
"Turbulence in the Woods: A History of Canada's Forests & Forest Sector, 2000-2050"

Scenario C
(one of four scenarios)

prepared by the

Forest Futures Project
Peter Duinker, Project Manager
Sustainable Forest Management Network
University of Alberta
Edmonton, AB

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Comments are welcome!

Please send them to Peter Duinker (peter.duinker@dal.ca)

http://www.sfmnetwork.ca/html/forest_futures_e.html

Summary: Can Canada and Canadians be proud of their forests and the forest sector at this halfway point of the 21st century? Have we moved smartly along the road to sustainability? Are we better off, forest-wise, than we were in 2000? The forest sector has been able to make good on rather few of the issues of the day in the 1990s and 2000s. Forest ecosystem diversity is shameful. Climate change is overwhelming all types of ecosystems. Despite strong global timber and forest-products markets, Canada is a marginal player on the world stage. The energy situation has brought new emphasis to bioenergy. Local and community-based input and control on forests has waned in light of a strange return to a kind of forest feudalism. Abundant conflicts occurring in and over the woods are rarely peacefully resolved - strife is the order of the day. Aboriginal communities are worse off politically and economically. All in all, one could long for a return to the conditions of 2000 - most indicators were more favourable at that time. The future can only get better - we hope!

2000-2050 Trends at a Glance - Drivers

Climate Change	<ul style="list-style-type: none"> - huge warming, well beyond the range of adaptability for most sectors - serious droughts in the prairies; more large storms in Eastern Canada - much less snow across all of Canada; 40 cm rise in sea level - evapotranspiration way up, lower lake levels and reduced river flows nationwide
Geopolitics	<ul style="list-style-type: none"> - increased conflict and international hostilities - Amazonia war (2030s) and ongoing Arctic cold war - UN of little influence
Global Energy	<ul style="list-style-type: none"> - twofold increase in real price of fossil fuels; rampant consumption - large increases in nuclear and renewable energy as well - Canada uses a lot of forest bioenergy, especially hogfuel
Air Pollution	<ul style="list-style-type: none"> - increased due to higher consumption of fossil fuels and climate change - more-frequent and more-serious ozone and smog episodes - heavy metals and mercury depositions dangerously high
Invasive Species	<ul style="list-style-type: none"> - huge increase in invasive alien species in the forests - many are ravaging forests, resulting in widespread forest declines
Global For Prod Demand	<ul style="list-style-type: none"> - strong growth in consumption of most wood-based products - fluctuating prices because of unstable roundwood availability - plantations around the world have had mixed results
Technology	<ul style="list-style-type: none"> - concept of wood refineries has flourished (needed due to unstable wood supply)
Industry Profitability	<ul style="list-style-type: none"> - mixed; lots of commodity-specific ups and downs - biorefineries doing comparatively well - investments dominated by energy (petroleum) interests
Demographics	<ul style="list-style-type: none"> - Canada grew from 30.9 to 59.8 million people - growth due to immigration as well as rising birth rates - continued urbanization, with huge growth in small to mid-size cities
Societal Values	<ul style="list-style-type: none"> - continued consumeristic society; individualistic behaviours; low volunteerism - long-time residents depressed and recent immigrants upbeat about Canada - people focus on urban and peri-urban forests, and ignore hinterland forests
Governance	<ul style="list-style-type: none"> - widespread experiments with community forests gave way to timber baronism - comparatively weak forest regulations by provincial governments - few changes in forest-land ownership
Aboriginal Empowerment	<ul style="list-style-type: none"> - no real progress on political or economic empowerment - Aboriginal peoples feeling disconnected from the climatically ravaged landscape - Aboriginal peoples experiencing cultural discontinuity - Aboriginal peoples strongly urbanizing, with trends toward assimilation
Conflict over Resources	<ul style="list-style-type: none"> - active users of forest lands are frequently at conflict - many conflicts characterized by minor acts of violence - many conflicts remain unresolved and fester away - this erodes any sense of community in many rural areas

2000-2050 Trends at a Glance - Responses

Biodiversity	<ul style="list-style-type: none"> - 12% of all forests formally protected (9% in timber-productive forests) - climate change has invalidated all models of biodiversity conservation - generally young degraded forest across Canada - many more forest species at risk; several high-profile extinctions
Ecosystem Condition and Productivity	<ul style="list-style-type: none"> - greatly impoverished ecological integrity - hugely increased levels of disturbances - ubiquitous forest regeneration failures, modest investments to restore forests
Water and Soil	<ul style="list-style-type: none"> - widespread water quality and quantity problems, due mainly to climate change - forest soils are stressed nationwide, due to a wide range of pressures
Carbon Cycles	<ul style="list-style-type: none"> - most forests in Canada are strong sources of atmospheric carbon
Amenity Values	<ul style="list-style-type: none"> - heavy recreational use of near-urban forests; low use of hinterland forests - most people's attentions are turned to urban forests - these are highly valued
Participatory Processes	<ul style="list-style-type: none"> - continuing wide range of opportunities for participation in forest decisions - however, few people get involved, given the neo-feudal decision-making - increasing public involvement in urban-forest decision-making
Forest Employment	<ul style="list-style-type: none"> - numbers of traditional forest jobs increased, but lots of fluctuations - increases in forest jobs related to urban forests
Wood Harvests	<ul style="list-style-type: none"> - annual industrial harvest nationwide up from 180 to average 280 million m³ - huge fluctuations in annual harvests - range is 180 to 330 million m³ - 2045-2050 - annual harvest down to 150 million m³ - a new Royal Commission is investigating the wood-supply crisis
Wood-processing Industries	<ul style="list-style-type: none"> - dismal period 2000-2020, but industrial fortunes picked up since - bioenergy production is the main contemporary winner - wood-supply fluctuations mean ongoing mill closures; hard on communities
Non-Wood Forest Products	<ul style="list-style-type: none"> - production flat due to deteriorated forest health - harvest levels up only by Aboriginal communities - sustainability of harvests of heavily used species is in question
Markets for Forest Services	<ul style="list-style-type: none"> - carbon markets exciting for some time, now have disappeared - water markets have emerged and become quite vibrant; good water is scarce! - biodiversity markets much discussed but never materialized

(Note: text in italics is common to all four scenarios)

C1. Introduction

Canada has long been described as a forest nation. For ages before Europeans arrived to settle in North America, Aboriginal peoples exercised strong relationships with the land. For many, the forests were the lifeblood of economy, society and spirit. Over recent centuries, settlers from Europe built up a series of wood-using enterprises based on Canada's forests, making Canada one of the world's top producers and exporters of wood-based forest products through much of the 20th century.

In this year 2050, marking the half-way point in the 21st century, what can we say about the kinds of changes we have witnessed in Canada's forests and forest sector since 2000? For long-time observers, the changes have been most interesting, and some surprising. Unfortunately, many of the changes have not been positive. As discussed below, Canadians by and large do not seem overly concerned about the sorry state of Canada's forests today.

The purpose of this paper is to summarize trends and developments in Canada's forests and the forest sector during the period 2000-2050. We have based our account partly on the data sets assembled through provincial state-of-the-forest reporting exercises and the Canada Forest Information Program (CFIP), and partly by interviewing a few dozen forest-sector old-timers who have followed developments closely as far back as the turn of the century. The trends and developments are first put into the context of a suite of major drivers of change, followed by synopses of key indicators commonly used to track the Canadian forest and forest-sector situation.

C2. Drivers of Change

To understand how and why the Canadian forests and the forest sector have changed so dramatically in the past fifty years, we shall examine a suite of major agents of change that act upon the forests and forest sector. Below we look at a dozen such drivers, charting their paths over the past five decades and inquiring into the ways in which each driver has influenced the Canadian forest and forest-sector scene.

C2.1 Climate Change

Al Gore and the Intergovernmental Panel on Climate Change may have received the 2007 Nobel Peace Prize for their work on understanding and communicating climate change, but that and other similar efforts were of little help in slowing down the runaway climate. As Gore said at the time of the receiving the prize, global warming is "the greatest challenge we've ever faced." He was right. Unfortunately for everybody, the actual changes in climate have more or less mirrored the predictions of largest conceivable change as envisaged back in the early 2000s. This has been due to two factors: (a) underestimates of the role of non-CO₂ greenhouse gases (such as methane) and overestimates of the role of oceans in absorbing CO₂; and (b) little

progress in shifting the world economy off fossil-based fuels and onto non-fossil sources. Constant bickering over the Kyoto Protocol continued through the first quarter of the century. Progress under the replacement agreement, known as the Sydney Protocol and signed in 2026, has been little better. Thus, changes in Canada’s climate have been dramatic (Table 1). Of most serious implication for Canadian forests are:

- (a) the hugely increased mean winter temperatures, which have led to dramatic reductions in snow packs and length of time the ground is snow-covered (especially in central and eastern Canada);
- (b) the increase in hot summer days, which has led to severe droughts across the country, and seriously worsened the effects of high-ozone days in urban areas;
- (c) the increase in high-rain events, which is increasing the rates of erosion and flash floods in all parts of the country; and
- (d) the increased numbers and intensity of storms, particularly in Atlantic Canada; huge blowdowns occur pretty much every year in some part of Canada.

The hoped-for productivity gains, based on the notion that trees should grow faster in warmer conditions and with higher atmospheric CO2 concentrations, have not materialized. Trees everywhere - especially in rural farmed areas and the broad forested landscapes across Canada - are severely stressed. Regeneration in the drier parts of Canada has become increasingly problematic. And even when the trees can be re-established successfully, fires are so frequent that multiple attempts at regeneration are commonplace.

Table 1. Regional changes in key climate variables. Changes are defined as means for the period 2040-2050 minus means for the period 1990-2000.

Climate Variable	Region of Canada						
	BC Coast	BC Interior	Prairie Provs	North ON & QC	South ON & QC	Maritimes	NL
Mean Jan Temp	4 C incr	6 C incr	8 C incr	10 C incr	8 C incr	6 C incr	4 C incr
Mean Jul Temp	2 C incr	4 C incr	6 C incr	6 C incr	4 C incr	3 C incr	2 C incr
Days over 35C Max T	100% incr	100% incr	100% incr	200% incr	200% incr	100% incr	100% incr
Total Precipitation	10% incr	no change	20% decr	no change	no change	10% incr	10% incr
Prop. Precip as Snow	50% decr	70% decr	70% decr	80% decr	80% decr	80% decr	60% decr
Large Precip Events	100% incr	100% incr	100% incr	100% incr	100% incr	200% incr	100% incr
Wind-storm Events	100% incr	40% incr	40% incr	40% incr	40% incr	100% incr	100% incr

C2.2 Geopolitics

Since 2000, the world seems to have lost much of its post-WWII stability and order. Due to a combination of factors including climate change, resource scarcity, population growth, religious intolerance and continued economic disparity among nations, international hostilities have steadily risen. Most notable among the conflicts, as history is sure to tell, were: (a) the so-called Battle of the Amazon (2036-2041) in which five South-American countries and a host of troops from other countries waged dirty warfare over jungle resources; and (b) the Arctic Conflict (2023 and ongoing), with Canada, Russia, the USA and Fennoscandia constantly threatening heightened aggressive tactics as they each try to secure shipping and sub-surface rights. Indeed, the latter has become a kind of 21st century cold war. The UN, trying as it might to hold things together, is more or less impotent in world affairs. International trade in particular has evolved into strange patterns unforeseen even twenty years ago.

C2.3 Global Energy

Since the turn of the century, real energy prices - in fossil-fuel equivalents - have tripled. Despite calls in the 2000s for dramatic reductions in fossil-fuel use, global consumption of energy has actually skyrocketed. Oil, gas and even coal are doing well in all markets around the world. Nuclear and renewable energy projects have also increased dramatically, but the world appetite for energy has grown so substantially so that these non-fossil sources are not substituting for fossil fuels.

The rise in wood use for bioenergy has been nothing less than remarkable, also driven by society's insatiable craving for all types of energy. While bioenergy still makes a minor contribution to Canada's total energy picture (ca. 8-10%, depending on whose numbers one uses), it is very important in the overall pattern of forest use. Huge amounts of salvage wood go to the bioenergy industry, and fibre from the woods is so valuable that minimal amounts of residue are left within the forest. Concern over food security has led to provincial and federal regulations that have the effect of keeping agricultural crops largely out of the bioenergy cycle. As discussed below, this has not been a problem because of breakthroughs in technology to convert lignocellulosic materials into a diverse range of fuels. No doubt Canadian farmers would have been livid about the regulations had the prices for food crops not risen sharply at the same time.

C2.4 Air Pollution

Despite strong and successful efforts to control air emissions from fossil-fuel-burning machines, power plants and buildings, the huge and growing numbers of such emitters has led to a situation of worsening air pollution in Canada. Sulphur and nitrogen deposition in rural forested Canada are of less concern than heavy metals and mercury on one hand, and smog-forming chemicals in urban areas on the other. Climate change - particularly temperature extremes - has made ozone episodes in southern Ontario and Quebec much worse and more numerous. Overall, the forests of Canada, whether urban, rural or wilderness, are under continuing and growing stress from air

pollutants. This can be said with some confidence even though the manifestations of each kind of pollutant stress are highly uncertain. What seems clear is that the cumulative negative effects of the full range of pollutants, in combination with climate change, are indeed significant.

C2.5 Invasive Species

The ravages of invasive species on Canada's forests of the 20th century - foreign ones such as Dutch elm disease and beech bark disease, and domestic ones such as the Eastern spruce budworm and the mountain pine beetle - pale in comparison with the situation in the first half of the 21st century. Invasives add insult to the ongoing injury of climate change. Even with a huge boost in funding in the 2020s, the Canadian Invasive Alien Species Agency (CIASA) has been fully unable to stem any population increases and migrations of invasive species. The emerald ash borer, coming into southern Ontario at the turn of the century from the USA, decimated ash populations across Eastern Canada. On the east coast, the brown spruce longhorned beetle, discovered in Halifax at the turn of the century as well, has established itself at nuisance levels across the Acadian forests of the Maritime provinces. On the west coast, the green fir short-eared sawfly, found first in Stanley Park in 2032 and suspected to have arrived in shipping materials from east Asia, was found last year as far east as northern Manitoba. The mountain pine beetle, which ravaged BC and AB pine forests through the 2000s and 2010s, resurfaced in the 2030s and is munching happily through most of the pine regenerated after the last outbreak.

C2.6 Global Forest Products Demand and Wood Supply

Global consumption of roundwood has risen sharply since 2000, from 3.3 billion m³ to 4.6 billion m³ today. This is explained by a number of factors including the rising global population, some buoyant economies on most continents, a broadened set of uses to which wood is put (both high- and low-tech), and a growing application of wood in various energy cycles. At the same time, global wood supply, in aggregate, has also increased. However, its quality and regularity of availability have diminished. The temporary bump-up in wood consumption in the early 2020s came from the worldwide climate-related tree death, putting huge amounts of additional wood on global markets. The effects of climate change overall are being felt around the world, and the need to shorten rotations and undertake salvage harvests has meant that location-specific demand, in the short term at least, is easily met from local to regional supplies.

Forest management in Canada has become challenging, particularly on extensive landbases where growth is slow and interventions into forest stands are few and far between. Despite the diminishing land base dedicated to timber production (due to climatic inhospitability in western Canada, expansions of agriculture into previously wooded land in Ontario, Quebec and the Maritimes, and expansion of protected areas in the north), Canadian wood-harvest levels are still high, but they fluctuate considerably from year to year because of salvage-harvest requirements. As noted later, the wood-supply crash of the past few years will have serious repercussions for the industry.

C2.7 Technology

While technological advances permeate the entire economy and society, none has been more transformative on the forest economy than bioenergy and biomaterials technology. The wood-processing sector has had to become accustomed to large fluctuations, sometimes even from year to year, in the quality and quantity of wood fibre available to the mills - climate change and other ravages on the forests are to thank for that. It means that the solid-wood sector has become a sort of fractionation process that allocates the roundwood to its highest-value commodity use. The residues are then utilized by a rejuvenated former pulp-and-paper industry that operates large biorefineries producing energy materials and biomaterials to meet North American market needs. Particularly advanced are the biorefineries set up in Prince George, BC (2022) and Grand Falls, NL (2028).

C2.8 Industry Profitability

The transition of the traditional forest-sector companies of the 2000s and 2010s toward the bioeconomy was painful, but the companies that survived seem to be doing well. Part of this stems from continued globalization and ownership concentration. Alberta's oil patch brought huge sums of money to bail out much of the pulp-and-paper sector and transform the mills into biorefineries, so much so that fully 63% of the chip-processing capacity in Canada is now owned by petroleum interests. Because overall wood-harvest rates are up (see below), the contribution of Canada's forests to national GDP has risen as well.

C2.9 Demographics

Canada's population grew from 30.9 million in 2000 to 59.8 million people today. During the half-century, birth rates have been rising and now exceed replacement levels. Particularly high birth rates are evident in the Aboriginal populations of Canada as well as the recent waves of immigrants from Africa and Latin America. Both ethnic and environmental refugeism in the 2020s through the 2040s gave Canada influxes of new residents well over half a million people a year.

Where are all the new residents living? As expected, the three largest urban concentrations in Canada - Vancouver, Toronto and Montreal - all grew tremendously. For example, the Greater Toronto Area was at about 6 million people in 2000, and now is home to 11 million. But the greatest proportional growth has been in Canada's smaller cities and former towns that have become cities in their own right. Due to continuing air-quality problems in Toronto and Montreal, the frequent unbearable heat waves, and the continuing marginalization of smaller rural communities, people have become far more attracted to living in the smaller cities with more northern or maritime climates. Some examples of the population growth of selected Canadian cities from 2000 to 2050 (figures are in thousands of people): Corner Brook, NL - 20 to 48; Halifax, NS - 360 to 659; St. John, NB - 70 to 135; Riviere du Loup, QC - 18 to 52; Timmins, ON - 43 to 91; Kenora, ON - 16 to 46; Prince Albert, SK - 34 to 53; Grande Prairie, AB - 36 to 156; Prince George, BC - 72 to 180.

Speaking of marginalization of rural forest-based communities, many of them have experienced

such boom-and-bust cycles in the past few decades that they could not survive. Not since the Great Depression of the 1930s has Canada witnessed such abandonment of rural communities. Where some stalwart residents have chosen to stay and try to make a go of things, those communities exude a threatening feel to travellers passing through.

C2.10 Societal Values

What are Canadian citizens like today compared to 2000? Can we observe any differences in their values, attitudes and behaviours? The University of Moncton's Demographic Research Institute (DRI) has been studying these questions since the 2020s. Its most recent annual report (2049) focussed on what Canadians are thinking, especially about the environment and natural resources. It seems that there are two distinct groups of Canadians. One is the people born in Canada, who are generally quite depressed about the environmental and socio-political trends - climate change and continued urban population growth are bringing an unwelcome instability in their lives. The other group is the immigrant population. Most of them are upbeat because they know and experienced horrid conditions in their own countries and living in Canada is very good by comparison. They had not known this great country in the early part of the century.

Consumerism is alive and well in Canada. A doubled population has meant a concomitant increase in manufacturing needs, food production, forest-products demand, and other industrial developments. We are still a car-based society, so liquid fuels are in ever-increasing demand. Other trends include lower rates of volunteerism as well as widespread cynicism about participation in advisory processes convened by government and industry.

The DRI studies have also shown that urban Canadians by and large think mostly about their urban and peri-urban forests, which they cherish for amenity values and environmental services but not wood and wood products. While absolute amounts of visitation to distant rural forests have risen slightly, on a per-capita basis these rates have fallen considerably. Following the brilliant lead of Parks Canada in the 2010s, most cities now have Green-MAX edutainment complexes where people delight in taking virtual tours of distant forests, be they national parks or timber-producing plantations.

C2.11 Governance

Scholars at the UBC forest-policy think-tank known as Forest Scholarship Centre (FSC) recently described the forest-governance situation in Canada as neo-feudal. Quite contrary to the wishes of the forest industry, provincial governments experimented on a grand scale in the 2020s and 2030s with transfer of Crown-forest management responsibilities to local interests such as municipalities. It was thought that the concept of community forest, widely lauded in socialist academic circles at the turn of the century as the only way to secure sustainable forests across the country, would emerge from this transfer of authority and responsibility. These hopes were dashed as community after community let their respective forest administrations devolve into fiefdoms for wood-harvesting contractors and other timber entrepreneurs. Forests across Canada are in such a sorry state due to climate change and other stressors that people seem to care little

for them, and they are “managed” largely by timber barons. Forest historians at the University of Mattawa claim that it feels like a return to the forest regimes of the early 1900s. One thing about the new regime, though, that keeps the industry as happy as it is possible to keep it these days - the governance shifts of the past decades have kept wood flowing into the economy in abundance.

Through all the forest-governance changes noted above, the forest-land ownership patterns have changed little (Table 2). Of most significance is a considerable transfer of forest ownership to Aboriginal communities across the boreal north - they now own some 3% of Canada’s forests. Unfortunately, the amount of land thus transferred is still too small for each Aboriginal community to make a real go of commercial forest enterprises. Some have succeeded, but the Aboriginal forest authorities are behaving much like their non-Aboriginal counterparts.

Table 2. Proportion of total forest land (excluding urban forests) by ownership category.

Year	Ownership Category				
	Federal	Provincial	Private	Community	Aboriginal
2000	23	71	6	0	0
2010	23	71	6	0	0
2020	22	70	6	1	1
2030	22	69	7	1	1
2040	22	67	7	2	2
2050	22	64	9	2	3

C2.12 Aboriginal Empowerment

The 21st century has so far not been kind to Canada’s Aboriginal peoples. Most of the court decisions over land claims and other resource issues in the 2010s and 2020s were not in their favour. Progress with land claims has been pathetic, and changes to the Indian Act have been marginal at best. Despite gains in land ownership, as mentioned above, Aboriginal communities are still struggling economically. Most Aboriginal communities have witnessed incredible population growth, putting great strain on facilities and services in their towns and villages and exacerbating poverty. The decline in forest health due to climate change and other stressors hasn’t helped - Aboriginal people who want strong ties to the land for their livelihoods and socio-spiritual health are finding the pace of forest change too much to deal with.

The only positive side to the condition of the forests is that Aboriginal people have been able to capture some of the jobs associated with salvage harvests. Overall, there is a general sense of resignation among Aboriginal people. They express feelings of intense cultural discontinuity - links to their past are rapidly vanishing. There seems to be renewed interest, after many decades otherwise, in gradual assimilation of Canada’s Aboriginal peoples within the dynamic and increasingly diverse matrix of people in the country. This will become increasingly easy to

accomplish with the steady migration of Aboriginal people out of their rural communities into Canada's growing cities.

C2.13 Conflict over Resources

Several factors have coalesced to produce a situation of tense relations among users of forest space. Population growth has put enormous pressure on forests at the edges of cities. Oil and gas interests (especially in AB and SK as well as NS and NB), as well as mining companies and hydro-electric utilities (especially in BC, MB, ON, QC and NL) are successfully vying for land-use rights in hinterland forests. Agriculture too has expanded, particularly for crop production in the vast clay belt of northeastern ON and neighbouring areas of QC, as well as for grazing rights in forests across western Canada. It is a good thing that the Master of Alternative Dispute Resolution program at University of Victoria expanded to take in 60 students per year - all the graduates get good jobs upon completion, and there are still not enough mediators to service demands for conflict-resolution practitioners.

C3. Evolution of Canadian Forests and Forest Sector

Forest analysts worldwide have developed systems of tracking the state of the forests and forest sector with sets of so-called criteria and indicators. Original sets for Canada were developed in the 1990s under the auspices of the Montreal Process and the Canadian Council of Forest Ministers. The C&I systems have evolved significantly during the past half-century, but the basic structures have remained intact. Here, we examine how Canada's forests and forest sector have responded to the driver forces described above and to the various policies put in place since 2000.

C3.1 Forest Ecosystem Sustainability

C3.1.1 Biodiversity

All biodiversity indicators associated with Canada's forests have shown impoverishment since 2000. This is indicative of unsustainability in its own right, but Canadian forests were not in great shape in 2000 either, so we've gone from bad to worse. We managed to get to the 12% protected-area targets set by provincial and the federal governments, but the changing climate has nullified any biodiversity-conservation functions of parks and wilderness areas. Canada's Species at Risk Act was a good thing when it was passed at the turn of the century. However, the considerable conservation activity it spawned in the 2000s through the 2020s has not been able to stem the rise of numbers of forest-dwelling species at risk. Fourteen went extinct between 2020 and 2045, and more than 300 species that were previously not on any risk lists have by now been listed. Alongside COSEWIC, each province now has its own council on species at risk to handle the increase in cases.

In sum, we have what is fairly described as a young degraded forest across Canada. As a consequence, Canada lost any positive image it might have had on the world stage as a forest

conservator. What few international discussion forums were still ongoing after the Global Convention on Biological Diversity was abolished in 2027 saw Canadian participants suffering great criticism. Cries of “don’t shoot the messenger” went unheard, and Canada thus stopped all participation in the UN Food, Forest, and Fish Organization in 2041.

C3.1.2 Ecosystem Condition and Productivity

In terms of the ecological integrity index (EII, developed in 2029), we can only extend our reach back to 2030 because we lack the appropriate measurements to calculate the index. However, the last twenty years of EII calculations show a depressing reduction in the index from 685 EIU to 319 EIU today. Most components of the index have contributed negative influences during the period. Climate change is mostly to blame, but the way timber producers have been harvesting the forests (plenty of “cut and run” incidences) and forest managers have been shortening rotations as an adaptation measure have led to a relatively young and beleaguered forest.

As for forest disturbances, these are among the most significant EII components driving forest impoverishment. Rates of fire, diseases, insects and windthrows are up dramatically because of climate change, far beyond what were determined to be within the range of natural variation in the 2000s. The pattern of increased forest disturbances is not uniform across Canada. Fires and insects dominate the forest carnage in western Canada, whereas insects and windthrow ravage trees in the east. Windthrow is especially acute in the Maritimes, and salvage harvests are critical in reducing fire and insect hazards. Forest regeneration failures are common right across the nation, and increased forest-protection measures such as fire suppression and spraying for insects have been largely meaningless.

C3.1.3 Water and Soil

In the early 2000s, water was widely cited as the main resource and environmental issue of the 21st century. So it is today, but governments at all three levels in Canada have been unable to resolve most water quantity and quality problems. A number of factors lie behind this situation, but again climate change is the overwhelming culprit. Riparian management guidelines, untested when prepared and implemented some decades ago, have proven today to be inadequate for watercourse protection. Despite large increases in the financial resources put toward water-source protection, the challenges are much larger. Indeed, Canadians are starting to describe the country as a have-not area without sufficient supplies of potable water. There is some truth to this claim, but in terms relative to most other countries around the world, Canada is still a water-rich nation.

Forest soils are taking a beating with climate change and altered forest-management regimes. Erosion, permafrost melting, shortened periods of winter freezing, and higher rates of organic-matter decomposition and mineralization all are stressing forest soils that for centuries supported forests in a relatively stable way. Soil processes have proven to be key factors that, when stressed by the changing climate, lead to widespread forest declines.

C3.1.4 Carbon Cycles

Under the changing conditions of climate and forest utilization, it has been impossible to make Canadian forests a carbon sink. Indeed, calculations using the Canadian Climate Centre's Carbon Accounting Tool (C3-CAT) show that, in aggregate, Canadian forests have been strong sources of carbon to the atmosphere in 26 of the past 30 years. Most of the source carbon is from respiration and fires, but methane escaping from boreal wetlands is also a significant culprit.

C3.2 Social and Community Sustainability

C3.2.1 Amenity Values

Over the last fifty years, forest-based recreation has increased markedly in the forests near cities and towns, due simply to the huge population increases. However, recreational use of hinterland forests, while low to begin with, has all but vanished. Hunting and fishing are dying pastimes except for Aboriginal people. While urban Canadians have some continuing appetite to learn about nature, the Green-MAX technology allows them to interact with forests without stepping outdoors.

On a positive note, urban forests have come strongly into focus in Canadian cities, as they have become increasingly appreciated for their wide range of social, environmental and economic benefits. The Hug-a-Tree campaigns of the urban-forest NGOs, started in the 2010s, resulted in considerable decreases in warm-blooded pet populations and dramatic increases in the amounts of money both municipal governments and citizens are now spending on urban trees. Species choices are often less than the naturalist community would desire, but under the circumstances of climate change and rising urban populations, people are agreeing that any tree is better than no tree at all.

C3.2.2 Participatory Processes

Canadians have enjoyed such a plethora of opportunities to participate in forest decision-making processes for so long (since the 1980s) that such activity has become part of the normal way of life. However, timber-producing forests across Canada are no longer benefiting from such processes given the neo-feudal decision-making environment that characterizes them. The forests that are benefiting are the urban forests, as noted above. The Urban Forests Union (UFU), a nationwide network of urban-forest NGOs, was created by the Canadian Federation of Municipalities in 2024, with funding from federal Department of Urban Affairs. These urban-focussed participatory structures are attracting huge followings.

C3.2.3 Forest-related Employment

The number of forest-based jobs in Canada has gone up considerably since 2000, principally because harvest levels are up and silviculture for short-rotation timber production has intensified.

Qualified and experienced labourers are hard to find, and Aboriginal people have become successful in capturing some of the new openings, particularly in relation to salvage harvesting. Jobs related to forest recreation are concentrated in and near the major cities, and it has become quite prestigious to be an urban forest guardian whose main role is guiding visitors on near-urban ecotourism ventures.

C3.3 Economic Sustainability

C3.3.1 Wood Harvests

Through much of the last half of the 20th century, calculated sustainable timber-harvest levels from Canada's forests hovered around the 230-240 million m³/yr mark, and actual harvest levels remained significantly below. Indeed, at the turn of the century, actual harvesting had plummeted to about 180 million m³/yr. This is clearly explained by the declining fortunes of the wood-products industry, and the reductions in harvest levels by governments nervous about overall forest sustainability.

Global net wood demand and climate change have altered that picture significantly during the last five decades. Calculations of long-term sustainable timber-harvest levels are all over the proverbial map because analysts can't agree on what assumptions to use about ongoing impacts of climate change. Actual harvest levels are both high and unstable. They are high because of (a) climate-induced forest decline, giving people incentives to harvest before the declining fibre is worthless in industrial processes, (b) the general despair over conservation of forest biodiversity, (c) the capturing of forest decision-making power by timber barons, and (d) the relatively high demand for all qualities of wood fibre for the bioenergy industry. They fluctuate because of the unpredictability of the need for salvage harvests. To illustrate, in the period 2030 to 2045, national annual logging volumes have oscillated between a low of 180 million m³ and a high of 330 million m³, with an average of 280 million m³.

Of tremendous concern to the entire forest industry since 2045 is the sudden paucity of wood on the market - harvest levels have plummeted to about 150 million m³, and prospects for a recovery are dim indeed. The wood-supply situation in BC, ON and QC is desperate. Last year's announcement of a national Royal Commission on Wood-Supply Crisis in Canada is testament to the gravity of the situation.

C3.3.2 Wood-processing Industries

The dismal decades of the 2000s and 2010s led to more bouyant decades for the commodity producers and a fairly healthy situation for the bioenergy producers. The Canada-US lumber dispute, now almost two centuries old, has been a continuing burden for Canadian lumber producers, although many have stayed afloat. The hardest adjustments have been due to the unpredictability of the timing and location of forest calamities that require salvage harvesting. Sometimes the harvesters have been idle for months or even years, and then suddenly they are faced with an overabundance of work. Contractors in small isolated communities have been particularly hard hit by this situation, and the ripple effects through the communities are economically crippling.

The value of shipments last year amounted to NAD 60 billion (the USD and CAD joined in 2027), a slight increase from the roughly CAD 40 billion in 2000. Newsprint is virtually gone, and bioenergy materials have taken a commanding position. With a doubling of Canada's population and instability in world markets, a much greater proportion of our forest-based material is staying in the country. But of what we do export, the USA share is still high (80%), Europe has gone slightly up to 12%, Asia sits at 4%, and the rest goes in small amounts to Africa, and South and Central America.

C3.3.3 Harvests of Non-Wood Products

Given the deterioration of forest health across Canada, production of non-wood goods is flat. Harvest levels for most such goods - e.g., country foods (e.g., berries, mushrooms, nuts, plants), craft materials, medicinals - have risen only in relation to Aboriginal communities, for both subsistence and sale. Few are concerned about the long-term sustainability of such harvests due to the harvest levels - of far greater concern are the changing ecological conditions brought by climate change. People are seriously asking whether some heavily used species such as blueberries will grow in the future in places where they did for many centuries in the past.

C3.3.4 Markets for Forest Services

Markets for forest carbon were a spectacular hit back in the 2010s, but as soon as Canada's forests were deemed to be overall net emitters, that market pretty much vanished by around 2040. However, water rights became a hot commodity with a forest water-rights market having been established in 2037 at the Regina Stock Exchange. A host of small and medium-size enterprises became established, many associated with community forests and Aboriginal forest companies. The predictions in the 2000s that water would eventually become a big business were right - hundreds of Canadians have become water-barons, a situation not dissimilar to the timber-baron mentality pervading contemporary Canadian forestry.

In the 2010s and 2020s, much discussion took place about starting up some biodiversity markets associated with Canadian forests. Provincial forest managers in particular were excited to see if they could enhance Crown-land revenues using biodiversity credits. The discussions quickly

turned sour as biodiversity values were steadily eroded and people began to murmur, tongue in cheek, about biodiversity debits. A few minor biodiversity markets still remain in various places around the world, mainly in relation to Aboriginal peoples and medicinally important biodiversity.

C4. Conclusions

Making predictions about the future - in particular the future we are concerned with here, the forests and forest sector - is a risky venture at the best of times. Our ability to foresee the future with any useful clarity is restricted to the very short term. However, our forests are far too cherished for us to sit idly by. We must consider seriously their long-term future and the policies needed to shape them and use them so that we can speak positively about the forests and our relationships with them as the year 2100 approaches in fifty short years. What Canada needs now is a policy-planning exercise that generates a small set of radically different yet plausible scenarios of how the forests and forest sector could develop through the decades to 2100. These will serve as a sound basis for enriched policy discussions dedicated to an even stronger pursuit of sustainability.