

THE NOVA SCOTIA GENUINE PROGRESS INDEX FOREST ACCOUNTS

VOLUME 1 INDICATORS OF ECOLOGICAL, ECONOMIC & SOCIAL VALUES OF FORESTS IN NOVA SCOTIA

EXECUTIVE SUMMARY

Nova Scotia today only contains remnants of the mature and old-growth forests that historically were present in the province. A long history of high-grading (removing the best trees), land clearing, and clearcutting over more than two centuries has severely degraded the province's forested natural wealth. The ecological integrity, health, and economic value of Nova Scotia forests have continued to decline sharply since the 1950s, when the Department of Lands and Forests inventory noted that the quality of the province's forests had already decreased substantially.¹

Major losses in age-class diversity have occurred since the 1950s, with an increasing percentage of forests in younger age classes, and the loss of almost all the province's older forests. In 1958, forests more than 80 years old covered 25% of the province's forest area. Today they cover only 1% of forest area. Forests more than 100 years old covered 8% of the province's forest area in 1958; today they cover only 0.15% of forested land.

True old-growth forest in Nova Scotia is endangered and exists only in very small, scattered, isolated pockets in the province. We are currently witnessing the disappearance of the natural site-evolved species, structure, and age characteristics of the once dominant Acadian forests.

Natural species diversity² has also declined with a particularly sharp decline among some tolerant hardwood species. According to forest inventories, merchantable oak, beech, and yellow birch, for example, have all declined significantly.³ Black ash, of great cultural importance to the Mi'kmaq, is now rare in Nova Scotia. Among softwoods, eastern hemlock has seen a particularly sharp recent decline, down by more than half since 1958 alone. In the early 1900s, 300-year-old stands of eastern hemlock

¹ Ken Snow, Manager, Forest Inventory, NSDNR, (2001) notes that the 1958 forest inventory report by Hawboldt and Bulmer. 1958. *The Forest Resources of Nova Scotia*, refers specifically to the reduction of saw log timber. The 1958 report notes that Nova Scotia had lost most of its primary forest, increased the land covered with non-commercial or low-value species, and suffered greater damages due to reduced resilience.

² Natural species diversity, mentioned throughout this report, means the full array of native species known to Nova Scotia at the time of European settlement, and includes consideration of distribution, abundance, age-class structure, genetic diversity, and ecological inter-relationships. A goal of restoration forestry should be to steer the forest toward pre-settlement conditions, thereby creating conditions that will favour restoration of natural species diversity.

³ Beech bark disease, caused by the introduced beech scale insect and *Nectria coccinea* fungus, is responsible for much of the recent decline in beech volume throughout North America (Farrar, 1995; and Ontario Ministry of Natural Resources 1998).

were common in Nova Scotia, with many trees up to 800 years old. White and red pine occupy less than 50% of their former range in this region (CCFM 1997).

The rate of cutting in Nova Scotia has doubled over the past two decades by *volume*, and in the last decade alone the actual *area* clearcut annually has doubled, placing additional stress on the province's forests. The wood volume harvested annually grew from an average of 3.3 million cubic metres between 1981 and 1985 (NSDNR 1997) to 6.5 million m³ in 2000 (NSDNR 2001).⁴ Ninety-nine percent of this wood is harvested by clearcutting. Based on the annual growth rate of the province's forests, on the rate of seeding and planting in the past decade, and on changes in age structure and species composition, the current annual rate of cutting is unsustainable.

⁴ For more detailed actual annual harvest information refer to Figure 18 in Volume 2 of the Forest Accounts.

These findings are in accord with public perceptions. A recent public opinion poll found that 91% of Nova Scotians believe the present rate of timber harvest is too high to sustain the forest for other values or uses. A majority also believes that clearcutting should not be used as a harvest method in Central Nova Scotia because it harms wildlife, ruins forests, causes erosion, looks bad, and wastes wood

However, the majority of the province's forests are privately owned, making regulation and forest protection initiatives more challenging than in jurisdictions with higher rates of public ownership of forestland. Of public land in Nova Scotia, only about 20% of provincial Crown land is classified as not available for resource extraction. Once deductions are made, about 60% of the Crown forests or 732,000 hectares are actually available for timber harvesting.⁵

Land clearing and recent increases in clearcutting and the loss of both mature forests and natural species diversity in Nova Scotia forests represent a substantial depreciation of the province's valuable natural capital assets, and a decline in forest economic value due to:

- loss of valuable species;
- loss of large diameter logs and clear lumber that fetch premium market prices;⁶
- loss of resilience and resistance to insect infestation that is enhanced by species diversity;
- loss of wildlife habitat, including decreasing populations of birds;
- loss of forest recreation values that can impact tourism;
- a decline in forested watershed protection, which has likely contributed to a 50% decline in shade-dependent brook trout;
- soil degradation and the leaching of nutrients that can affect future timber productivity;
- a substantial decline in carbon storage capacity and an increase in biomass carbon loss; and
- a decline in other essential forest ecosystem services.

This decline has been invisible in standard measures of progress based on the gross domestic product (GDP) and economic growth statistics, which give value to forests only when they are cut for timber. Because they count the extraction of natural resources as economic growth, without considering the direct and indirect costs, GDP statistics send misleading messages to policy makers and the general public and blunt potential remedial action. The GDP gives no value to standing forests, and thus counts their depletion and liquidation as economic gain. This is bad accounting, like a factory owner selling off his machinery and counting it as profit. Similarly, current timber accounting methods ignore the loss of timber and non-timber values such as natural age-class and species diversity.

By contrast, the Genuine Progress Index (GPI) assigns explicit value to natural capital assets, including the full range of forest functions and vital ecosystem services that provide multiple benefits to human society. In the GPI, natural capital is subject to depreciation when not used sustainably. Conversely, restoration forestry is seen not just as a cost, but as a re-investment in natural capital that will produce a valuable flow of goods and services in the future. Just as a factory owner's economic viability depends on the quality and quantity of his equipment, the GPI recognizes that the capacity of forests to provide vital services to human society depends on the health of the standing natural capital stocks.

⁵ Area deductions include special use areas and leases, ecological reserves, protected beaches, offshore islands, infrastructure and abandoned railway corridors, areas of low forest capability and steep slopes, wildlife habitat, travel corridors, unique features, view planes along highways, traveled watercourses, special management zones, and riparian areas (pers. comm. D. Eidt, 2001).

⁶ For this analysis, see Volume 2 of these Forest Accounts, Chapter 8.

Extrapolating from one global study, Nova Scotia forests are estimated to provide a minimum of \$1.68 billion (1997\$) worth of services annually in climate regulation, soil formation, waste treatment, biological control, food production, recreation, and cultural benefits (Costanza et. al. 1997).⁷ This estimate does not include other vital forest ecosystem services such as soil erosion control, water supply and watershed protection, nutrient cycling, gas regulation, pollination, habitat, disturbance regulation, and genetic resources. Increased clearcutting and the loss of natural forest diversity are rapidly diminishing the value of these forest ecosystem services in the province.

Nova Scotia's forests store about 107 million tonnes of carbon, thereby avoiding an estimated \$2.2 billion in climate change damage costs. However, the accelerated rate of cutting, and the loss of old growth and mature forests in Nova Scotia since 1958, have drastically reduced the province's carbon storage capacity by 38%, costing an estimated \$1.3 billion in lost value. In other words, based on the 1958 forest inventory, the carbon stored would be worth \$3.5 billion. Carbon loss in Nova Scotia's forests is now contributing to global climate change.

Direct non-timber contributions to the Nova Scotia economy include a four-fold increase in maple sugar production over the past three decades. However, valuable forest-dependent medicinal plants that are dependent on mature forests, are becoming increasingly rare in the province as forest ecosystems with old-growth characteristics disappear.

Nova Scotians spend \$250 million a year on nature and wildlife-related pursuits, a lot of it in forests, of which 70% is non-consumptive (e.g. hiking, bird-watching, canoeing) and 27% is consumptive (mostly hunting and fishing). In addition, total tourism revenues rose to a record \$1.26 billion in 1999, contributed \$430 million to the provincial GDP, and generated \$200 million in tax revenues (current dollars), with nature tourism the fastest growing sector of the industry. The tourism industry directly employs more than 12,000 Nova Scotians, with direct and indirect tourism jobs increasing by 23.4% between 1997 and 1999. A Nova Scotia government report on the nature tourism market noted that natural settings, protected areas, parks, and opportunities for hiking and wildlife viewing were critical to the development of ecotourism market potential.

Total forestry industry shipments in 1999 were \$1.4 billion, and contributed \$431 million to GDP,⁸ remarkably similar in size to the tourism industry contribution.⁹

⁷ This figure is based on global estimates of forest ecosystem values per hectare, arrived at by a team of international scientists. No such separate study has been done for Nova Scotia, and detailed scientific analysis would be required to assess the comparability of these global estimates with Nova Scotia conditions.

⁸ Shipments from APEC (2000). GDP statistics from Statistics Canada, *CANSIM II* Database, Table 379-0003, GDP at factor cost by Standard Industrial Classification (SIC).

⁹ The purpose of the comparison here is not to rate one or other industry as having greater importance, but simply to demonstrate that two major Nova Scotia industries of comparable importance to the provincial economy, are both resource-dependent and share a need for sustainable management of the province's forest resources.

From the perspective of sustainability, however, this forestry industry contribution must be assessed in relation to the health of the natural capital stocks on which it depends. Otherwise, the degradation and depletion of these stocks may appear as economic gain. For example, the fisheries industry appeared to be booming, with record catches recorded, on the eve of the Atlantic groundfish stock collapse.

When the forestry industry contribution to GDP is assessed in relation to volume of biomass harvested, the trends are much more troubling. In 1984, the forestry industry contributed \$90,804 per 1,000 cubic metres of timber harvested. In 1999, the industry contributed only \$68,023 per 1,000 cubic metres, a 25% decrease (constant 1997\$). In other words, the GDP and shipment figures in isolation conceal the reality that far greater quantities of timber are being harvested to maintain a relatively fixed contribution to GDP.

Depending on which job categories are included, estimates of forestry industry employment vary widely. Statistics Canada's Survey of Employment, Payroll and Hours puts forestry industry employment at almost 9,000, while a recent study by APEC (2000), prepared for the Nova Scotia Forest Products Association, put the figure much higher – at 13,000.¹⁰

However, once again, it is not the absolute employment numbers that are most significant from the perspective of sustainability, but the employment per unit of biomass harvested. Higher ratios are a sign of genuine progress in the GPI. However, employment per unit of timber harvested has declined by 26% since the 1980s, from an average of 1.9 jobs/1,000 cubic metres in the 1980s to an average of 1.4 jobs/1,000 cubic metres in the 1990s. In other words, greater quantities of timber are being harvested to maintain each job in the industry.¹¹

Clearcutting is currently the dominant harvest method in the province, accounting for 99% of the total annual harvest. New government regulations provide financial incentives for silviculture (e.g. planting and thinning) with the goal of doubling the volume of softwood harvested from 5.5 million cubic metres (the mean harvest from 1995 to 1998) to over 11 million cubic metres by 2070.

However, the continued focus of both policy and current accounting methods on quantity rather than quality not only encourages clearcutting, but also conceals a significant loss of value per unit of biomass harvested, due to the changing age and species structure of the province's forests. The potential lost market value of premium-priced large diameter and clear lumber through the destruction of old trees in the last 40 years alone is roughly estimated at \$260 million annually, or 19% of total annual revenues.¹²

¹⁰ See Volume 2, Chapter 8, for a detailed discussion of alternative estimates of forestry industry employment, and possible explanations for the discrepancies.

¹¹ Calculations are based on the average employment figures cited by Statistics Canada's Survey of Employment, Payroll and Hours: averages of 7,401 jobs in the 1980s and 7,618 jobs in the 1990s. Harvest levels used in the calculations were also based on averages of 3.8 million cubic metres in the 1980s and 5.5 million cubic metres in the 1990s. See also Volume 2, Chapter 9, for a discussion on the impact of mechanization in the forestry industry.

¹² See Volume 2, Chapter 8. This is an extrapolation derived from applying the portion of premium-priced lumber on a sustainably harvested Nova Scotia woodlot to the province as a whole. For a more accurate estimate, far more detailed analyses are necessary, based on varying forest, soil, and climatic conditions in different parts of the province, and on the different historical forest structures that existed.

To protect and restore the value of Nova Scotia's forest wealth and the full range of forest services, this GPI study recommends:

- incentives for investment in forest restoration and uneven-aged management, including selection harvesting, in order to protect and restore the natural age distribution and species diversity of the province's forests, and to provide more jobs;
- a sharp reduction in the rate of clearcutting and the volume of timber harvested annually;
- a gradual industrial shift from volume-based to value-added forest products, to produce high-value wood products, and to increase the number of jobs per unit of resource harvested;
- protection of all remaining old-growth forest;
- that the full range of forest values and services, and the full cost and benefits of associated harvest methods, be counted and tracked in annual forest accounts and in ongoing forest management planning; and
- Sustainable forest management is not the whole answer. Even with the most careful harvesting techniques, there will be some level of impact on forest ecosystems. While there is a great difference between clearcutting and selection harvesting systems, they both involve the construction of roads and the removal of biomass. Even the highest standards applied on a particular woodlot cannot guarantee needed protection of critical forest values at the landscape level. Therefore, no matter how excellent forest operations may be, they are not a substitute for an adequate network of representative protected areas in Nova Scotia.

VOLUME 2
A WAY FORWARD: CASE STUDIES IN SUSTAINABLE
FORESTRY

EXECUTIVE SUMMARY

“It’s all a question of story. We are in trouble just now because we do not have a good story. We are in between stories. The old story is no longer effective.”

- Thomas Berry

Volume 1 of the Nova Scotia GPI Forest Accounts indicates that Nova Scotia’s forests are at a watershed juncture. Clearcutting and the liquidation of the province’s forest wealth are occurring at unprecedented rates in the interests of immediate economic gain. This trend is undermining the province’s ecological, social and economic fabric, and depriving future generations of Nova Scotians of their natural inheritance.

While economics are touted as the rationale behind current practices, the full-cost accounting methods of the Genuine Progress Index demonstrate that current harvest practices actually contravene basic economic investment principles. Our natural capital - the principal, or what is left in the ‘forest account,’ has been reduced to a fraction of its former value. This trend is supported by an economic accounting system that has measured and valued only the timber extracted from the forest, without accounting for what remains in the forest. Clearly, “the old story” is not working any more.

This second Volume of the GPI Forest Accounts portrays “the new story.” It describes a way forward, by describing actual viable, working examples of efforts to maintain and restore forest natural capital. It describes the harvest methods and economics of these operations in considerable detail, in order to provide practical, concrete information to interested wood lot owners and forest industries, and to governments willing to play a leadership role in supporting such efforts through appropriate incentives. The new story must also be supported by a new economic accounting system that values the standing forests as well as the products extracted from them. That is a key function and purpose of the Genuine Progress Index.

“Changing the story” in Nova Scotia represents a particular challenge because of the ownership structure of the province’s forests. Twenty-eight per cent of forestland is provincial crown or publicly owned land, 3% is federal land and 69% is in private hands. Fifty-two percent of privately owned lands are small land holdings (less than 400 hectares) and the rest is owned by the forest industry.

Private woodlots account for most of the wood that ends up at sawmills and pulp mills. According to the Nova Scotia Department of Natural Resources (NSDNR), private woodlots are being “over-harvested” in Nova Scotia. According to one 1997 NSDNR report, “overharvesting is a potentially serious problem demanding immediate attention...softwood harvests have exceeded the sustainable supply....The increasing demand for forest products is leading to the harvesting of immature stands that should form part of the future wood supply.”

Between the periods 1981-1985 and 1991-1995, the total amount of timber harvested in Nova Scotia increased by 43%. Most of this cut occurred on small private woodlots where the average annual harvest doubled over this same period. This trend is not ecologically, socially or economically sustainable in the long-term.

Another emerging trend in Nova Scotia is a dramatic shift in forest age structure towards ever younger age-classes. The most recent forest inventory (1999) indicates that nearly 70% of the province's forests are younger than 60 years of age. By contrast, forests over 100 years old account for only 0.15% of the province's total forest area, a 50-fold drop from 8% of the total in 1958. Old-growth forests are endangered and exist only in very small, isolated pockets. We are currently witnessing the disappearance of the natural site-evolved species, structure and age characteristics of the once dominant Acadian forest.

In addition, in the last two decades, the area clearcut has also doubled. In 1997 the area of crown and private land clearcut reached an all-time high at 68,718 hectares. This means that, on average, 188 ha (465 acres) of forest in Nova Scotia were being clearcut every day.

Today, 98.9% of forest harvesting in Nova Scotia uses clearcutting methods (including shelterwood). Volume 1 of these forest accounts indicates that clearcutting adversely affects soil and water quality, and degrades intrinsically valuable ecosystems that provide habitat for forest-dependent wildlife and aquatic species. At current harvest levels, clearcutting is also producing an overall loss in age diversity and shade-tolerant tree species. The quick removal of trees for short-term economic gain also has a negative impact on communities that rely on stable long-term employment.

In short, Volume 1 demonstrated that our current forestry practices have resulted in the substantial degradation of a valuable natural asset, in the loss of services that a forest ecosystem provides "for free" (as outlined in Chapter 1 of this Volume), and in an overall decline in the economic value of our forests.

In the midst of what Thomas Berry refers to as the "dark age of exploitation," there are, nevertheless, inspiring examples of a 'way forward.' -- of sustainable forest practices that can restore the value of the province's forests and leave a rich inheritance of natural wealth to future generations of Nova Scotians. The following remarkable stories were selected because these forestry operations protect the full range of forest values and are therefore sustainable in the long term. They provide working models for both large and small scale operators in the province and demonstrate a way to turn around the destructive practices of the past.

In all of the following case studies, the forest managers have adopted a long-term vision that considers all the values of the forest and all the costs of forestry practices. These costs include the costs to forest ecosystems, the costs to society, and the costs of foregone income in the short-term for the purpose of longer-term gains. These case studies demonstrate how present generations are paying the costs of a legacy of poor forestry practices in the past, and how current forest restoration efforts are investments of which future generations will be the primary beneficiaries. They also represent examples of what Berry refers to as the struggle to enter into an "ecological age."

Windhorse Farm, Pictou Landing and the woodlot of Jeremy Frith are examples of small woodlots in Nova Scotia where ecologically sustainable forestry and restoration forestry practices provide a model for other small woodlot owners in the province. Algonquin Park in Ontario and Menominee Tribal Enterprises (MTE) in Wisconsin are examples of large industrial operations that provide models of sustainable forestry practices that could be adopted by the large industrial forest companies operating in Nova Scotia. Finewood Flooring and Lumber Ltd. is an example of a very successful value-added wood products company in Nova Scotia that demonstrates how the number of jobs per unit of biomass harvested can be sharply increased.

It must be emphasized that sustainable forest management is *not* the whole answer to protecting the functions and value of Nova Scotia's forests. Even with the most careful harvesting techniques, forestry practices will have some impact on forest ecosystems. While there is an enormous difference between clearcutting and selection harvesting systems, they both involve the construction of roads and the removal of biomass. Therefore, no matter how admirable the following models are, they do not constitute a substitute for an adequate network of representative protected areas in Nova Scotia. In Volume 1, protected areas are separately described as an indicator of forest health. The focus of these case studies on harvesting methods must therefore be seen in the context of an effective protected areas strategy.

WINDHORSE FARM (CHAPTER 1)

Located in southwest Nova Scotia near New Germany, Windhorse Farm contains a rare 36-hectare remnant of the province's original Acadian forest that has never been cleared. Despite 160 years of logging, this hemlock-dominated forest retains its original sylvan magnificence and boasts trees as much as 450 years old. This extraordinary 36-hectare parcel is part of a 60-hectare holding at Windhorse Farm that includes 5 ha. of farmland and crops, and another 19 ha. of woodland that had historically been cleared for pasture but is now in active restoration.

While only 1.1% of Nova Scotia's forest area remains in the over-80-year-old age class, by contrast, trees over 80 years old dominate 90% of the 55 hectares of forest stands at Windhorse Farm. These old trees dominate 100% of the 36-ha. old forest, and 71% of the additional 19 ha. parcel that is being restored. Even though the Windhorse Farm forest has been logged every year since 1840, the volume, quality and value of wood not only remains undiminished, but has been enhanced, because the logging has been conducted according to ecological principles.

Jim Drescher, the owner of the woodlot, uses a technique called slow-grading, in which a tree is cut if it is slow-growing relative to nearby trees of the same species and if it has relatively high economic value. If it is one of a small group of slow-growing valuable trees, the whole patch of 4 to 5 trees might be cut, opening up a gap in the canopy that allows light to penetrate to the forest floor. Drescher says selection cutting mimics the natural disturbances (single and multiple tree fall) of the region. At Windhorse Farm, the tallest trees are never cut in order to ensure high canopy height and structural diversity within the stands.

The woodlot currently has 2 million board feet of trees over 8 inches in diameter. In total, over 8 million board feet have been cut since 1840 – a far greater volume than would have been obtained from the woodlot had it been clearcut every 50 years.

In total, Drescher harvests about 110,000 board feet of wood annually, some from his own woodlot and the rest from land belonging to neighbors. He purchases another 40,000 board feet and directly employs the equivalent of 7 full-time people at his sawmill and in the woods. According to Drescher, ecoforestry employs five times more people per unit of wood than do current industrial practices. "If Nova Scotia were to move toward an ecoforestry paradigm, we could double the employment on half the harvest."

Restoration costs paid today are the unpaid costs of past forest exploitation. As with any investment, says Drescher, costs go down when capital assets function at full capacity. At Windhorse Farm, he says, all forest stands are in various stages of restoration, and all profits are reinvested in forest restoration.

PICTOU LANDING FIRST NATION (CHAPTER 2)

Pictou Landing provides an excellent model both for landowners interested in restoring seriously degraded woodlots and for communities interested in gaining greater control over their forest lands. The Pictou Landing (PL) forests have been subjected to more than 300 years of land clearing, cultivation, burning, high-grading, and clearcutting. The large-sized, long-lived trees of the Acadian forest, like white pine, red oak and sugar maple, have all but disappeared. Today, the PL forests are dominated by short-lived, low value tree species.

PL forests are unusual in that they are owned and managed by the Pictou Landing First Nations Band, for the long-term economic, environmental and social benefit of the community. They are also unusual in that the forests are being managed to promote a similar tree species mix, abundance, and age class distribution as that which existed in this part of Nova Scotia prior to European settlement. To this end, low impact forestry practices have been adopted, including single tree selection, group selection, and shelterwood harvesting techniques. The harvesting systems employed favour the remnant, long-lived, shade and semi-shade tolerant tree species that were once dominant in the region.

While the economic benefits of forest restoration will only be realised well in the future, the social benefits for the Pictou Landing community are already beginning to be realised. They include:

- community control of forest management operations;
- optimizing hunting and wildlife-viewing opportunities for band members;
- restoring a sense of pride and accomplishment among community members;
- re-introduction and promotion of culturally valuable species, like black ash;
- training and employment opportunities in the woods; and
- provision of basic supplies, such as firewood and poles.

PL was recently recognized for its forest management practices by achieving Forest Stewardship Council (FSC) certification. The FSC is an international body that puts a ‘green’ stamp on wood products derived from forest management practices that adhere to strict environmental and socio-economic standards, and that protect Indigenous People’s rights. Pictou Landing is the first FSC certified operation in the province, the first certification in Canada held by a First Nations band, and only one of a handful of woodlots across the country holding the distinction of FSC certification.

JEREMY FRITH (CHAPTER 3)

After more than 200 years of high-grading, clearcutting and land clearing by prior owners, Jeremy Frith inherited a degraded, devalued woodlot of young, mostly even-aged forests. His woodlot is typical and largely representative of the condition of many Nova Scotia forests.

Frith embarked upon a management regime that utilizes the existing degraded forest to hasten the restoration of a healthy mixed forest. His long-term goals include:

- enhancing growth rates and standing timber volumes;
- increasing the health and insect/disease resistance of trees;
- creating product diversity to capitalize on timber markets when at their best; and
- leaving his land in much better condition than when he bought it – with more standing timber volume and value, and producing more oxygen, clean water, and abundant wildlife.

Early on, Frith ignored the advice of local forestry officials, who recommended converting his mixed wood stands to softwood monocultures. Frith knew that this would only increase vulnerability to pests, disease and other disturbances, and he opted instead for selection harvesting systems. Frith is convinced that selection harvesting is the only harvesting system that will enable the volume and quality of standing timber in the forest to increase continually, allowing for greater future harvested volumes and a steadily increasing canopy height.

The recurring theme in Frith's approach to forest management is his investment in the future. From pruning, to thinning, to reintroducing tree species once common to the region, to avoiding damage to residual trees - all of these activities are carried out with an expectation of future returns. Over the last 8 years, Frith has pruned spruce, fir, maple and birch, and thinned and removed poorly formed and suppressed trees. In 10-15 years, Frith hopes to begin harvesting white birch sawlogs at prices that greatly exceed those for spruce logs.

Frith argues that his woodlot is a better investment in time and effort than his RRSP: restoration forestry increases forest value directly by increasing canopy height, age and species diversity, and the proportion of valuable wide diameter, clear lumber. Restoration also has many indirect benefits, including the gradual improvement of soil quality and timber productivity.

MENOMINEE TRIBAL ENTERPRISES (CHAPTER 4)

The Menominee Indian Tribe in Wisconsin was recognized by the United Nations in 1995 for its expertise in sustainable forest management and the tribe was given the first ever U.S. Presidential award for Sustainable Development in 1996. Today, it is the only Native American tribe to have its forests certified by two Forest Stewardship Council-approved certifiers, SmartWood and Scientific Certification Systems.

The Menominee's 89,000 ha forest has been logged for 147 years and there is more wood there today than there was when the reservation was first established in 1854. The Menominee cut about 58 million board feet of timber last year and have harvested more than 2 billion board feet since cutting began in 1865. Yet the most recent forest inventory indicates a higher volume and quality of saw timber now than when the land was first surveyed.

Fifty percent of the harvesting that takes place in the Menominee forest uses the selection method, where only single trees or small patches of trees are cut. Highly regulated clearcutting is used in approximately 25% of the forests and the shelterwood method in the remaining 25%. Within any given year 3,240 ha are harvested using these various methods (less than 4% of the total forested area). Within the areas where selection methods are used, what gets cut depends on "vigor and risk." "If a tree is 30 inches in diameter and it's healthy and vigorous, we leave it alone," says Marshall Pecore, the Menominee Forest Manager. "Those that are risky, that won't be alive in 15 years when we re-enter that forest, they're removed." This "slow-grading" method has improved the quality of the Menominee forest.

More than 30 species of trees can be found in the Menominee forest, some as old as 350 years. The dominant forest cover types within the Menominee forest include northern hardwoods (maple, red oak and basswood), hemlock hardwoods, mid-tolerant hardwoods, pine stands (jack, white and red), aspen, scrub oak and swamp forest. As well there are countless species of wildlife. "We still have lots of things that there's a shortage of everywhere else. Hawks, songbirds, bears, butterflies – every time they come looking for them, they find them here," says Pecore.

In addition to the 89,000 ha of forested land, more than 240 km of rivers and streams move through the reservation and 123 lakes cover approximately 1,600 ha. These features, together with the surrounding forest, provide a wide range of ecological, social, recreational and spiritual opportunities for the Menominee as well as providing habitat for forest dependent species. SmartWood describes the Menominee forest as a “fully structured forest” and “arguably the most unique biological resource in the region.”

Of the 8,500 Menominee on and off reservation, 450 work in the sawmill, as loggers, or in the administration of the forestry center. Approximately 70% of those employed in the mill and other forest operations are Menominee Tribal members, and approximately 25% of the work force on the reservation is employed directly in forest-based industries.

Maintaining a sustainable harvest in the Menominee forest has been an economic and social challenge. On many occasions, the short-term economic circumstances of the tribe could have been temporarily improved by the liquidation of the forests. If the Menominee were to clearcut their forests today, the timber alone would be worth more than US\$700 million. However, the Menominee have resisted this temptation. Much like the Mi'kmaq of Pictou Landing in Nova Scotia, the culture of the Menominee has put constraints on the harvest of timber. For them, the liquidation of their forests is not a social or cultural option.

ALGONQUIN PARK (CHAPTER 5)

Algonquin Park is an example of a large-sized forest management operation on a scale comparable to many in Nova Scotia, but with a management approach that embodies ecologically, socially and economically sustainable forestry practices. As large operations, both the Algonquin Park and Menominee forest management systems provide a potential model for Stora Enso, J.D. Irving, Bowater Mersey, Kimberly Clarke, MacTara, and other large companies operating in Nova Scotia.

Since 1975, the Algonquin Forest Authority (AFA) has focused on restoring the quality of managed stands by practicing selection and uniform shelterwood harvesting, and by investing in silviculture activities like tree marking, stand improvement, planting, and manual cleaning.

For Algonquin Park, “the level of harvesting is based on what is sustainable over the long term. The wood supply available to industry is a function of sustainable forestry practices and is not influenced by industrial demand” (AFA 2001). In other words, the forest managers are not forcing the forest succumb to market demands, but are instead allowing markets to adapt to what the forest can produce over time.

One of the guiding principles of management in Algonquin Park is to “regenerate the forest to the appropriate species for a site” using “the most current scientific forest management techniques” (AFA 2001). Great attention is paid to the silvics (conditions for growth and reproduction) of individual tree species in order to promote the vigorous regeneration of preferred species as well as species best adapted to a site. Over the past 30 years, the AFA has not only maintained the proportion of shade tolerant hardwoods and softwoods in the park, but invested in their long-term health and improvement.

Algonquin Park is an example of how public pressure resulted in improved harvesting practices on publicly owned land. Public pressure has ensured that forest, water and recreational values are maintained for all park users, and that timber extraction is limited to specific areas within the park, at certain times of year, and by low impact harvesting methods. As a result, Algonquin Park has managed to sustain both a vibrant tourism industry, including high quality recreational and wilderness experiences, and a healthy

forest industry. This successful combination can be attributed in part to the management systems adopted by the Algonquin Forest Authority, which “almost always mean that trees remain standing on the land at all times, and many people would be hard pressed to realise that logging had even taken place in most areas just a few years later” (Strickland 2000). Flying over the park today, an observer has difficulty distinguishing cut areas from uncut areas.

One of the AFA’s most distinguishing features is its openness to public input and participation, both in the Authority’s structure and in its actual management processes. A local citizens committee has been established to assist the planning team in the preparation of Forest Management Plans. Plans are also available for public review, and the Algonquin Forest Authority hosts open house sessions to invite public input into Plan preparation.

The key to accommodating all the various users of Algonquin Park is a well-designed land use plan that separates activities both spatially and temporally. The entire park is zoned for different land-use activities. Forest management activities are only permitted within the recreation/utilization zone. Almost nineteen percent (18.8%) of Algonquin Park is protected from logging activities in wilderness, nature reserve, and natural environment zones. An additional 21% is protected in reserves for watercourses, non-productive forestland, non-forested areas, and islands.

After only 25 years of careful and responsible management, Algonquin Park is already producing higher-grade lumber while continuing to enhance the value of the park’s standing timber. One sawmill owner, who is now starting to receive logs from areas cut 20 years ago, has reported that mills are now sawing a much higher proportion of valuable, higher grade logs (47% ‘number one common’) from the managed hardwood stands. Ten years ago, the same mills were experiencing ‘number one common’ and better yields of only 25%. As Jeremy Frith (above) noted on a much smaller scale, a responsible investment and restoration approach to forest management enhances the longer term economic value of the forest.

The Algonquin Park harvest methods and employment patterns contribute significantly to local community stability and resilience, providing steady and reliable employment opportunities for local residents year after year. By contrast, clearcutting has created high unemployment among many forest-dependent communities in Canada which have lost their resource. Over 280 people are employed steadily in forest operations in Algonquin Park, and at least 1,800 people are employed in the 7 sawmills, 2 veneer plants, one pole plant, one pulp mill, and one oriented strand board mill that receive wood from Algonquin Park. The employment opportunities created by the forest industry in Algonquin Park have occurred primarily within the communities immediately adjacent to the park. All the mills and plants that process wood from Algonquin Park are located within 50 km of the perimeter of the park.

Investments in the quality of forest stands, and in the variety of products derived from forests have given Ontario the best record among forest industries in Canada for ‘living off the interest’ of forested natural capital assets. Ontario has the highest value-added per cubic metre of wood harvested of any province in Canada: in 1997/8, Ontario’s value-added was \$273/m³, compared to Quebec at \$204/m³, New Brunswick at \$122/m³, British Columbia at \$110/m³, and Nova Scotia, at \$82/m³.

FINWOOD FLOORING AND LUMBER LTD. (CHAPTER 6)

Finewood Flooring and Lumber Ltd. on Cape Breton Island, Nova Scotia, was built by Peter and Candace Christiano with private financing in 1982. A drying kiln on the site produced 300,000 board feet of dried, graded hardwood lumber. To make the enterprise economically viable, the owners realised they had to

make a finished product. By 1984 they were manufacturing hardwood flooring, and by 1985 they had entered into the trim and molding markets.

One of the goals of sustainable forest use is to reduce the quantity of wood harvested without reducing the economic value of the forest and forest products and the employment they provide. The goal at Finewood is to add value per unit of biomass harvested in order to get the maximum value from each cubic metre of wood harvested.

Through manufacturing, Finewood Flooring adds 10 times more value per unit of wood harvested than the local pulp mill owned by Stora Enso. For example, pulp and paper revenues are approximately \$118 per m³ of wood, compared to Finewood's finished products, which fetch an average of CDN \$1,200 per m³ on the domestic market and CDN \$1,600/ per m³ on the foreign market.

In addition, for every 1,000 cubic metres of wood processed, Finewood Flooring directly employs approximately 10 people full-time, whereas the pulp and paper industry produces only 1.4 jobs for every 1000 m³ of wood processed.

Finewood Flooring has experienced 20 –30% growth over the last three years and currently exports 60% of its product, a testimony to its economic viability and to the great potential for enhancing both employment and the economic contribution of Nova Scotia's forests while reducing the harvest to sustainable levels.

CRITERIA FOR CHOOSING THESE CASE STUDIES

The key to ecologically-based forestry is that any manipulation of a forest ecosystem should try to mimic the natural disturbance patterns that were dominant on the landscape prior to extensive anthropogenic disturbance. Ecological forestry practices also maintain the integrity of natural patterns and processes, even when it becomes financially difficult or inconvenient to do so. Ecological forestry means harvesting wood without compromising the wide range of vital ecological services provided by a forest and without undermining the natural systems that allow the forest to function effectively in all its aspects. This approach maintains the long-term ecological, social and economic values of a forest.

GPI Atlantic recognizes that all forestry operations will have some level of impact on forest ecosystems. Even with selection logging operations, biomass is removed and roads are built. However, these case studies provide examples in which the maintenance of ecological integrity is paramount, in which the impacts of forest practices are explicitly recognized, and in which efforts are made to minimize these impacts. Clearly, the best way to protect the full-range of forest values is to establish protected areas, where there is little, if any, human alteration of the landscape. Conservation biologists argue that a 30% protected set-aside is essential to maintain forest biodiversity. However, if logging is to take place, then the case studies in this Volume are testimony to the possibility of harvesting wood products in such a way as to minimize the negative impacts while sustaining viable forest-dependent communities.

In sum, the six case studies in this Volume all met the following criteria:

- ❑ The key to ecologically-based harvesting is to harvest wood without compromising the ecological services and systems of a forest, thus maintaining the ecological, social and economic values of a woodlot.

- ❑ Any manipulation of the forest ecosystem should emulate the dominant natural disturbance patterns of the region prior to extensive anthropogenic alterations, i.e. the forest conditions prior to European settlement.
- ❑ Forest practices overall protect the integrity of naturally developed ecosystems and promote tree and wildlife species in terms of distribution, abundance, age structure and individual quality, genetic diversity, and fitness.
- ❑ Forest practices are geared toward maintaining the native ecological integrity of the forest based on forest conditions prior to European settlement.
- ❑ Efforts are made to maintain or improve forest ecosystem health in ways that recognize the multiple uses of a forest.
- ❑ Forest practices are sustainable for present and future generations.
- ❑ Communities surrounding the forest are sustained by stable, long-term employment.
- ❑ Harvesting is accompanied by an increase in the quality and volume of wood grown over time.
- ❑ Harvested timber volumes are consistent, stable and justified.
- ❑ Efforts are made to increase the value per unit of wood (value-added), and therefore the jobs per unit of biomass harvested.
- ❑ Efforts are made to restore the natural ecological integrity of degraded forestland.
- ❑ Attempts are being made to internalize the real human and ecological costs of forestry.
- ❑ Forest operations are locally owned and controlled by members of the community, ensuring that costs and benefits are accounted for locally and thus internalized to a greater degree.

It will be recognized that, in almost every instance, these principles and practices stand in sharp contrast to those that currently dominate the Nova Scotia forest industry and that have resulted in the serious degradation of the province's forests described in Volume 1. In particular, the two-fold increase in clearcutting in the 1990s has degraded Nova Scotia's forests at a more rapid rate than at any previous time in the province's recorded history, and sharply diminished the province's natural wealth. Restoration forestry, accompanied by a "moratorium" on current practices will, in the long term, bring back the forest's natural capital and gradually rebuild its value.

The case studies described in this report are examples of operations that are now paying the costs for past practices that have degraded forest values. They also provide evidence that some benefits of current restoration efforts can be realised within 10-25 years, but that, for the most part, restoration is a long-term investment, the benefits of which will be enjoyed primarily by future generations. In the words of Wendell Berry:

"A forest makes things slowly; a good forest economy should therefore be a patient economy. It would also be an unselfish one, for good foresters must always look toward harvests that they will not live to reap."

The case studies adhere to the approach, framework and indicators in Volume 1:

The case studies follow the description and valuation of forest functions and services outlined in Volume 1 of these GPI forest accounts. In other words, they are literally micro-level case studies of principles, indicators, and practices previously applied on the provincial level. This approach has the disadvantage of lengthening this report by repeating the description of each forest function in each case study, but it has the advantage that any one case study can provide the reader with a window on the overall framework and approach of the GPI forest accounts.

The fundamental approach of the GPI natural resource accounts as a whole is to assess the health of a resource in accordance with its capacity to perform all of its functions optimally and effectively. Thus, a

healthy forest is one that protects soils, watersheds, biodiversity, and habitat for wildlife; regulates the climate; sequesters carbon from the atmosphere; and provides timber, employment, recreational opportunities, and other services to human society. The case studies that follow adhere to this approach and framework, in order to illustrate the extent to which sustainable harvesting practices protect and promote the capacity of forests to perform their varied functions effectively.

In an attempt to adhere to the structure and indicators presented in Volume 1, the reader will therefore find some degree of repetition in these case studies, as some evidence is relevant to different indicator sets. Indeed, the same evidence (for example, age structure) may be an indicator of effectiveness for several different forest functions. Because we are still at an early stage in the development of natural resource accounts, GPI Atlantic has opted for repetition at the expense of elegance of presentation, in order to retain transparency in presenting the specific evidence on which all conclusions are reached.

Part II of this Volume also explores the implications of the six case studies for forest policy in Nova Scotia, and contrasts the evidence from the case studies with the impact of current forest practices, including the reduced value of lumber under clearcutting systems. It also examines the implications of the evidence for employment in the forest industry, for mechanization, and for the potential incentives and disincentives that can be offered by governments to reduce the current level of environmental damage.