2008), such that natural forests tend to store more carbon than forests managed for timber production (Kurz et al. 1998). Older forests also support more bird species than young forests, with the highest species diversity existing in forests that are older than typical rotation ages (Schieck and Song 2006). Woodland caribou is another species associated with older forests, and timber harvest can drive predation pressure beyond sustainable levels by increasing the abundance of other ungulates (e.g., moose) and subsequently of gray wolves (Vors et al. 2007). Caribou also avoid other industrial footprints including linear disturbances such as roads (Dyer et al. 2001). Indeed, access corridors are highly detrimental to ecosystems and are a ubiquitous feature of industrial development due to the need to access and transport natural resources. Roads impact ecosystems in numerous ways, including alteration of the physical and chemical environment, facilitating invasion by exotics, direct mortality (e.g., collisions with vehicles), and increasing human use (Trombulak and Frissell 2000) such as hunting, angling, and the use of recreational on and off road vehicles. Numerous recreational fisheries have declined across Canada due to over-fishing (Post et al. 2002), and the quality of fisheries has been shown to be inversely related to angler access (Sullivan 2003). Roads can further impact fish populations when culverts at stream crossings prevent fish movement, thereby fragmenting habitat (Park et al. 2008).

While the examples in the preceding paragraph are not comprehensive, they serve to demonstrate the sensitivity of boreal ecosystems to industrial development. Protection is therefore needed to maintain the ecological integrity of Canada's boreal region, and the Framework recommends the establishment of a network of large protected areas that span at least 50% of the region. The recommendation represents a substantial increase relative to existing protected area networks, but is consistent with the current conservation science. Conservation biology identifies four requirements for ecological integrity (Noss and Cooperrider 1994): 1) representation of all native ecosystem types; 2) maintaining populations of all native species in natural patterns of abundance and distribution; 3) maintaining ecological processes; and 4) maintaining resilience to environmental change. Protected-areas planning has historically failed to address this full range of requirements (Schmiegelow et al. 2006). Representation has received the most attention by protected-areas planning exercises such as the Endangered Spaces campaign of the

1990s, which sought to protect a representative network of protected areas across Canada's natural regions. Although the campaign achieved substantial gains in protected areas, its goal of increasing protection to 12% of Canada was based on political considerations rather than a scientific assessment of conservation needs (DeMarco and Bell 2000). Indeed, Soulé and Sanjayan (1998) concluded that protection of 10% of the world as natural habitat would not prevent large-scale species extinction, and Noss et al. (2012) concluded that the Nagoya target for 2020 (protection of 17% of terrestrial areas globally) is also far below what is needed to maintain ecological integrity. The inadequacy of representation alone as a guide for protected areas networks is in part due to the requirements of some species for large expanses of habitat. Inadequate size relative to species' habitat requirements makes Canada's national parks incapable of maintaining the full suite of native species (Gurd and Nudds 1999), a problem that is exacerbated by the loss of habitat from regions adjacent to parks as a consequence of land use (Wiersma and Simonson 2010). As an example, woodland caribou range has contracted as development has extended northwards (Schaefer 2003), and persistence of herds may require ranges that are not exposed to industrial development (Vors et al. 2007). However, few protected areas in the woodland caribou's range are large enough to contain entire ranges that typically span thousands of sq. km.

Maintaining ecological processes such as natural disturbance regimes and hydrologic and nutrient cycles is vitally important because they are responsible for generating and maintaining biodiversity (Noss and Cooperrider 1994), as well as providing ecosystem services to human communities. Two ecological processes, in particular, require consideration during the design of protected areas capable of maintaining naturally functioning ecosystems: fire and the hydrologic cycle (Schmiegelow et al. 2006). To incorporate the hydrologic cycle, protected areas should ideally contain intact catchments that may require areas spanning thousands of sq. km (Schindler and Lee 2010). To incorporate fire, a protected area should be large enough to contain large fires while still maintaining examples of all habitat types so as to ensure the persistence of all species (Leroux et al. 2007). Given the potential for fire sizes in boreal ecosystems to reach thousands of sq. km, incorporating fire in the design of protected areas requires very large areas. Protecting examples of naturally functioning ecosystems in the Boreal Shield of Saskatchewan is estimated to require areas ranging from 9,000 to 16,000 sq. km (Canadian BEACONS Project 2008). Further emphasising the need for large protected areas are the potential consequences of climate change. The unprecedented rate of climate change expected this century will require shifts in species' ranges, in some cases by hundreds of kilometres (McKenney et al. 2007). Species richness patterns tend to respond to environmental gradients related to temperature (Szabo et al. 2009), and maintaining connectivity across such gradients is important if the shifts are to be accommodated. Indeed, a global analysis found that restricting migration resulted in a doubling of the number of species likely

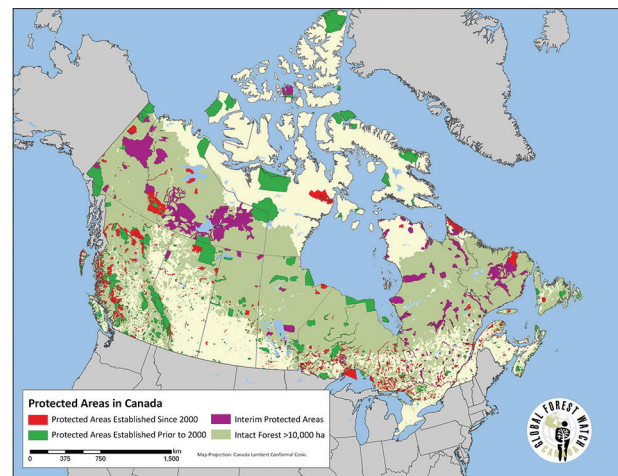


to be committed to extinction by 2050 (Thomas et al. 2004). Protecting large landscapes along climatic gradients will be important for maintaining the resilience of ecosystems to climate change (Noss 2001).

When the requirements for ecological integrity are fully considered, it is apparent that the existing protected areas networks are inadequate. A literature review of conservation targets found that evidence-based conservation targets were nearly three times higher than those reflected by policy (Svancara et al. 2005). Noss and Cooperrider's (1994) review of conservation planning initiatives determined that between 25% and 75% protection was necessary to maintain ecological integrity. Other reviews have also concluded that 50% protection is a scientifically defensible target (Schmiegelow et al. 2006; Noss et al. 2012). Conservation-planning exercises in the Canadian boreal region are consistent with the findings of these reviews. In Labrador and the Northwest Territories, for example, the inclusion of conservation-biology principles during land-use planning of largely intact boreal regions resulted in approximately equal allocation of land to protection and sustainable use (Innes and Moores 2003; Dehcho Land Use Planning Committee 2006). While ambitious, the objective of expanding the protected areas network to cover at least half of the boreal region is consistent with requirements for maintaining ecological integrity, and has been endorsed by over 1,500 scientists in a letter calling on governments to implement the Framework's vision for Canada's boreal region (International Boreal Conservation Campaign 2007).

## FRAMEWORK IMPLEMENTATION

Canada's boreal forest is one of the last regions on earth where there is potential to implement, in advance of widespread development, a network of protected areas capable of supporting ecological integrity. Implementation of the Framework's vision of Canada's boreal region as the best conserved ecosystem in the world will take time, but progress is encouraging. While still well below the Framework's objective of at least 50%, land under permanent or interim protection in Canada (Figure 1) increased from 6.6% to 12.2% between 2000 and 2010 (Lee and Cheng 2011), including several areas of sufficient size to maintain their full complement of species. Recent protection announcements include the 26,000 sq. km Tursujuq National Park in Quebec's boreal and arctic regions, a 14,000 sq. km landscape in Labrador encompassed by Mealy Mountains National Park and Eagle River Waterway Park, a 33,000 sq. km landscape in the Northwest Territories through the six-fold expansion of the Nahanni National Park Reserve, and the 8,600 sq. km Poplar River Anishinabek Traditional Territory in Manitoba through the approval of the First Nation's land-use plan which prohibits industrial resource extraction. Sustainable forest management is also improving, as demonstrated by increased certification of forestry operations by the Forest Stewardship Council (FSC). Established in the early 1990s by environmental groups, industry, Aboriginal organisations, and community groups, FSC has grown into



**Figure 1**

*Protected areas and intact forest landscapes in Canada as of 2010. Interim protected areas are areas with effective protection while negotiations and legal issues are resolved*

a global initiative to achieve consensus on sustainable forest management and promote its adoption. Canada's Boreal FSC Standard (Forest Stewardship Council Canada Working Group 2004) has been developed through a process that gives equal weight to aboriginal, environmental, economic, and social interests. To date, over 400,000 sq. km in Canada's boreal region has received or is actively pursuing FSC (M. Patel pers. comm. 2011). Perhaps more compelling than increased protection and certification are commitments to conservation through comprehensive land-use planning. The most dramatic commitments to date are those by the governments of Ontario and Quebec to protect half of the northern regions of their provinces (Ministry of Natural Resources 2010, Développement Durable, Environnement et Parcs 2011). In the Northwest Territories, a community-based process for establishing protected areas across the territory has identified over 130,000 sq. km for protection (Northwest Territories Protected Areas Strategy 2009). Our intent here is not to argue that all recent progress in boreal conservation is directly attributable to the Framework. Indeed, protected areas expansion is a global trend, with terrestrial protection increasing by almost 50% over the past two decades (IUCN and UNEP-WCMC 2012). We do, however, contend that the Framework has helped in catalysing action over the past decade by fostering a common vision for Canada's boreal region. At the same time, it must be emphasised that conservation gains—and, in fact, the existence of the Framework itself—reflect the interests and efforts of Aboriginal, provincial, and federal governments, conservation organisations, and companies.

The geographical scope of the Framework is vast, spanning the nearly six million sq. km covered by Canada's boreal and taiga ecozones—Boreal and Taiga Plains, Boreal and Taiga Shield, Boreal and Taiga Cordillera, and Hudson Plains. The Framework explicitly recognises that conservation challenges and opportunities will vary across this diverse region depending on factors such as industrial allocations

and the state of land-use planning. As such, the Framework is best seen as a national vision rather than a rigid formula that is expected to be immediately followed across jurisdictions. Indeed, many of the examples of conservation gains cited above are from intact boreal landscapes where potential conflict with ongoing or planned development is currently relatively limited. Large-scale increases in protection within lands with an industrial presence is not straight-forward, and associated challenges such as negotiating the release of resource rights held by industry emphasise the importance of establishing a comprehensive protected areas network prior to issuing tenure. However, even within boreal regions with substantial industrial presence, ambitious land-use planning efforts are emerging. In northeastern Alberta, home to the second largest oil deposit in the world, a land-use planning process is calling for expansion of the protected areas network to 22% of the landscape (Land-use Framework 2012).

Additional evidence of a newly evolving paradigm is the Canadian Boreal Forest Agreement, whereby forestry companies and conservation organisations have committed to collaborate towards a more competitive forest industry and a better protected, more sustainably managed boreal forest (Canadian Boreal Forest Agreement 2010). Applying to more than 720,000 sq. km, the agreement seeks to expand protection, improve conservation of species at risk, implement world-leading sustainable forest management practices, mitigate climate change impacts, improve the prosperity of the forest sector, and achieve recognition in the marketplace for environmental performance. Although promising conceptually, progress towards the agreement's goals has been challenging. One conservation organisation recently withdrew from the agreement citing a lack of progress and alleging one company's violation of its commitment to defer logging in caribou habitat (Greenpeace Canada 2012). Despite these setbacks, other signatories remain committed to working towards the successful implementation of the agreement, and there are some signs of progress. Methodological frameworks have been established to guide protected areas planning and caribou conservation, and the ability to achieve real conservation benefits was demonstrated in 2012 by a joint proposal to government to set aside 8,000 sq. km of caribou habitat in northern Ontario from harvest.

Progress towards the Framework's vision has been strengthened by collaborative planning for the maintenance of the full range of values provided by forest ecosystems. We believe that this commitment to collaboration, including acknowledgement of the legitimacy of all parties' values, is the key to resolving conflict between protection and sustainable forest management. While we agree with Wiersma et al. (This issue) that conflict between protection and development interests is more likely when neighbouring parcels of land have contrasting levels of disturbance, we believe that comprehensive land-use planning is the more important requirement for resolving or avoiding conflict. The existence of contrasting levels of disturbance (i.e., from protection to intensive developments such as mining or agriculture) may

actually support achievement of the full range of ecological, economic, and cultural values, when viewed at the regional scale in the presence of careful planning (Phalan et al. 2011). Fortunately, the intactness of Canada's boreal region provides unparalleled opportunities for comprehensive land-use planning. Development trajectories from elsewhere indicate that these opportunities are time sensitive, however, and achievement of the Framework's vision depends on fostering cooperative planning processes to guide a balance between protection and development. Quebec's Plan Nord is now discussed as an example of progress towards a collaborative and balanced approach to conservation.

### A CASE STUDY: PLAN NORD

Quebec's boreal forest spans 1.2 million sq. km, accounting for 21% of Canada's boreal region. Given its scale and intactness, it is not surprising that the region supports globally significant ecological values including storage of 31 billion tonnes of biotic carbon, 25% of North America's most pristine rivers, breeding grounds for 180 bird species, and among the world's most significant herds of barren ground caribou (International Boreal Conservation Campaign 2010). Northern Quebec is also rich in natural resources including minerals, hydroelectric potential, and timber, and development is expected to increase. The Quebec government has expressed its desire for socially responsible and sustainable development in the region, and has established the 'Plan Nord', a planning process to support this goal. As expressed by then premier Jean Charest in 2008 (Parti Libéral du Québec 2008):

[W]e are strongly affirming our desire and intention to equate development of the North with the creation of a truly sustainable development space. From now on, economic development and protection of the environment will be synonymous in Quebec's North. It is my hope that other northern populations will look at us and say: 'Let's follow Quebec's example!'

A key component of the government's commitment to sustainability is excluding industrial development from at least 50% of northern Quebec. The pledge was applauded by conservation groups throughout North America and endorsed by over 500 scientists that encouraged the government to follow through on its commitment (Canadian Boreal Initiative 2009). The government intends to realise its conservation goal by increasing internationally recognised protected areas coverage from 8% to 20% by 2020, and establishing areas that exclude all industrial activity from an additional 30% of the region by 2035 (Développement Durable, Environnement et Parcs 2012).

Northern Quebec's high level of intactness provides the planning flexibility to establish a comprehensive protected area network while maintaining substantial opportunities for economic development. This opportunity for balance likely explains why conservation commitments at the scale of Plan Nord are largely unheard of outside of Canada's boreal

region. In most regions, the ability to plan in advance of or, at least parallel to, development has long since vanished, and establishment of a comprehensive protected area network would therefore require curtailing existing industrial activity. Growing recognition of the need to balance development and conservation, combined with a high level of intactness, make northern Quebec and the rest of Canada's boreal region perhaps the best opportunity globally for maintaining the full range of ecological, economic, and cultural values supported by forest ecosystems in perpetuity.

Realising the conservation potential of Plan Nord is contingent upon the establishment of an open, balanced, and proactive planning process. Initially, a so-called 'mirror approach' was proposed for conservation planning, whereby for each area of land used for industrial purposes, an area of equivalent size and quality would be dedicated to non-industrial activity (Corbeil 2010; George 2010). It is unlikely that such a reactive process driven by industrial land-use decisions could establish a protected area network capable of maintaining ecological integrity, especially large protected areas needed to support naturally functioning ecosystems and the full range of species. The opportunity for establishing large protected areas is now, while intactness is high; attempts to create large protected areas in the future through the mirror approach would be frustrated by ongoing fragmentation of wilderness.

Fortunately, legislation (Bill 65) introduced to guide conservation and sustainable development under Plan Nord replaced the mirror approach with ecological planning (National Assembly 2012). Ecological planning is intended to explicitly incorporate conservation objectives in the land-use planning process, thereby providing an approach better suited to address the challenge of proactive and balanced planning. An important role of ecological planning will be to identify which lands are of interest for protection, based on knowledge of ecological values and their sensitivity to development. Bill 65 indicates that ecological planning is to involve Aboriginal communities, as well as regional and local authorities. To incorporate cultural values and local knowledge, and identify an appropriate balance between development and protection, it is essential that conservation decisions be driven by comprehensive land-use planning that respects the leadership role of Aboriginal people in achieving conservation and development goals in their traditional lands. Details of the planning process are yet to be established and Bill 65 has not yet received assent, but it is encouraging that the Government of Quebec appears committed to a collaborative approach. Following the Quebec general election in 2012, the new Premier of Quebec, Pauline Marois, affirmed that development in northern Quebec will be in collaboration with northern populations, including Aboriginal and Inuit, and that at least 50% of the region will be protected (The Pew Charitable Trusts 2012).

Plan Nord is not without controversy, and the challenges it has encountered are typical of challenges associated with implementing the Framework. Plan Nord has been accused of

promoting an industrial development agenda under the guise of conservation (e.g., Nature Quebec 2012). This concern is understandable, given the large-scale expansion of northern resource development called for by the plan including 3,000 MW of hydroelectric development, numerous mines, and investments surpassing CAD 80 billion (Gouvernement du Québec 2012). Given international demand for resources, governments' need for revenue, and societal appetite for economic growth, pressure to develop northern natural resources is likely to increase through time. The Plan Nord, like the Framework, takes the pragmatic position of accepting that resource development expansion will occur but that planning can ensure that the impending development proceeds in a fashion that does not sacrifice ecological integrity. However, a risk associated with promoting the Framework's vision of balance between protection and development is that it could be used to garner support for the industrialisation of previously intact landscapes. This risk is most pronounced if development proceeds ahead of conservation, because options for implementing a protected areas network capable of maintaining ecological integrity will diminish as intactness is lost. The viability of Plan Nord from a conservation perspective rests on the establishment of a comprehensive protected areas network that accounts for at least half of the region.

To help maintain focus on conservation objectives as Plan Nord moves forward, the Pew Charitable Trusts and the Canadian Boreal Initiative partnered with the Government of Quebec to host a scientific symposium in the spring of 2012 to identify criteria for the successful implementation of ecological planning. The importance of Aboriginal engagement was an important message from participants, not only to respect legal obligations but also to ensure that Aboriginal expertise is applied. Participants identified ecological knowledge as a deficiency that must be addressed through collection of new data, improved data accessibility, and application of traditional ecological knowledge. The conservation matrix model (Schmiegelow et al. 2006) was recommended by participants as a model to follow during planning, whereby decisions focus not on how much protection is enough but rather how much development is too much. An important component of the conservation matrix model is proactive establishment of a comprehensive network of protected areas anchored by large areas of sufficient size to act as ecological benchmarks when assessing the consequences of industrial development. Participants emphasised that the diversity of the region encompassing Plan Nord necessitates that protected areas be dispersed across northern Quebec. Given the enormous ecological planning task facing Plan Nord, and the pressure to develop natural resources, participants also recommended that ecological planning initially focus on areas where development pressure is highest to ensure that conservation decisions are made in advance of widespread development.

Early indications of the Government of Quebec's commitment to conservation are promising. Based on recommendations received during consultations, Plan Nord guidelines were revised to incorporate commitments to expand protection to



20% by 2020 (and 50% by 2035), establish pilot projects to improve ecological knowledge, and initiate ecological planning by 2013. In response to concerns expressed at the symposium, the Government clarified that mineral exploration and logging are considered industrial activities under Plan Nord and therefore will be excluded from at least 50% of the Plan Nord along with other forms of industrial resource development. The government's willingness to implement new protected areas was demonstrated in late 2012 when the 26,000 sq. km Tursujuq National Park was created. Also encouraging is an agreement between the Government of Quebec and the Crees of the Eeyou Istchee James Bay territory. The agreement provides the Cree with decision-making powers with respect to land use, thereby charting the course for an inclusive planning process. Similar agreements with other Aboriginal governments in the region is a prerequisite for the success of Plan Nord, as is the establishment of comprehensive protected areas networks ahead of widespread development. It is hoped that recent progress towards these goals continues.

## CONCLUSION

Sustainable management and protected areas are related but distinct, with one emphasising resource production and the other the maintenance of ecological and cultural integrity. Due to their differing roles, the distribution of land between the two management paradigms influences the range of values supported by forests. Indeed, we contend that the proportion of the landscape allocated to each paradigm is the defining characteristic of the relationship between protection and sustainable management. At present, the relationship is imbalanced with protected areas accounting for a small portion of the forest landbase. As a consequence, forest management in Canada has historically traded off ecological values in favour of resource production. For much of northern Canada, however, the relationship between development and protection is still a work in progress. The relative intactness of northern forests provides Canadians with the opportunity to consider the desired future condition of boreal forests, and then allocate land to development and protection accordingly. It is an opportunity that comes but once, and one that should be informed by analysis and reflection. Discourse across diverse perspectives is needed to ensure that land-use decisions are consistent with Canadians' collective vision for their forests.

To summarise our perspective on the relationship between sustainable management and protected areas, we conclude by addressing four features identified in the introductory article: values; framework; criteria for success; and future vision. We believe that the full range of ecological, cultural, and economic values provided by Canada's forests are important and deserve careful stewardship to ensure their persistence in perpetuity. Due to this belief, we suggest that a framework for the relationship between protection and sustainable management must be characterised by balance. Emphasis of one management paradigm to the detriment of the other will result in the degradation of ecological, cultural, or economic values. The

Boreal Forest Conservation Framework proposes a balanced relationship between protection and development that allocates land approximately equally between the two management paradigms. The validity of this approach is supported by conservation science, and its fairness is confirmed by support from industry, conservation, and Aboriginal organisations. Indeed, implementation of a balanced approach requires engagement of the full range of interests and perspectives. The key criterion for success is therefore comprehensive land-use planning to establish inclusive objectives and identify land-use strategies capable of achieving the objectives for decades to come. Meaningful collaboration through land-use planning can ensure that sustainable management and protected areas strategies are consistent with all parties' values, thereby forging a cooperative rather than conflictual relationship between the management paradigms. The Framework's vision of Canada's boreal region becoming the world's best conserved forest ecosystem while also supporting northern communities through sustainable management is representative of the cooperative relationship that we hope will come to define forest stewardship in Canada.

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