REGIONAL FORUM IV

16 Forests in North America: Responding to Social, Economic and Ecological Pressures

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Abstract: Forests are of great importance to the peoples and economies of Canada, the United States and Mexico. Over the past two decades or so, forest values and practices have evolved to encompass economic, environmental, social and cultural considerations. As a result, sustainable forest management and/or ecosystem management have emerged in North America as a new paradigm. The meaning of the paradigm shift differs somewhat among the three countries. In Mexico, sustainable forestry has led to a stronger emphasis on rural development and equitable benefit distribution. In Canada and the US, a higher level of economic development has led to a more exclusive focus on the environment; increases in wealth, education and life expectancy in these two countries have led to greater demands for a wide array of environmental services from forests. Significant changes have also taken place in forest policies and governance arrangements of the three countries. The reasons for this have been changing government priorities; the influence of forest interest groups; new knowledge about natural disturbances, climate change and dynamics at the forest landscape level; as well as the influence of global initiatives with respect to forest practices. Different management models and approaches have emerged for the purposes of diversifying livelihoods in the case of non-timber forest products, and promoting forest products trade in the case of implementing various forest certification vehicles. The chapter describes these changes and new trends, with six illustrative case studies highlighting important issues.

Keywords: Ecosystem approach; forest products trade; model forest; paradigm shift; sustainable forest management; non-timber forest products; policy; land tenure; climate change; certification; North America.

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16.1 Introduction

North American forest management and its underlying science have developed from a focus on relatively simple harvest and regeneration issues (fiber provision), through multiple use management, to the current paradigm(s) of sustainable forest management and/or ecosystem management. While these are contested and interrelated concepts, those championing ecosystem management tend to emphasize environmental problems, while those championing SFM balance environmental protection with explicitly emphasized socio-economic considerations in the approach to forest management deliberations. Drawing on the Brundtland Commission's often cited approach to sustainable development (World Commission on Environment and Development 1987), Wilson and Wang (1999) have defined sustainable forestry as encompassing "…a host of management regimes designed to maintain and enhance the long-

term health and integrity of forest ecosystems and forest-dependent communities, while providing ecological, social and cultural opportunities for the benefit of present and future generations".

We propose that changes in forestry are responses to changes in societal values and/or to serious failures in the historic fiber provision paradigm. The shift is very different among the three countries in North America, and the institutional setting is unique in each country. Tenure arrangements for forests that are dominant in Mexico are the topic of our first case study (Box 16.1). The drivers behind changes toward SFM are highlighted by the next two case studies, on shifting forest values (Box 16.2) and the problems created by a massive insect epidemic in western Canada (Box 16.3). We examine some key aspects of this paradigm shift, focusing on changes in forest management, and the impacts of these changes within the three countries. A key environmental issue, and the institutions to cope with it across North America, is climate change, the focus of the next case study (Box 16.4). The review uncovers important trends, including the increased role of privately owned plantation forests for timber supply in the US, accompanied by a greater focus on ecosystem management on US national forest lands; a growing emphasis on practicing SFM through innovative approaches, such as experimentation with "Model Forests" and forest certification (Box 16.6); and popularization of decentralized and participatory governance approaches that stress the role of forestry for enhancing rural livelihoods in Mexico. There is also an increasing recognition of the values of traditional knowledge and non-timber forest products in all three North American countries. The role of non-timber products is the subject of the case study in Box 16.5.

16.2 An Overview of Forestry in North America

Forest Ownership Patterns

Canada, the United States (US) and Mexico have different ownership arrangements and governance structures for forestlands. In Canada the forests are primarily publicly owned (Table 1), and private companies access fiber through a variety of licensing arrangements with provincial governments. Exceptions are found in the eastern provinces of Nova Scotia and New Brunswick, where private ownership of forestland is 68% and 50% respectively. Typically, Canadian tenure arrangements allow licensees either exclusive access to a defined area (area-based tenures) or a specified volume allotment within a larger management area (volume-based tenures). Stumpage fees on harvested timber are paid to provincial governments, with timber pricing methodologies varying across provinces. Such arrangements allow for public control of various aspects of forest management, typically "command and control", achieved through the use of regulations. Future access to fiber depends upon a licensee meeting a suite of defined obligations. Other important features of forestry in Canada include long rotations and generally extensive forest management regimes, especially in Canada's vast boreal forest. These factors help to explain why Canada harvests approximately 42% of the volume harvested in the US each year, despite Canada's having 20% more timberland than the US.

About 57% of US forestlands are publicly owned, including 33% under federal ownership. However, today national forestlands are not important for industrial forestry. The harvest from US Forest Service property, which accounts for the majority of federal

Table 1. Forest land base and harvest in North America

Country	Ownership				Total
	Public	Common property	Private: Industry	Private: Non-Industrial	
United States (2002):					
Forestland (1000 ha)	129 158	n.a.	26 863	147 053	303 074
Timberland (1000 ha)	59 601		26 545	117 625	203 772
US harvest (mill. m^3)	36.3	n.a.	131.6	284.2	452.1
Canada (2001):					
Forestland (1000 ha)	374 844	n.a.	4 012	20 630	401 530
Timberland (1000 ha)	220 039		3 858	18 616	242 513
Canadian harvest (mill. m^3)					192.1
Mexico (2001):					
Forestland (1000 ha)	2 770	44 240	8 300		55 300
Mexican harvest (mill. m^3)					41.3[a]

[a] It should be noted that 32 million m^3 of this, or 77% is for fuelwood.
(CCFM 2004; Ghilardi et al. 2004; Smith et al. 2004)

BOX 16.1 Common Property Land Holdings in Mexican Forestry

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The Mexican Constitution (1917) defines different types of land property: a) social property, including ejidos and communities, and b) private property. Ejido is a land granted by the federal government to a group of people called "ejidatarios" who have the right to use the land. Communal property is based on the historical rights of the pre-Hispanic indigenous communities that have maintained their traditional structure.

Ejidos and communities hold about 80% of the total forestland in Mexico (Banco Mundial 1995), including an estimated 7200 indigenous ejidos and communities with 12 million people. In 50% of forest ejidos, at least 9% of the ejidatarios are indigenous (Banco Mundial 1995). The most important ethnic groups are: Tepehuanes and Tarahumaras in Northern Mexico; Tarascos and Otomies in Central Mexico; Zapotecas, Chinantecas and Zoques in Oaxaca; and Mayas in southeastern Mexico. Most of these people live in poor conditions with limited employment opportunities (Mota 2002).

Although in Mexico forest and water issues are on the national priority list, and the federal government has exhibited high confidence in rural communities, community forestry has not been a political priority. This has restricted the forest ejidos' and communities' development. However, the current new strategies in forest policy, such as the "Ley General de Desarrollo Forestal Sustentable" (General Sustainable Development Law), and the Strategic Forest Program for Mexico 2025, recognize the importance of community forestry development (SEMARNAT-CONAFOR 2001; Congreso de la Unión 2003).

The Ley Agraria of 1992 (Congreso de la Unión 1992) established the official organizational structure of forest ejidos and communities. Ejidos have three authority levels: "asamblea" (assembly) that represents the highest authority and is elected by the ejidatarios, "comisariado ejidal" (commisioner), and "consejo de vigilancia" (vigilance council). Communities have two authority levels: the "asamblea general de comuneros" (general assembly of commune) and the "comisariado de bienes comunales" (commisioner of community holdings) (Congreso de la Unión 1992). However, a wide variety of internal organization for decision-making exists, and depending on the differences in social organization and cultural circumstances, forest use patterns vary from one place to another. Usually ejidos are the lowest administrative units in the official structure (CESPEDES-CEMDA 2002).

Approximately 25% of the forest ejidos and communities sell only growing stock, 50% harvest and sell logs, and the final 25% are involved in both harvesting and processing logs into forest products (INDUFOR 2000). Although timber production has been the main objective of forest management, forest ejidos and communities have maintained multiple resource use, and are increasing their emphasis on economic diversification and forest ecosystem conservation projects related to environmental services. Community forestry development is gaining momentum and around 50% of the certified community forestland in the world is in Mexico (Bray and Merino 2004).

Most forest ejidos and communities sell their products in domestic markets. However, economic globalization has affected the commercialization process by exposing the markets for cheaper imported products (Mota 2002; Bray and Merino 2004). It is also important to mention that, in general, ejidos distribute profits among the "ejidatarios". Therefore, most of the ejidos do not reinvest their profits in forest management, or in industrial infrastructure. As a result, they do not have enough economic resources for improving the social, economic and environmental conditions.

In conclusion, forest ejidos and communities are facing important challenges in their future development because of economic globalization, industrialization, commercialization, and lack of organization for forest resource management and administration. Because of these factors, ejidos and communities need to be more efficient and effective in planning, implementation and evaluation of development plans and programs in order to become more competitive and improve their social and economic conditions. In the meantime, it is necessary to consolidate the development process by supporting production forestry and by advancing sustainable development.

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timber harvest, has fallen approximately 70% since 1987. Most of the harvest reduction on federal lands can be traced to administrative appeals (O'Laughlin 2004) and litigation over efforts to protect the Northern Spotted Owl (Yaffee 1994), which eventually culminated in the adoption of "ecosystem management" in which environmental considerations were paramount, dominating social and/or economic concerns. Commercial forestry in the US is primarily practiced on private forestland, with most of these lands owned by non-industrial landowners. Non-industrial landowners harvest 60% of the US total. Summary information on the forestland base in North America is shown in Table 1.

The forests of Mexico have two main characteristics: first, they have the most pine (72) and oak (130) species in the world; and second, 80% of the total forest area is common property land (ejidos and comunidades forestales) and only 15% is privately and 5% publicly owned (see Box 16.1 for a description of Mexican forest ownership). Pine and oak are the main harvestable species, with 79.6% and 9.7%

of the harvest respectively. High diversity of species makes biodiversity concerns important.

In the Mexican forest industry, the sawmill sector is the most important, representing 60% of the total established industry. In 2000, the sawmill industry represented 69.3% (6.5 million m^3) of the total forest production, the cellulose 18.3% (1.7 million m^3) and the plywood and charcoal, among others, 12.4% (1.2 million m^3). The largest portion of the timber harvest in Mexico is for fuelwood, which totaled 32 million m^3 for 2000 (Ghilardi et al. 2004).

Industrial Forest Production and Trade

The traditional forest industries in North America provide considerable economic benefit to the people in all three countries. Canadian forest products shipments for 2002 totaled CAD 66 billion (USD 42 billion) with 48% from wood products (including panels) and 52% from the pulp and paper sector (Industry Canada 2005). US production (2002) totaled USD 240 billion, with 37% attributable to wood products and 63% pulp and paper (US Census Bureau 2005). Forest products trade between Canada and the US is the largest in the world, with US market access the key to the continued strength of the Canadian forest sector. Canada exports 70% (of volume) of its total softwood lumber production, and 90% of that goes to the US market. Mexico's total timber production reaches only about two and five percent of the US's and Canada's production volumes respectively. Of the timber consumed in Mexico, 58% is from domestic sources (SNIF 2001), rendering Mexico, along with the US, a net-importer of timber.

Access to the US market for Canadian lumber has been impeded by a series of tariffs and quotas over the past 20 years (Cashore 1998), even though numerous recent studies show that the largest cost of such policies is borne by US consumers (Zhang 2001; van Kooten 2002; Stennes and Wilson 2004). This relationship, with the US making demands on how timber is allocated and priced in Canada, has major implications for forest management in Canada. In addition to Canada's timber pricing policies other issues, such as cut control and raw log export bans, have induced the US to launch trade measures against Canadian lumber. US market access considerations must now be included in many Canadian domestic policy decisions; otherwise they may result in additional trade actions by the US.

Employment

Although the US is the largest producer of forest products, forestry plays a relatively more important role in the economy of Canada. This is especially true in the west; in British Columbia (BC) alone, forestry directly employs 90 000 people, or 4.5% of the total workforce. In some US regions, most notably the South, forestry is also relatively more important as a source of economic activity. Many of these jobs are in rural forest dependent communities with little alternative employment. Overall, forestry in Canada directly employs 310 000 people or 1.8% of the total employment, while in the US direct forestry employment is approximately 1.2 million (less than 1% of US jobs). In addition to these direct employees, there are many more indirect and induced jobs (jobs associated with additional spending by either forest industries or workers), as well as jobs in both the consumptive and non-consumptive non-timber forest product sectors.

In Mexico, the forest sector represents only 1.1% of the gross national product (GNP) (SNIF 2001), and overall in the year 2000, forestry employed directly 216 200 or 0.64% of the total registered employment (INEGI 2004). However, as in Canada and the US, in Mexico there are many indirect (and non-registered) forest sector jobs.

16.3 Shifts in the Forest Management Paradigm

Over the past two decades or so, changes in societal values and priorities regarding natural resources and the way these resources are managed have led to significant shifts in the way that forest management decisions are made and communicated. The phrase "sustainable forest management", or SFM, is increasingly used to describe forestry that sustains economic, social and environmental benefits over the long term. SFM has emerged as a highly contested normative concept, and there is considerable debate regarding what forest practices best deserve the SFM label. To varying degrees, forest values and practices are evolving to encompass economic, environmental, social and cultural considerations. In many jurisdictions across North America, SFM is becoming an explicit forest policy goal, and similar means are used to achieve it.

While debates continue over the nature and degree of change required to achieve SFM, policy-makers across North America have developed a number of similar strategies. One of these is the promotion of adaptive management as a tool for sustaining biodiversity. The key feature of adaptive management is that managers must accept that they lack full understanding of ecosystem function, and have to adjust their management plans when the outcomes of these plans become better understood. An example of this is the Northwest Forest Plan (USDA 1997), which explicitly designates 10 Adaptive Management Areas.

Debates over the meaning of SFM differ somewhat among the three countries covered in this chapter. In Mexico, the presence of a large rural population dependent on subsistence farming and primary production, has arguably led to a stronger emphasis

on rural development and equitable benefit sharing as critical components of sustainable forestry. In fact, the largest single use of wood in Mexico is for fuelwood with approximately 25% of the Mexican population cooking with fuelwood, either alone or in combination with other fuels (Ghilardi et al. 2004).

In Canada and the US, in contrast, a higher level of economic development has perhaps led to a more exclusive focus on the environment. In fact, theorists have argued that increases in wealth, education and life expectancy (increased average age) in these countries have led to greater demands for a wide array of environmental services from forests (Adamowitcz 2002). These changing societal preferences, and the valuing of a wider range of goods and services from the forest, have been identified as important drivers of the paradigm shift toward SFM (See second case study in Box 16.2).

16.4 Changing Forest Policies

While numerous forestry interest groups have professed similar attitudes towards forest management, major disagreements remain regarding the appropriate means to promote the goal of "sustainable" forestry. These disagreements have often been accompanied, and arguably compounded, by a lack of trust between those holding conflicting views (McDermott 2003). Perhaps stemming from this lack of trust, many environmentalists in North America have pushed for more restrictive or "stringent" forestry laws that protect the environment while strictly limiting forest manager discretion. Many forest managers, on the other hand, have argued that such a "straightjacket" approach runs counter to the principles of adaptive management and sustainable forestry. The following brief review of trends in forest policy in the three North American countries illustrates some of the push and pull between different policy approaches for promoting more "sustainable" forest practices.

In the western US states and Canadian provinces, in particular, public demands have led to more of the forestland base being protected from commercial forest activity. On the US side, this has resulted in a near complete cessation of commercial timber harvests on federal lands. As the demand for timber resources remains at historic highs in the US, this has resulted in pressure to increase harvests on private lands, with the South becoming the dominant timber supplier in the US. The US is home to the largest area of commercial timber plantations in the world, with a total area of approximately 18 million ha, the vast majority in the US South (Brown 2000).

Forest policies are likewise dramatically different on US national forestlands than they are in the US Southeast. Cashore and McDermott's (2004) comparison of forest policies in twenty countries worldwide across a range of key environmental forest practice indicators, revealed stark contrasts between the mandatory and prescriptive rules governing US Forest Service lands and the voluntary Best Management Practices applied to private lands in nine top producing US Southeast states. For example, the study found that on US Forest Service lands, streams of all sizes were protected by larger mandatory no harvest buffer zones than those found in any of the US states or Canadian provinces under review. US national forestland regulations were also among the most stringent for clear-cutting, road building, reforestation, cut calculations, and the protection of endangered species (Cashore and McDermott 2004). Policies also vary significantly between state regulation of forest practices in the west coast states of Oregon, Washington, and California, where regulations regarding clear-cutting and riparian zone protection are similar to forest regulation enacted in British Columbia (BC) in the 1990s, placing these states as less stringent than federal lands regulations, but significantly more stringent than states in the US southeast.

There is considerable disagreement among US forestry interests, however, regarding the appropriateness of forest policies governing national forest lands. A number of major environmental groups have pushed for an end to all commercial harvests in US national forests. In contrast, some foresters and scientists have argued that, even given environmental protection as the sole objective of national forest management, the rigidity of existing forest management rules has served to undermine forest health.

For example, it has been argued that the very high fire risk currently facing forests in the western US can be directly attributed to the lack of removals on US federal lands (USFS), in combination with years of fire suppression and a prolonged drought. Although there has not been a move back to active forest harvests on USFS lands, the Forest Service has expressed keen interest in forest-health based thinning regimes. In response, President George W. Bush announced in August 2002 a new initiative called "Healthy Forests", which highlights the role of silviculture, with an emphasis on thinning, in wildfire management on federal forestlands. This so-called "Bush Plan" came into being, in the wake of one of the worst summer wildfire seasons in US history, during which some 2.5 million ha of forests burned. In December 2003, President Bush signed the Healthy Forest Restoration Act, billed as a means to prevent catastrophic wildfires. The Act, meanwhile, has generated considerable controversy among those opposed to logging in national forests.

While the debate over logging on US public lands continues, rules governing the ownership of the country's most productive timberlands, i.e. private forestlands in the Southeast, have remained among the least restrictive of those found in top forest product producing countries worldwide (Cashore and McDermott 2004). This stark dichotomy suggests

BOX 16.2 MULTIPLE VALUES AND FOREST MANAGEMENT IN THE US AND CANADA

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Continuous interactions between human values and beliefs and the surrounding social, economic, cultural, legal, and ecological environment contribute to the dynamic nature of human values, including forest values – shared notions of what is good or desirable about forests and forest ecosystems. In recent decades, forest values have undergone a dramatic transformation in North America, shifting in relative importance and expanding in number. A growing proportion of the general population and diverse groups of people in the US and Canada view forests as a means to enhance quality of life (e.g. aesthetic, recreational, spiritual, cultural, and heritage values) and ecological services (e.g. carbon sequestration, absorption of pollutants, and soil conservation) rather than as a source of commodities. These changing perspectives are occurring across different regions, and for public and private forests.

Social scientists have developed numerous classification systems for forest values. Three common classifications are: (i) assigned values and held values; (ii) instrumental values and non-instrumental values; and (iii) bio-centric values and anthropocentric values. Assigned values provide a measure of the relative importance of forest objects, while held values specify what is considered good (or bad) related to forests. The instrumental value of a forest arises from its utility as a means to specific ends, while the non-instrumental value focuses on the worth of a forest as an end in itself. Similarly, bio-centric values emphasize the importance of protecting the environment and promoting ecological goals, and anthropocentric values emphasize human uses and benefits.

Steel et al. (1994) found that the US population is more bio-centric in orientation than anthropocentric. Bengston et al. (2004), when examining the trends (1980–2001) in forest value orientations in the US, found an increasing share of bio-centric values and a decreasing share of anthropocentric values. Manning et al. (1999) found that Vermont (US) residents rated aesthetic and ecological values as most important and economic values as least important. In a survey of thirteen southern states of the US, Tarrant et al. (2002) found: (i) for public forests, commodity value (wood production) was rated least important, ecological service (air quality) most important, and scenic beauty and cultural and natural landscape (both bio-centric values) were rated second and third most important, respectively; (ii) for private forests, air quality was ranked first, followed by scenic beauty, wood production, and cultural and natural landscape; (iii) the younger generation (age 16 to 24 years) valued scenic beauty significantly more than the oldest generation (50+ years) for both public and private forests; (iii) women valued public forests for scenic beauty significantly more than men and men valued private forests for wood production significantly more than women; and (iv) rural residents rated scenic beauty as a more important objective for public forests than did near-urban residents.

McFarlane and Boxall (2000), in a survey of the public, environmentalists, registered professional foresters (RPFs), and forest-industry public advisory groups (PAGs) in Alberta, Canada, found: (i) the public and environmentalists placed higher importance on bio-centric values (existence values, inherent worth, and spiritual values) than that of the RPF and PAG groups; (ii) the RPF and PAG groups placed higher importance on anthropocentric values than that of the public and environmentalists; and (iii) in the total sample, 25.7% of the respondents belonged to the anthropocentric group, 31.8% to the bio-centric group, and 42.4% to an intermediate, moderate group. Hunt and McFarlane (2002) found that the general public of southern as well as northern Ontario ranked bio-centric values higher than anthropocentric values. In a survey of four groups – forest industry, environmental groups, Aboriginal people, and Ministry of Natural Resources (MNR) professionals in north-western Ontario, Lee and Kant (2003) found that all the groups ranked bio-centric values (environmental, spiritual, and recreation) either first or second, and all the groups ranked most of the anthropocentric values (uses and tourism) lower than these bio-centric values. Aboriginal people ranked Aboriginal values first, while all other groups ranked Aboriginal values last. However, in Canada, Aboriginal values have gained considerable importance during the last decade (Myre 1998).

that other social values, such as conceptions of private property rights, may exert profound influences on people's views of forests and their appropriate management.

In Canada, changing societal values have led to both changing forest management and an increased interest in protected areas. This is particularly pronounced in BC, which announced the Protected Areas Strategy in 1993, with the goal of doubling the province's protected areas to 12% by the year 2000. In fact, protected areas now represent 13% of the province's total land base. In addition to expanding its protected areas, BC has also developed more restrictive regulations governing the remainder of its public forestlands. In 1995 BC enacted a new Forest Practices Code, which included extensive forest planning requirements, as well as detailed forest practice prescriptions. According to Cashore and McDermott's (2004) above-mentioned global forest policy study, BC and other top producing Canadian provinces ranked among the highest of the twenty case countries in terms of the "stringency" (i.e. prescriptiveness) of their approach to key environmental forest policy indicators.

BC forest policy, however, has more recently moved away from a purely prescriptive approach to environmental protection. Around the same time that the "Bush Plan" has granted US Forest Service managers greater discretionary authority, BC has recently introduced a "results-based" forest practices code that entails fewer planning requirements and a generally more decentralized approach to regulating forest practices. The former Forest Practices Code had been criticized as overly costly and bureaucratic, with a heavy emphasis on written documentation (Wilson et al. 1998). The new Forest Range and Practices Act (2004), in contrast, has been billed as a means to more effectively and efficiently target on-the-ground "results" of forestry practices. Similar to environmentalist reactions in the US, many BC environmentalists have opposed the imposition of more flexible forest management rules.

In Mexico, as in the US and Canada, forest policy makers consider sustainable forestry as a priority for

The shift in forest values in the US and Canada, from anthropocentric to bio-centric values, has been attributed to a post-industrial society in which higher order needs for self-development and self-actualization override subsistence needs that are satisfied through material acquisition (Steel and Lovrich 1997). However, the ecological values of forests have grown as scientific understanding of the functions and dynamics of forest ecosystems has increased. Similarly, Aboriginal values of forests have become prominent due to many court decisions in Canada, international recognition of Aboriginal and treaty rights, and consumer preferences in other countries for certified forest products.

In democratic societies, public lands are managed with the tacit consent of the citizenry, and private forestlands are also not immune to public preferences. In market-based economies, firms and private forestland managers must also be responsive to changing public values, especially values expressed through consumer preferences. Hence, all the associated sectors – governments, forest industry, and private woodlot owners – have responded to the changing forest values by developing new approaches to forest management beginning in the late 1980s and early 1990s. Some of the main new approaches include ecosystem based forest management, forest certification, forest management partnerships, and statutory requirements for public input into forest management. These new management approaches are a response to new goals for forest management that have arisen as a result of changing forest values in the US and Canada.

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national development. Mexico's Natural Resource and Environmental Secretary (SEMARNAT) was formed for the primary purposes of formulating a national forest policy for sustainable forestry development, and regulating and controlling forest harvesting and environmental conditions. SEMARNAT coordinates the National Forest Commission (CONAFOR), which is an institution of the federal public administration. CONAFOR was created in April 2001 and is responsible for developing production activities, conservation and restoration actions in forest ecosystems. CONAFOR also participates in designing plans and programs, and the application of sustainable forestry development policy. In order to achieve the objectives of CONAFOR, the development of forest policy includes the 2025 national strategic forest program, the 2001–2006 national forest plan, and sustainable forestry development law.

Mexico, like the US Forest Service and Canadian provinces, has also enacted a number of mandatory rules governing key environmental forest practices, such as the protection of riparian zones, reforestation and the establishment of annual cut limits. A number of Mexico's rules, however, are more "procedural", i.e. centered on planning requirements, than the more prescriptive rules characteristic of US and Canadian public lands (Cashore and McDermott 2004). Such procedural approaches, in fact, have accompanied a recent trend towards the decentralization of forestry decision-making. A major component of Mexico's 1992 forest law is the devolution of environmental management decisions to local forest managers via approval of management plans detailing individual forest protection strategies (Segura 2000).

16.5 Current Challenges to Sustainable Forest Management

Compliance

Forest policies are only as meaningful as their ability to affect on-the-ground forest practices. Illegal logging, defined as removal of fiber by those with no assigned property rights, is a fundamental problem undermining the efficacy of many forest policies in the developing world (Cashore and McDermott 2004). More developed countries such as Canada and the US, in contrast, suffer less from illegal forestry activities. Although high value timber theft does occur in Canada and the US, its institutions are generally more effective (Esty and Cornelius 2002) in curbing and punishing criminal activity, with the requirements of timber marks and inspections making the movement and sale of illegal logs very difficult.

In Mexico, however, illegal logging constitutes a major problem. The factors contributing to illegal forest harvest are numerous, including land tenure conflicts, local forest producers' needs, insufficient mechanisms for supervision and vigilance, opening of forest areas for land use changes without authorization, and the existence of markets for illegal wood products. It is difficult to obtain accurate and consistent data on annual volumes of illegal wood production. However, SEMARNAT (2002) estimates that, in the year 2000, the volume of illegal harvestings was approximately 1.41 million m^3. This value represents approximately 15% of the total forest production legally harvested (9.4 million m^3). Such a high rate of illegal harvesting creates barriers to the SFM principles outlined in Mexico's national forest policy.

To combat this problem, Mexico has established in its 2025 Forest Strategic Program an important strategy to prevent and control illegal logging. This strategy includes actions such as increasing the risk and cost of illegal activities, improving the structure and organization of the industrial forest sector, and increasing market transparency and reducing the market access of illegal operators. Additionally, the institutional policy promotes the participation of different social sectors to preserve the natural resources through communitarian inspection and vigilance committees.

Past Management Legacies

It has become clear that past management decisions based on the timber procurement paradigm have created ecological problems. A central crisis facing the entirety of the North American continent has been the rapid loss of species biodiversity. This species loss has been attributed to a wide range of factors, including a loss of forest cover extending into the mid 1990s, intensive forest practices involving even-aged monocultures, chemical use, and the rapid liquidation of primary forest habitats. In response to such past management legacies, more recent concepts of SFM have involved an increased emphasis on forestry that "mimics" natural forest habitats. In particular, many proponents of a more naturalistic approach to forestry have pushed for the conservation and/or restoration of old growth forests.

Not all of the environmental crises created by the legacies of past management paradigms, however, lend themselves easily to solutions with wide popular appeal. One of the largest current crises in North American forests is the Mountain Pine Beetle (MPB) epidemic in the province of BC. In this case, effective fire suppression in a fire dominated ecosystem led to an age class structure of lodgepole pine (Pinus contorta latifolia) more heavily weighted to older age classes than would naturally occur with a historic pattern of fire. As these older age classes are the susceptible host trees for MPB, the relative abundance of these trees in combination with a sustained period of favorable weather have created the conditions for the largest outbreak ever recorded in BC (see Box 16.3).

The impact of this pest on the forest industry in BC is going to be very large in terms of displacing forest workers in remote rural communities. In approximately 15 years, the harvests in the affected regions of the BC interior are anticipated to fall by 4.5 million m^3 from pre-MPB outbreak levels of 23.2 million m^3 (BC Ministry of Forests 2003). These reductions will be concentrated in areas that are highly dependent on the forest sector for employment and income, threatening the medium-term viability of some communities.

Debates abound, meanwhile, over the appropriate means of "managing" the Mountain Pine Beetle epidemic. Proposed solutions range from rapid harvest of infected stands in order to prevent further spread, to the "no action" solution of leaving nature to "take her course". Given the tremendous environmental, social, and economic matters at stake, there will clearly be no consensus or resolution of the issue for some time to come. Although the MPB outbreak is an extreme example due to its immense scale, there are a host of forest pests across North America whose levels of damage are increasing as a result of increasingly favorable climate conditions. Other examples include the recent epidemics of spruce bark beetles in the Kenai Peninsula and Canada's Yukon, and Pinyon Ips in the southwestern US, which are threatening the Pinyon Pine species in the Pinyon-Juniper ecosystem.

Climate Change

Climate change and international agreements in response to climate change have important implications on how forests are managed in both the US and Canada. Climate change is having impacts on forest ecosystems in both countries, and thus on how the forests are managed (i.e. adapting to climate change, increased drought with associated pest damage and increased fire activity). Canada, having ratified the Kyoto Protocol, is also assessing the potential contributions of forests and forestry in meeting commitments for reducing net greenhouse gas (GHG) emissions under Kyoto (see Box 16.4). The US, choosing not to ratify Kyoto, is under no such obligations. The next case study explores the relationship between climate change and forests in the Canadian context.

BOX 16.3 Consequences of Altered Disturbance Regimes in an Era of Changing Climate

Allan L. Carroll

The mountain pine beetle (MPB) is a native insect that is widely distributed in western North America, occurring from northern Mexico to central British Columbia in Canada. Throughout its range, it breeds in virtually all species of pine, but in Canada its major host is lodgepole pine. MPB preferentially attacks mature, large-diameter trees where it feeds and reproduces within the phloem. Colonization of trees is facilitated by aggregation pheromones that coordinate mass attacks and a mutual association with phytopathogenic fungi that circumvent tree defenses. Successful colonization of a tree by MPB almost always results in tree death.

Although MPB populations have reached epidemic densities in the past, the latest outbreak that began in 1992 has reached levels that are nearly an order of magnitude greater than anything previously recorded. Indeed, the area attacked in 2002 alone (detected in 2003) covered approximately 4.1 million ha of pine forests (BC Ministry of Forests 2003). For a mountain pine beetle outbreak to occur, two main conditions must be satisfied, an abundance of susceptible host trees, and a sustained period of favorable weather for beetle survival. Both of these conditions have coincided in recent years in BC. Moreover, evidence suggests that these conditions have been exacerbated by anthropogenic activities.

Lodgepole pine-dominated forests cover approximately 14 million ha of British Columbia (BC Ministry of Forests 1995). Virtually all of these forests originated from stand-replacing wildfires (e.g. Smith 1981). In fire-maintained forests the rate of disturbance will determine forest age-class structure. Where wildfires occur randomly in space at a relatively constant rate, and stands have an equal probability of burning irrespective of age and location, forest age structure will reach a steady state approximating a negative exponential distribution (e.g. van Wagner 1978). Based upon a reconstruction of forest conditions in BC during the early 1900s, Taylor and Carroll (2004) found that the age-class distribution of pine forests for the province did indeed mimic a negative exponential distribution derived from a 60-year fire return interval. Therefore, historically the majority of pine forests comprised relatively young age classes (i.e. <80 years old) due to frequent wildfires.

Forest fire suppression began approximately 100 years ago in BC and its efficacy has increased over time. By 2002, the average annual initial attack success rate (i.e. fires constrained to < 4 ha in size) was 95%. As a result, since 1910 the average yearly area burned by wildfires in BC's pine forests declined from approximately 100 000 ha to less than 10 000 ha (Taylor and Carroll 2004). This dramatic reduction in the rate of disturbance has allowed pine forests to age to the extent that nearly 70% of current stands are at least 80 years old – significantly older than that expected from the historic wildfire regime. Since MPB preferentially attacks trees that are at least 80 years old (e.g. Safranyik et al. 1975), fire suppression has significantly increased the amount of susceptible trees for the beetle. In fact, Taylor and Carroll (2004) estimated that at the start of the present outbreak there was 3.3 times as much MPB-susceptible pine in BC as in 1910.

In addition to an abundance of suitable hosts, climatic conditions have been steadily improving for MPB populations in recent years. Historically, the extent and severity of MPB epidemics have been limited by the occurrence of summer temperature regimes optimal for beetle development and/or minimum winter temperatures below a critical threshold (Safranyik et al. 1975). In fact, a large proportion of pine forests in western Canada normally experience climatic conditions insufficient for the establishment and persistence of MPB populations. By comparing the annual occurrence of MPB infestations against maps of the historic distribution of climatically suitable habitats derived from past weather records and a model of the impact of climatic conditions on MPB populations, Carroll et al. (2004) have shown that during the past three decades climatic conditions relevant to MPB have improved over large portions of BC. More importantly, as a consequence of climate change populations have expanded into formerly climatically unsuitable habitats, especially toward higher elevations and more northerly latitudes. Indeed, large parts of the current MPB outbreak occur in areas that before 1970 were climatically unavailable to the beetle (Carroll et al. 2004).

On average, past large-scale outbreaks by MPB seldom persisted longer than 10 years. Their collapse was due to localized depletion of suitable host trees in combination with the adverse effects of climate. The current epidemic is now 14 years old and shows no evidence of subsiding. The coincidence of an over-abundance of mature pine due to fire suppression, and ameliorating climatic conditions due to global warming, has served to exacerbate the extent and severity of MPB impacts in BC.

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BOX 16.4 Climate Change and Forests

G. Cornelis van Kooten

The Kyoto Protocol (KP) is the international community's policy response to the threat posed by global climate change. It requires developed countries to reduce CO_2 emissions by an average of 5.2% from the 1990 level during the commitment period 2008–2012, or by a total of some 250 megatons (106 metric tons) of carbon, denoted Mt C, per year. It comes into effect 90 days after it is ratified by 55 states, but developed countries that ratify must account for at least 55% of the CO_2 they emitted in 1990. Before Russian ratification in late 2004, over 120 countries had ratified, with developed countries' proportion of the 1990 emissions at 44.2%. With Russian ratification and in light of the United States having decided not to ratify, the proportion of 1990 emissions accounted for by developed (Annex B) countries is 61.6 percent. Russia agreed to ratify in exchange for European support of its bid to become a member of the World Trade Organization. While Russia may not have 'hot air' to sell, it likely will have forest carbon offset credits to sell to countries that are unable to meet their commitments under Kyoto.

The KP permits countries to take into account carbon fluxes due to afforestation, reforestation, and deforestation (ARD) activities in determining 2008–2012 emissions. Afforestation refers to human activities that encourage growing trees on land that has not been forested in the past 50 years, while reforestation refers to human activities that encourage growing trees on land that was forested but had been converted to non-forest use since 1990. In the first commitment period only, some countries can claim carbon credits that need not be offset against ARD debits. Canada can claim 12 Mt C (44 Mt CO_2) each year through (verified) forest management activities that enhance carbon uptake. (Russia can claim 33 Mt C per year, Japan 13 Mt C, Germany 1.24 Mt C, Ukraine 1.11 Mt C and other countries much lesser amounts.) According to its Implementation Plan (Government of Canada 2002), Canada expects to claim 5.5 Mt C (20 Mt CO_2) in this fashion, amounting to 8.3% of its required CO_2 emissions reduction (if Canada elects to include forest management in its Kyoto accounting). While more can be claimed there is fear that, by identifying a larger managed forest area, CO_2 release from natural disturbances (fire, insects, and diseases) on the managed land will negate the claimed amount. The impact of average forest fire levels on carbon was included in the 20 Mt CO_2 estimates, so it is likely that only the impact of larger than normal fires during the commitment period may negate the amounts claimed.

More important, perhaps, is that Canada can claim carbon credits for ARD activities, particularly for tree planting on agricultural lands. Canada's KP implementation plan calls for nearly one-quarter of the country's total KP target to be achieved through terrestrial carbon sinks (16–18 Mt C per year), split between actions already underway and proposed new actions (Government of Canada 2002). Research using meta-regression analysis suggests that a lower range of cost estimates for creating carbon forest credits is some USD 10–USD 35/t C (USD 2.75–USD 9.50/t CO_2) if product sinks are permitted and opportunity costs of land are ignored, but USD 62–USD130/t C (USD 17–USD 36/t CO_2) if opportunity costs of land are appropriately credited (van Kooten 2004). Based on a study region in northeastern British Columbia consisting of 1.2 million ha, with 10.5% of marginal agricultural land, Krcmar et al. (2001) found that more than 1.5 Mt C can be sequestered in the region over a period of 200 years at a cost of about USD 40/t C. This amounts to an average of about 1.3 t C per ha, or about 52 kg C per ha per year over normal carbon uptake. If this result is applied to all of Canada's productive boreal forestland and surrounding marginal farmland, some 20% of Canada's annual KP target, or some 10–15 Mt of C annually, could be achieved through afforestation at an average cost of about USD 40/t C, or USD 11/t CO_2. The time required to implement such a planting program, which could take 40 years, and associated transaction costs were neglected in this calculation (van Kooten 2000).

The problem is that terrestrial carbon offsets are temporary and it is impossible a priori to determine how credits for temporary offsets will exchange for permanent CO_2 emission reductions in carbon trading markets (Marland et al. 2001; Sedjo and Marland 2003). If the discount rate is 10%, then a temporary carbon offset will be worth only one-tenth as much as a permanent CO_2 emission reduction. This makes the sink option much less attractive from a financial perspective. Of course, this does not preclude some tree planting for biodiversity as well as carbon purposes. Also the more one uses forests for carbon credits, the more industry in other sectors can pollute. In other words, Kyoto may help conserve forest, but at expense of greater pollution elsewhere.

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Expanding Markets for Sustainably Managed Forest Products

Non-Timber Forest Products

North American forests provide a wide array of non-timber products and services including food, recreation, eco-tourism, energy, pharmaceuticals, clean air, clean water, and habitat and amenity benefits. These comprise a mix of consumptive and non-consumptive benefits, some of which have been exploited for commercial purposes. These values must be incorporated with traditional timber harvesting values to develop SFM strategies; this combination has been difficult for policy-makers. Many non-timber forest values are closely related to the historic rights of the First Nations peoples, and particular problems have arisen when management for timber production has led to the loss of these values. While there have been some successful examples of com-

BOX 16.5 Management Issues Concerning NTFPs in Canada and the US

Susan J. Alexander, Darcy Mitchell and Sinclair Tedder

Although forest management in North America has not generally focused on the production of NTFPs, they are abundant in forest ecosystems. NTFPs play important roles in North American culture and commerce. Over 200 species of NTFP are harvested from public and private lands in the US Pacific Northwest alone for commercial, personal, and traditional purposes (de Geus 1995) with dozens of other species harvested in central and eastern North America. Some of these species, such as maple syrup, wild rice, wild blueberries, and several medicinal herbs, are established in cultivated or semi-cultivated production systems. Using forest management practices to enhance NTFP production has become a focus for some forest managers (Weigand 1998; Kerns et al. 2003). However, although some NTFPs are becoming scarce in an economic sense (Pearce 1992), their value generally has not been regarded sufficient to manage them for increased production. They are usually regarded as by-products of forest management. The use of NTFP in Canada has largely been unmanaged and unregulated (Tedder et al. 2002). The primary focus of management in the US has been managing and regulating access to NTFP. Access management includes controlling the physical ability to get to a place with e.g. road closures and gates, and legal access with e.g. permits, contracts, treaties, and regulation (Alexander and Fight 2003).

In Canada, resource use on public (Crown) lands operates in most places under an open access environment, where no restrictions are placed on users, no harvesting approval is required, and no specific rights are accorded to any users. Exceptions include Special Forest Product permits in the province of Saskatchewan, prohibitions on harvesting in parks, and Community Forest Pilot Project tenures in British Columbia, which are the only forest tenures in BC that provide for the management of botanical (non-wood) forest products (Tedder et al. 2002).

Property rights in the US are fairly explicit and are based on notions of exclusivity; that is, the landowner can determine who has access to his or her land. Timber and most other forest products are private goods irrespective of management. A private good is both rival and exclusive. Rival means that one person's consumption of a resource reduces the amount available to others (Ostrom 1990). Exclusive means the owner can restrict access to the resource. Randall (1988) points out that pure non-rival goods are rare. Instead, he uses the term congestible good. As a capacity restraint is approached, congestion sets in, and the resource becomes scarce. As timber became congestible, it was realized that it could become scarce. Access to timber on all ownerships in Canada and the US is regulated through harvest contracts, sales mechanisms, and pricing structures. Most NTFPs continue to be regarded as non-exclusive and non-rival goods, particularly those growing on public lands. The transition to congestion and scarcity and the resultant efforts to allocate harvest rights to NTFPs challenge forest managers of both public and private lands (Alexander and Fight 2003).

Forest managers on public and private lands in Canada and the US face an array of choices when deciding how to allocate formal or informal access rights for NTFPs. Forest managers may be aware of and support informal access rights. In these cases, gathering takes place without explicitly written rules, laws, or policies. Informal access rights may be public, or just a personal sense of ownership. Formal access mechanisms, such as contracts or permits to harvest NTFPs, are becoming more common in the US. This increased formalization, and sometimes elimination, of access has led to concerns that long-standing customary claims to NTFPs, including claims of non-native Americans, need to be acknowledged (Goodman 2002). Goodman suggests that recognizing and embracing elements of informal legal systems may enhance the development of sustainable NTFP management. Historically, highly mobile groups of First Nations peoples had a structured set of informal rules and traditions that dictated where, when, and who harvested NTFPs, such as berries and salmon (Fisher 1997; McLain and Jones 1997; Turner and Loewen 1998; Turner and Cocksedge 2001). In Canada, particularly in BC where treaties in most parts

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mercial exploitation of these values other important services, such as the provision of carbon uptake of forests, require new and well-developed institutions. The issue of non-timber forest products and how they fit into forest management schemes is the topic of the next case study (Box 16.5).

SFM involves using forestlands and resources to satisfy a variety of human needs. The harvest, processing and marketing of non-timber forest products require appropriate institutional arrangements to address a large number of issues concerning the livelihoods of forest-dependent communities in a broad sense, employment opportunities, governance and markets. In addition to their effects on the well-being of local communities, practices in managing non-timber forest products also have significant implications for the overall health of forest habitats and the capacity of forest ecosystems to deliver a steady stream of environmental services. The experiences in North America indicate the growing importance of non-timber forest products in the transition towards SFM and the diversity of approaches that may be implemented.

Forest Certification

Increasing rates of global deforestation (Meyer et al. 2003), improved information and ready access to this information, combined with a strong re-emergence of environmental values, have raised the public profile of forest sustainability in North America. ENGOs, the forest industry, and governments have taken a range of approaches in response to this pressure for forest sustainability. The range includes intensive regulation (command and control) of forestry practices, ENGO orchestrated calls for consumer boycotts of products sourced from 'unsustainable' forests, media campaigns showcasing the impacts of select aspects of commercial forestry (typically clear-cut harvesting and habitat loss), and standards developed by producer associations. One promising approach is the certification of forests and labeling of forest products sourced from sustainably managed forests to demonstrate compliance with certain standards. The following case study provides an overview of forest management certification in North America (Box 16.6).

of the province have yet to be negotiated, Aboriginal rights and title are a significant factor in the recognition and specification of formal rights to NTFPs.

Today's managers and policymakers face an array of decisions when they formally allocate access rights to NTFPs, in jurisdictions where formal rights are recognized. Managers use mechanisms such as permits and regulation to determine who can harvest, where, and when. People harvesting for personal use may be sent somewhere different than those harvesting commercially. Groups with specific legal rights, such as those allocated through treaties, may have priority use in certain areas or for specific resources. Other decisions regarding access allocation are whether or not entry is limited, and the duration of access. Can the harvester gather whatever size or amount he wishes? Is the access right granted for a season, a year, or multiple years? The manager selling NTFPs must also decide how the prices will be set and how the payment will be made (Alexander and Fight 2003). The combination of choices in granting access rights to NTFPs can have significant long-term effects on the productivity and sustainability of non-timber forest resources. In determining an appropriate system of access rights to NTFPs, decision-makers must also consider the interactions among NTFPs, timber and other non-timber management systems. In an ideal system, values (including non-pecuniary values) of the forest resource would be optimized through the system of property rights. In actuality, however, established uses, such as harvesting trees for fiber, have been slow to give way to other claims for forest use.

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BOX 16.6 Forest Certification in North America – Drivers, Status and Outlook

Bill Wilson

Forest certification has its roots in the perceived failure of the international community to respond to rapid tropical deforestation and forest degradation during the 1980s (Vogt et al. 1999; Hansen and Fletcher 2000). However, the watershed 1992 UN Conference on the Environment and Development (the Rio Earth Summit) served to highlight the question of forest management in developed countries. The Summit subsequently led to the development of a set of principles and a suite of criteria and indicators, the key ingredients to an operational basis for SFM and an evaluation pursuant to forest certification. This case study presents the drivers pushing forest certification, provides the status of forest certification, and concludes with comments on future outlook.

Certification Drivers

In North America the public objective in forest management is mainly forest ecosystem sustainability. Certification is but one vehicle to assist in achieving this objective. However, certification does have a cadre of very strong supporters with a range of reasons for positioning and promoting certification in its various "institutional" forms. These forms include a host of international, national and regional standards. The major drivers for SFM and certification in North America (similar to those in many other jurisdictions) include wealth and education effects, reduced time and distance costs, urban economic migration, and increased globalization.

These drivers have translated into society's expecting a greater degree of non-timber and preservation values being integrated into forest use decisions. In some instances regional governments have responded to this social expectation with

Table A. Characteristics of North American forest certification vehicles

	Forest certification vehicle		
	Canadian Standard Association (CSA)	Sustainable Forestry Initiative (SFI)	Forestry Stewardship Council (FSC)
Main developer	Industry	Industry	ENGOs
Basis	Performance & systems	Performance & systems	Performance
Application	Canada[a]	US & Canada[a]	International
Verification	3rd party	1st, 2nd 3rd party	3rd party
Chain-of-custody	Yes	No	Yes
Label & logo	Logo	Logo & label	Label & logo
Upgrade provision	Yes	Yes	Yes

[a] Vehicle is available to players beyond defined region.

a regulatory package. However, a parallel process involving ENGOs, industry and landowners generated a series of forest certification options (see Table A). Basically these options seek to ensure a greater balance among timber and non-timber values. The incentives to participate are the threat of boycotts by buyer groups or consumers (i.e. loss of market share) and the potential for certified product price premiums.

Empirical evidence to date on premiums is largely related to the willingness-to-pay version, with all its inherent methodological limitations, and some temporary niche market premiums reflecting a supply/demand imbalance. Research on forest owner and industry attitudes has also typically identified market access as a greater driver than expected premiums on certification decisions (Wilson et al. 2001).

Status

At the beginning of 2004, an estimated 164 million hectares, about 4.2% of total world forests, were certified. In North America, an estimated 16.8% of forests are certified (van Kooten et al. 2004). The Canadian Standards Association (CSA) certification option is the main vehicle in Canadian forest certification. Current CSA certified forest area is 32.9 million hectares, as compared with 5.4 million in 2001. In the United States, the American Forest & Paper Association's Sustainable Forestry Initiative (SFI) is the preeminent certification vehicle. A total of 20 million hectares is SFI certified – almost double the area certified by 2001. Forest certification in Mexico has followed the Forest Stewardship Council' (FSC) option, and the total area certified, although small (about 505 000 hectares), has increased sharply in recent years. Mexico's forests are largely collectively owned and managed by farmers and indigenous communities, in contrast to the public and private ownership common in Canada and the United States. These forests are highly fragmented and have a strong human "footprint". As a consequence, forest certification in Mexico is challenged by both certification costs and institutional limitations.

In recent years the CSA has introduced a chain-of-custody (COC) process that is available for lumber, pulp and paper products. FSC has had a COC process, label and logo from its early days. COC certification is the category of forest certification that deals with the certification of forest products at each stage of the supply chain, from time of harvest until the final product reaches the end consumer (Upton and Bass 1996).

Outlook

Mutual recognition across the various certification options progressed despite strong opposition from various FSC supporters. Canadian companies have successfully achieved SFI certification (a total of nearly 26 000 hectares), a strategic consideration given the large concentration of Canadian forest product exports into the US market. Both CSA and SFI are members of the Pan-European Forest Certification (PEFC) Council and are seeking a broader consensus on recognition.

The PEFC emerged as European landowners developed their own national certification programs, after balking at the FSC response to their needs and opinions. The European process has led to a package of SFM criteria and indicators against which various national standards are vetted. PEFC mutual recognition has endorsed FSC and a collection of national standards in twelve European countries.

The European model demonstrates that mutual recognition can happen. A question to consider is whether mutual recognition is beneficial to a sound SFM objective. Institutional economic theory provides logical arguments for both sides of this question, but no definitive conclusion. The theory provides two lessons: the only desirable monopoly is your own, and substitute products will continue to challenge market share.

Certification is costly, particularly for small-scale operations. However, only rarely can market forces provide an adequate reward to offset the costs of certification. Instead, certification is becoming a cost of doing business in forestry. Certification will directly influence access to both timber and markets, and in cases where the additional costs are prohibitive, future land use change.

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In addition to certification, there are a number of other approaches to forest management that may advance our knowledge related to pursuing the goals of SFM. Specific Canadian examples include provincial initiatives to examine the possible role of community forests, best portrayed by the Community Forest Pilot Project in BC (a similar, although smaller program exists in the province of Ontario). Communities were invited to submit bids for 5-year forest licenses, and at the end of 2003, 8 license agreements had been signed and approximately 140 000 m^3 of timber had been harvested by the community forests in that year.

Another innovative approach adopted in Canada is the Model Forest Program. Launched in 1992, the Model Forest is based on the concept of testing and demonstrating best management practices in a geographically defined, forested area. At present, there are 11 Model Forests in Canada covering sites that are representative of all the major ecological zones in the country. At the 1992 UNCED, the Canadian government announced the creation of the International Model Forest Network (IMFN) program to support development of Model Forests outside of Canada. Consistent with the Canadian Model Forest Network, the IMFN supported country-led development processes that incorporate a broad range of economic, social and environmental forest issues. Today there are more than 30 international Model Forests involving some dozen, including the US and Mexico. They represent a unique global community effort with a common theme, dedicated to finding working solutions to the challenges of SFM.

At the heart of the Model Forest approach is the idea of partnership recognizing different perspectives on the social, economic and environmental dynamics in managing a forest. These perspectives are essential for making informed and fair decisions in forest management for multiple values. Today, the eleven Canadian Model forests range in size from 113 000 hectares to 7.7 million hectares, and have dozens of significant achievements to their credit. Some 500 scientists and more than 1000 forest practitioners are actively involved in the Model Forest network.

As an example, the McGregor Model Forest in the BC Interior has gained useful experience in fostering partnership among research organizations, forest product companies, First Nations, government agencies, communities, practitioners, and recreation and conservation groups to integrate their respective interests into a common goal of managing the forest in a sustainable way. The Bas St. Laurent Model Forest in Quebec is trying an innovative form of management involving tenant farmers who are allocated approximately 1000 ha, designed to ensure multi-resource management. This Model Forest is located on three private woodlots, and has been in operation since 1994.

16.6 Summary and Conclusion

It is abundantly clear that forests are of great importance to the economic and social well being of people in Mexico, Canada and the US. The preceding review and associated case study analyses provide evidence suggesting changes in forest governance and associated livelihoods, the impact of forest management in the provision of environmental services, and the shift to plantations for fiber requirements. These are all components of the shift to a new paradigm of forest management in North America, a paradigm taking into account a wide array of products, services, and functions associated with the forest.

The shift along the continuum towards SFM is not consistent across these three countries. Reflecting their differing and unique histories and priorities, the US, Canada and Mexico have pursued their commitment to SFM using different approaches. In Mexico, the shift has led to a stronger emphasis on rural development and equitable benefit distribution. Forests are communally owned, and management decisions are made closer to the local level through decentralized decision-making. The majority of harvest is for fuelwood, and is utilized by a large proportion of the Mexican population, especially in rural areas near the forest. In Canada and the US the shift has led to a more exclusive focus on the environment, and greater demands for a wide array of environmental services from forests. As managing for these additional values will certainly add costs, this will serve to reduce the relative competitiveness of the forest products sector.

Canada, with its predominantly publicly owned forests, has virtually no commercial forest plantations. Instead its vast, largely natural forests are managed by an extensive management regime. The forests in Canada provide livelihoods largely through commercial harvest and processing activities, although it is increasingly recognized that non-timber forest products play a large role as well. The US also has vast publicly owned forests, but there has been a shift to practicing commercial forestry on private lands, with the large southern US plantations becoming key suppliers of commercial timber. The paradigm shift for these private lands in the US has occurred differently from that governing public lands. There is a very wide divergence in policy related to the protection of environmental services between the publicly owned lands in the US and the private forestry lands in the US South, with the rules governing these private lands being much less restrictive.

The failure to recognize ecosystem function within forest management has led to problems such as loss of species biodiversity, and catastrophic fire and insect problems in the west. The current MPB outbreak, the topic of one of our case studies, covers over 4 million ha (2003) and will kill approximately 500 million m^3 of timber over the next few years.

This challenge will threaten the economic and social well being of communities across the northern Interior BC. The specific case of the MPB outbreak in BC illustrates the risks of ignoring ecosystem function, but there are other examples such as the buildup of hazardous fuels across much of western North America.

In addition to policy aimed at protecting other forest values, forest certification is a means by which consumers of forest products can make demands about how forests are managed. Certification is costly, particularly so for small-scale operations, and rarely does the market provide an adequate reward to offset the costs of certification. Instead, certification is becoming a cost of doing business in forestry. Certification will directly influence both access to timber and markets, and in cases where the additional costs are prohibitive, future land use change.

The emergence of a number of new paradigms within the overall SFM concept includes interrelations between forests, society and the environment. Forest practices will continue to change, in response to changing societal values, pressures from interest groups on the way forests are managed and utilized, and new knowledge and understanding about the natural, socio-economic, and cultural forces governing the forests.

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Map 17.1 Forest cover in Oceania (percent of land area) and total forest area per country
(Data: FAO FAOSTAT 2005; map designed by Samuel Chopo)