Initial Assessment of the Impact of COVID-19 on Sustainable Forest Management

Canada and the USA

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In order to have a broad overview of the impacts of COVID-19 on forests, forest sector, and forest dependent people, and to assess the potential of forests to diminish the adverse impacts of the pandemic, the United Nations Forum on Forests (UNFF), at its fifteenth session, requested the UNFF Secretariat, in consultation with other members of the Collaborative Partnership on Forests (CPF) and with input from members of the Forum, to compile an initial assessment of the impact of the COVID-19 pandemic on: (i) sustainable forest management (SFM), (ii) the forest sector, forest-dependent people, indigenous peoples and local communities, (iii) forest financing and international cooperation, and to present this assessment to the Forum at its sixteenth session in April 2021. To initiate this assessment and collect information, the UNFF Secretariat commissioned five assessments to be conducted on a regional basis.

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Executive Summary

The COVID-19 global pandemic has elicited extraordinary responses from governments worldwide. In order to contain the spread of the disease, individual and economic mobility has been increasingly restricted, with country-to-country mobility all but halted. Although epidemiologists and virologists are still investigating the long-term effects of COVID 19, it seems evident is that COVID 19 likely will require social distancing, mask wearing, and mobility limitations for some time. In response, changes in consumer behavior are accelerating long-term trends towards on-line working, learning, and shopping and a sharpened focus on sustainability. The pandemic has accelerated the decreased demand for newsprint, and commercial copying and printing paper while at the same time, increased demand for containerboard used in shipping packaging. What was not foreseen was the spike in demand for hygiene and personal protective equipment (PPE) such as masks and gowns.

Forests in Canada and the USA

In North America, Canada and the USA are both developed economies with significant forest resources and vibrant forest products industries. Canada is the third-most forested country in the world by area with its 347 million hectares comprising nearly 9% of the world's total forest area. Canada is the world's largest producer of newsprint, the largest producer of northern bleached softwood kraft pulp and the second-largest producer of softwood lumber. The USA ranks fourth globally in forest area with 333 million ha of forests and woodlands. The USA forest products industry accounted for more than 20% of the 2018 global production of pulp for paper, recovered paper, and pellets and a significant share of other products. Forest-related recreation and tourism are important in both countries. Ownership patterns differ, with implications for forest management and the regulatory environment; most forests in Canada are public or Crown land, with operational management done under concession. Forest ownership in the USA varies substantially with private ownerships dominant in the East and public ownership in the West. Nationally, 58% of forests are privately owned and account for 89% of the timber harvested annually.

COVID 19 has similarly impacted the two countries although their governments have responded differently in their efforts to contain the virus and the economic disruption that ensued. Importantly, both countries early in the pandemic declared forest management and forest products manufacturing as essential businesses. This allowed essential activities to continue, while taking measures to protect workers and the public.

Sustainable Forest Management

The pandemic disrupted forest management and research activities in both countries, caused mill closures and production pauses, and impacted employment and livelihoods. Uncertainty delayed capital investments and responding to the pandemic incurred significant incremental costs to implement health and safety measures in order to protect workers and local

communities. Long-term effects will depend on whether the measures implemented to control the spread of the virus permanently change consumer behavior and whether government responses are directed toward green infrastructure investments.

Forest management in the USA was affected by firefighter safety needs that dictated social distancing measures to reduce the risk of contracting and spreading the virus. The western USA experienced one of the worst fire seasons on record. Despite the safety measures, 405 firefighters tested positive by the end of November and in September, there was one fatality related to COVID and another person in critical condition. Risk reduction activities, such as prescribed burning and trimming vegetation near power lines have slowed due to social distancing policies. Required in-person training for fire crews and preseason meetings of fire teams held for information sharing and preparation were canceled. The fire season in Canada was less active than anticipated, but several Canadian wildland firefighters returning from the USA tested positive for COVID 19. In Canada, COVID-19 affected forest pest management activities. The Ontario Ministry of Natural Resources and Forestry cancelled a jack pine budworm aerial spray program. Some provinces operated their programs at reduced capacity; Saskatchewan, Manitoba and Nova Scotia prioritized forest pest survey and control activities, focusing on areas that could be accessed within day trips. Others, including Alberta and New Brunswick, conducted their regular forest health protection programs.

In Canada, forest management operations are seasonal and occur mostly in remote areas. Early in the pandemic, operations were delayed. Many jurisdictions banned prescribed burning. Salvage operations in western Canada following wildfires and bark beetle outbreaks proceeded. Tree planting was supported by a new government program that provided financial support to help the forest sector adjust to the new safety requirements; over 600 million seedlings were planted. Tree planting camps reported no cases of COVID-19 because of the physical distancing measures in place.

In the USA, meetings were held online or virtually for activities such as grazing permits, but timber sales, harvesting inspections, timber surveys, permit inspections, prescribed fires, scientific surveys and forest health monitoring have been postponed or halted. Forest certification audits were adjusted to be done remotely. For example, in April FSC announced options of postponing audits or conducting desk audits in order to avoid certificate holders losing their certification status because auditors and staff were unable to conduct on-site audits. Prescribed burning to reduce fuel loads has been suspended in most regions. National forests are subject to extensive planning that requires much public participation; it is unclear how to accomplish that virtually, especially given that many of the public meetings are held in rural communities that are underserved with internet connectivity. One potential impact of concern is how will moving from in-person to virtual meetings impact project implementation, litigation, and objections to forest management or harvesting activities.

Federal land management agencies in the USA collect significant revenues for resource extraction and other activities on forest lands that require personnel on-site for permitting, monitoring, and fee collection. These activities are likely to be affected by COVID-19. For example, the major land management agencies collected US$442 million in 2019 for recreation fees and US$217 in timber receipts. The National Park Service has about 500 concessionaires in 100 park units, employing around 25,000 full-time and seasonal employees. Delayed park openings, services limited in order to comply with federal, state and local health guidelines, and reduced international and domestic travel have caused an estimated 70% decline in revenues for January through July 2020, projected to be more than US$1.1 billion nationally for 2020.

Forestry research is heavily dependent on field measurements and the pandemic reduced the length of the field season and added costs and time, for example sending multiple vehicles instead of a single vehicle to transport crews to the field. In addition, access to research labs was also reduced that negatively impacted the work. The Government of Canada softened the impact by adjusting the current suite of forest sector specific programs. For example, an additional C$5.6 million was allocated in 2020-21 to forest sector research and development to compensate for lost industry contributions and accelerated COVID-19 related research (e.g., facemasks and filtration). Other programs increased flexibility of the application process and reduced industry cost-share requirements.

In the short-term, students, postdoctoral researchers, and early-career faculty are likely to be impacted by shifts toward virtual or hybrid classes without field labs or interrupted research. The longer-term impact of cancelled scientific and technical conferences and the inability to gather and share knowledge is harder to gauge. Some conferences are continuing virtually although the critical informal exchanges of information that occur at such gatherings will not occur. Subsequent waves of the pandemic are having significant impacts on private and public sector budgets, taking away from longer-term investments in the sector, including research.

Forest Sector, Indigenous Peoples, Local Communities

The immediate economic disruption of COVID-19 on the forest products sector was due to reductions caused by the closure of non-essential industries and workers not being able to remotely perform their activities. Consumer demand increased for some goods and services, e.g., toilet paper or healthcare, and overall reduced demand for goods or services because of restrictions, e.g., restaurants or tourism. Wood raw material consumption between January-July 2020 was 6.7% lower than the same period in 2019 – dropping by 21.4 million tons of material. This resulted in a 13% reduction ($1.83 billion) in value of the delivered wood. That $1.83 billion dollar loss in value has had a significant impact throughout the forest supply chain, from timberland owners to loggers and truckers. This decline was short-lived; demand has since increased substantially and lumber prices hit record highs. Shelter-in-place orders spurred home repair and renovation activity. This segment, including do-it-yourself (DIY) sales, has accounted for about 50% of softwood lumber consumption in the US. Longer-term, COVID-19

has accelerated the declining demand for paper products and some pulp and paper mills have been re-purposed from paper to make fluff or containerboard. Production of softwood lumber and wood pellets are expected to grow, while other products are expected to decline.

More than 130 Mills in Canada shut down or reduced production in response to the pandemic and other factors including lingering effects of wildfires from the previous year. Reduced production resulted from declining demand for newsprint and specialty paper, sawmill downtime, and reduced availability of the workforce due to safety precautions. As of August 2020, three lumber mills and five pulp/paper mills in Western Canada have closed or reduced capacity. Two pulp/paper mills, 6 sawmills, and a newsprint plant in eastern Canada have reduced capacity due to reduced demand and/or COVID restrictions.

Indigenous communities in Canada potentially were at increased risk from transmission of COVID 19 by workers coming in from other parts of the country to plant trees and conduct other forest management activities. These communities generally have limited access to health care. Rigorous protocols were put in place to protect rural communities, especially Indigenous peoples. Indigenous tourism faces unique economic and social/cultural impacts from COVID-19. Indigenous tourism had outpaced Canadian tourism activity overall but with the pandemic, it came almost to a complete standstill. In response, Indigenous Services Canada partnered with the trade association to stand up a COVID-19 Stimulus Development Fund. Since March, 678 tourism businesses have received grants from the fund, of up to $25,000 per applicant, totaling C$16.21 million. These grants have gone to export-, market- and visitor-ready Indigenous tourism businesses in Canada.

The economic impact of limiting outdoor recreation in the USA has significantly affected local economies of Gateway Communities in and around national parks and forests. The reduced visitation caused by travel restrictions, particularly international travel, has reduced spending on services as well as state and local sales and tourism taxes bases on concessioner sales. The impact extends beyond the peak summer vacation season. There are 460 ski areas in 37 states, many in the western USA located on National Forest System lands; most were deemed non-essential and closed in February/March. The impact has been estimated at US$2 billion from revenue losses at the end of the 2019-20 season and an expected drop in future season pass sales. Many small seasonal recreational businesses that provide outdoor recreation services or equipment are at risk of bankruptcy. These include outfitters and guides whose customers come from outside the local area, usually by air. Reservations in March had declined by over 25%. Longer-term impacts are due to reduced or delayed spending on equipment, marketing and recruitment of seasonal employees.

Open spaces such as forests have taken on increased value for recreation and leisure. Forests and parks near urban areas have experienced impacts from greater visitation, increasing pressure on ecosystem services. This surge in utilization has led to increased vandalism, garbage accumulation, and the danger of fire ignitions. State parks in the USA are facing

multiple threats to their funding as COVID-19 strains budgets and revenue is lost because of reduced tourism caused by travel restrictions. Some states such as Pennsylvania, are contemplating user fees, a departure from long-standing tradition of free access. At the same time, urban residents are flooding into rural areas including public lands. For example, during the early months of the pandemic, 26% of people visiting parks around Burlington, Vermont had rarely, if ever, visited nature in the previous year. There has been a similar upsurge in use of outdoor facilities in Canada, specifically in urban and peri-urban areas as well as provincial and national parks. For example, campground reservations in provincial parks in Alberta increased 5400 % in 2020 versus 2019.

Forest Financing and International Cooperation

Financial support from government to businesses and agencies to help survive the COVID-19 pandemic have included direct subsidies, favorable interest rates, tax reductions and delayed payments, additional credit lines, and regulatory changes. The federal government in the USA provided financial relief to some sectors of the economy through the CARES Act (Coronavirus Aid, Relief, and Economic Security Act) that was followed by the smaller Emergency Coronavirus Relief Act of 2020 COVID relief package that was signed on 28 December 2020. The second act added timber to supported commodities and includes $200 million in funding for logging and log trucking businesses who saw a greater than 10 percent loss in revenues in 2020 related to the COVID-19 pandemic.

Many small businesses in the forest sector qualified for assistance programs under the CARES and other acts such as the Paycheck Protection Program that provides a forgivable loan to help small businesses retain their employees. The CARES Act provided the USFS with US$70.8 million in supplemental funding to over extraordinary costs of the pandemic. This included US$3 million to re-establish scientific experiments impacted by travel restrictions, such as the Forest Inventory and Analysis program. The National Forest System received US$34 million for daily cleaning and disinfecting of recreation facilities, increased supply of personal protective equipment, and baseline testing for first responders. Facilities received capital improvement and maintenance funding of US$26.8 million for cleaning needs related to the coronavirus. Additional personal protective equipment and baseline testing for first responders, including wildland firefighters, was funded at US$7 million. The Forest Service allowed loggers more time to fulfill their contracts in national forests .

The Canadian government provided a similar suite of financial assistance programs to businesses and individuals. The Canada Emergency Wage Subsidy, the federal government's wage subsidy program, has provided limited benefit to the forestry sector. Forestry ranked fourth last in terms of share of private sector workers covered by the subsidy. Compared to other industries, the forest industry has not faced a large change in employment from April to August 2020. The federal government on 30 November 2020 released an economic statement that included funding for the forest sector. The Nature Based Solutions to Climate Change

provides C$3.16 billion over ten years, starting in 2021-2022, to NRCan to partner with provinces, territories, and other stakeholders to plant 2 billion trees. An additional C$30 million is to help small and medium-sized forest businesses to manage increased costs of safe operations, including tree-planting operations during the pandemic. In support of gender-centric provisions, the funding for commercial tree planting in 2020 and 2021 seeks to create opportunities for younger planters, as well as increased female representation. Beginning in 2021-22, C$631million will be provided over ten years to restore degraded ecosystems, protect wildlife, and improve land and resource management practices. The governmental response has been criticized for the rescue package containing a massive road expansion and tax relief for fossil fuel companies.

Building construction is the primary driver of demand for lumber, plywood and related materials. The housing market is the primary driver and if remote working and learning continue to grow, demand for solid wood and panel products will increase. People relocating to suburbs and rural areas, where housing is less expensive or simply to access more outdoors, will fuel this demand. Continued government intervention to keep interest rates low will support new home buyers. The effect on lumber demand should be substantial as a median-sized single-family home uses about three times more lumber than the median multi-family building. Without the continued government stimulus to support consumers and businesses, however, there is the risk of a collapse similar to the one in 2008.

Along with market forces, any lingering or continuing effects of COVID 19 on forests and the forest sector will be determined by the nature and scale of government actions. Government spending is a larger factor than any other economic sector. Immediately the question is whether emergency economic interventions will continue to provide economic stability. Although government interventions and regulations tend to both distort and perfect markets, they undeniably influence both the forest sector and forest management. Future government budgets will undoubtedly be subject to contentious debates about the deficits incurred in recent years and there could be less discretionary funding available for forest management and forestry research and development. While the emergency spending in response to COVID 19 is not the only factor in the deficit, it has certainly played a role, along with the economic impact of business closures and other public health measures undertaken to reduce the impact of the pandemic.

International cooperation has not been negatively impacted. Initially travel restrictions disrupted meetings, however, meetings, negotiations, and multilateral initiatives have resumed and moved to virtual platforms. Recognition that deforestation and forest fragmentation have increased incidence of zoonotic diseases or zoonoses, diseases transferred from animals to humans. Although the current emphasis is on diseases emerging from the Tropics, the USA and Canada have experienced Lyme Disease that is transferred from deer to humans. Climate change is accelerating the emergence of mosquito borne diseases typical of warmer climates into northern latitudes. Developing country debt of more than US$8 trillion could be swapped

by governments in pandemic economic rescue packages to address climate and biodiversity destruction. Past efforts have been designed by the Nature Conservancy, Conservation International and WWF to swap debt for climate and nature projects. Canada is seen as a progressive member of the G7 that could lead such efforts, but as yet there has been no discussion of this.

The changes in consumer behavior that affect consumption of forest products, increased levels of on-line shopping and remote working and learning, were largely accelerated by the actions taken to counter the pandemic, rather than emerging as novel drivers of change. While the question remains of whether these changes will be sustained, the immediate positive effect on the packaging industry and negative effect on graphic paper has been significant. Remote working, increased demand for outdoor experiences, and out-migration from cities and older suburbs, if sustained, will affect housing construction and ripple throughout the supply chain. Off-setting these trends are significant barriers arising from the pandemic and control efforts. The debt load from the stimulus spending and ballooning deficits will be a political issue whichever political party is in power. In both the USA and Canada, anemic recovery from the current economic recession caused by the pandemic will affect the forest sector, along with lingering effects of the 2008 recession. High unemployment and permanent losses of jobs due to business closures and cutbacks will depress consumer spending and housing starts with effects throughout the forestry supply chain. Declining public sector budgets will pressure discretionary funding, affecting research and international aid. Nevertheless, COVID 19 presents a once in-a-lifetime opportunity to shift the global development paradigm towards greater sustainability and a greener, more inclusive economy. Canada has taken the lead in planning for this transition and has shown the political will to go down this path; currently the USA is moving in the opposite direction, supporting fossil fuels and relaxing environmental protections. This trend is likely to be reversed by the new. In both countries the notion of directing stimulus spending to target infrastructure has momentum.

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This document has been prepared by a consultant (John Stanturf, InNovaSilva) based on literature review, interviews with key informants, and own assessments. It does not necessarily reflect the views of UNFF; UNFF does not guarantee the accuracy of the data included in this work.

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3 Abbreviations and Acronyms

BLM	US Bureau of Land Management
CARES	Coronavirus Aid, Relief, and Economic Security Act
CDC	Centres for Disease Control
CFPA	Canadian Forest Products Association
COFO	Committee on Forestry
CPF	Collaborative Partnership on Forests
CRS	Congressional Research Service
COVID-19	Coronavirus Disease 2019
DIY	Do-It-Yourself
ES	Ecosystem Services
FAO	Food and Agriculture Organiati0on of the United Nations
FPAC	Forest Products Association of Canada
FS	US Forest Service
FWS	US Fish and Wildlife Service
ILO	International Labour Organization
IPCC	Intergovernmental Panel on Climate Change
ITAC	Indigenous Tourism Association of Canada
IUCN	International Union for Conservation of Nature
NGO	Non-Governmental Organization
NPS	US National Park Service
NRCAN	Natural Resources Canada
NWFP	Non-Wood Forest Products
OECD	Organisation for Economic Co-operation and Development
SARS-COV 2	Severe Acute Respiratory Syndrome Coronavirus 2
SFM	Sustainable Forest Management
REIT	Real Estate Investment Trust
SFM	Sustainable Forest Management
SLM	Sustainable Land Management
SME	Small and Medium Enterprises
USA	United States of America
TIMO	Timber Investment Management Organization
UNFF	United Nations Forum on Forests
USFS	United States Department of Agriculture Forest Service
WB	World Bank
WUI	Wildland Urban Interface

4 Introduction

The COVID-19 pandemic has disrupted global economies in myriad ways. Besides the tragedy of hundreds of thousands of deaths, normal social interactions have been curtailed in an effort to stem the spread of the virus. The resulting cascade of impacts on individual lives, shuttered businesses and unemployment, over-stressed public health providers, and reduced fiscal capacity of governments to respond and provide safety nets has created enormous hardships in the short-term, with likely but uncertain long-term impacts (Nikolopoulos *et al.*, 2020).

COVID-19 stands for coronavirus disease 2019; it is a new disease, caused by a novel (or new) coronavirus that has not previously been seen in humans. Corona viruses are a large family of viruses that usually cause mild to moderate upper-respiratory tract illnesses, like the common cold. However, three new coronaviruses have emerged from animal reservoirs over the past two decades to cause serious and widespread illness and death. The third novel coronavirus to emerge in this century is called SARS-CoV-2. It causes coronavirus disease 2019 (COVID-19), which was detected in China in December 2019 and was declared a global pandemic by the World Health Organization on March 11, 2020[1]. Corona viruses are spread through the air by coughing and sneezing, close personal contact, touching an object or surface contaminated with the virus and rarely, by fecal contamination. Thus, absent an effective vaccine, the only preventive measures are reducing human contact and aerial spread by social distancing, wearing masks, and shutting down much economic activity for varying lengths of time. These measures, undertaken to varying degrees by different jurisdictions, have impacted the forest sectors (FAO, 2020) in Canada and the United States of America (USA).

Forests and the natural world have not gone unscathed by the pandemic. The COVID-19 has affected forests and forest-dependent people globally in multiple ways[2]. Supply chain disruptions have been the most obvious effects of the COVID-19 on forestry and the forest products industry in many countries[3]. Early uncertainty of when an effective vaccine against the virus would be widely available, as well as the long-term health effects of the COVID-19, made assessment of long-term effects wildly speculative (Nikolopoulos *et al.*, 2020). The initial responses were uneven but clearly, the COVID-19 pandemic has disrupted supply chains in the short-term and accelerated disruptive trends in consumer behavior with likely long-term effects. Even though apparently effective vaccines were developed by December 2020, widespread deployment and sufficient level of vaccination to control the pandemic is unlikely before mid-2021. Against this backdrop, the United Nations Forum on Forests has commissioned an initial assessment of the impact of the COVID-19 pandemic on:

- Sustainable forest management (SFM),

[1] National Institute of Allergy and Infectious Diseases. 2020. Coronaviruses. https://www.niaid.nih.gov/diseases-conditions/coronaviruses

[2] International Labour Organization. 2020. Impact of COVID-19 on the forest sector. https://www.ilo.org/sector/Resources/publications/WCMS_749497/lang--en/index.htm

[3] Fastmarkets RISI. 2020. The COVID-19 pandemic-the coronavirus's impact on forest products markets. https://insights.risiinfo.com/covid-19-pandemic-coronavirus-impact-on-global-forest-products-markets/index.html#Impact-Wood-products-daxgYGdK35

- The forest sector, forest-dependent people, indigenous peoples and local communities, and
- Forest financing and international cooperation.

The UNFF Secretariat is compiling a global assessment of the impacts of COVID-19 on these topics through commissioning several regional assessments. This report is one such assessment for Canada and the USA. To provide context, the report provides a brief overview of forests, their management, and the forest products sectors in each nation. Besides evaluating immediate and describing potential long-term effects, the report looks at the opportunity presented by the pandemic for a shift in the global development paradigm towards greater sustainability and a greener, more inclusive economy. Many of the immediate impacts identified are accelerating long-term economic and social trends already operating, as well as long-term impacts compounding effects of climate change (Phillips *et al.*, 2020).

5 Background

Canada and the USA are both developed economies with significant forest resources and vibrant forest products industries. COVID 19 has similarly impacted the two countries although their governments have responded differently in their efforts to contain the virus. Historically the border between the countries has been relatively open, with much cross-border trade. In the face of the pandemic, however, the Canada-USA border was closed for most traffic in March 2020, and remains a barrier to non-essential travel at least through the end of 2020. Essential travel, including movement of goods, has been exempt from border closure.

The two countries differ significantly in forest ownership that results in different operating environments for forest management and industry. Most of Canada's forest estate is public or Crown land, with operational management done under concession, within regulatory parameters mostly set by provincial governments with some federal regulations such as the Species at Risk Act. In the USA, private ownership of forest land dominates with comparatively little regulation of normal forest management activities although voluntary compliance with best management practices protects air and water quality. Industrial facilities in both countries are similarly regulated.

Importantly, both countries early in the pandemic declared forest management and forest products manufacturing as essential businesses. This allowed essential activities to continue, while taking measures to protect workers and the public. This included forest management activities such as wildfire suppression and manufacturing to produce and distribute products such as toilet paper, personal hygiene products, packaging, and biofuels.

5.1 Canada

5.1.1 Forest Area

Canada is the third-most forested country in the world by area and Canadian forests comprise nearly 9% of the world's total forest area, covering 347 million hectares (ha). More than 75% of Canada's forest area is boreal and 25% temperate (NRCan, 2018). Fully 7% of forest area is

protected in large national, provincial and territorial parks and other conservation areas. Canada's total forest area is stable, decreasing by less than half of 1% from 1990 to 2017. Some deforestation has occurred over the same time period, caused by increased activity in Canada's mining, oil and gas sector since 1990. Conversion of forest to agricultural land, however, has been the primary cause of deforestation and likely will remain so. These conversions are small relative to the overall forest estate (NRCan, 2018).

5.1.2 Forest Condition

Canada's forests contain an estimated 45 billion m^3 of wood. Volume declined between 1990 and 2016, primarily caused by natural disturbances. Fire and insects affected 20 times more area than harvesting and deforestation. In 2018, there were more than 7,000 forest fires in Canada, burning almost 2.3 million ha of forest, with both of these numbers close to twenty-year averages of 2.1 million. Although the national totals are close to average, in 2018, many fires occurred in places where large fires are unusual (NRCan, 2018). Lightning ignited wildfires are the cause of most of the area burned (85%) but account for only 50% of fire occurrences.

5.1.3 Forest Management

Almost all (about 90%) of Canada's forests are on provincial and territorial Crown lands and provincial and territorial governments are responsible for forest management (Gilani and Innes, 2020). By law, forests harvested on public lands must be regenerated; 599 million seedlings were planted on 410,000 ha of Crown and private forest lands (2017). Thus, a disproportionally high percentage (36%) of the world's certified sustainably managed forests are in Canada (NRCan, 2018).

5.1.4 Forest Sector

About 11 million people in Canada live in or adjacent to forested areas (31% of the population). Forestry and the forest industry are important to the economy of many rural and Indigenous communities. The forest sector directly employed 210,615 people in 2018 and an additional 91,874 indirect jobs. About 2% of the population (700,000 people) lives in what are termed forest-reliant communities. Approximately 70% of Indigenous people in Canada live in or near forests, and about 11,600 Indigenous people were employed in the forest sector in 2018. Forest sector jobs support 300 communities across Canada. Many of these communities, often remote, have few or no alternative employment opportunities.

Canada is the world's largest producer of newsprint, the largest producer of northern bleached softwood kraft pulp and the second-largest producer of softwood lumber. The forest sector accounted for about 7% of Canada's total exports in 2018, contributing roughly C$25.8 billion to Canada's economy. The share of global production and consumption of forest products in 2018 by the Canadian forest sector is shown in Table 1. Three subsectors, solid wood product manufacturing, pulp and paper product manufacturing, and forestry and logging respectively

accounted for approximately 44%, 36%, and 20% of the forest sector's contribution to the Canadian economy in 2013[4].

Table 1. Canada's share of global forest products production and consumption in 2018.

Product category	Percentage of global production	Percentage of global consumption
Industrial roundwood	7	7
Wood pellets	8	<1
Sawnwood	10	4
Wood-based panels	3	<1
Pulp for paper	8	4

Source: FAO STAT[5]

5.2 United States of America (USA)

5.2.1 Forest Area

The USA ranks fourth globally in forest area with 333 million ha of forests and woodlands (93% meet the FAO definition of forest). Forest area increased from 1987 to 2012 and now is stable (Oswalt *et al.*, 2019). Ownership patterns vary substantially as a result of land settlement history, land allocation policies, and other socioeconomic factors. Private ownerships dominate in the East and public ownership in the West. Nationally the majority of forests and woodlands are privately owned (58%) by an estimated 10.6 million families, individuals, trusts, and estates, referred to as family forests (Butler *et al.*, 2016). Family forests control more land (38%) than any other group. Timber investment management organizations (TIMOs), real estate investment trusts (REITs), and forest product manufacturing companies, termed corporate owners, control an additional 20% of the forest land. The smallest category of private owners, accounting for 2% of the land, includes nongovernmental conservation organizations and unincorporated partnerships, associations, and clubs.

Publicly owned forests, 42% of the forests and woodlands, are dominated by the Federal Government (31%). Although the Forest Service in the Department of Agriculture dominates the public land owner category (i.e., the National Forest System), there are many other agencies in the Departments of the Interior and Defense that own and manage public forest land. State forest, wildlife, and recreation agencies control 9% and local governments 2%.

[4] NRCan Overview of Canada's forest industry Jul 16, 2020, https://www.nrcan.gc.ca/our-natural-resources/forests-forestry/forest-industry-trade/overview-canadas-forest-industry/13311

[5] FAOSTAT. 2020. Forest product consumption and production. http://www.fao.org/forestry/statistics/80938@180723/en/

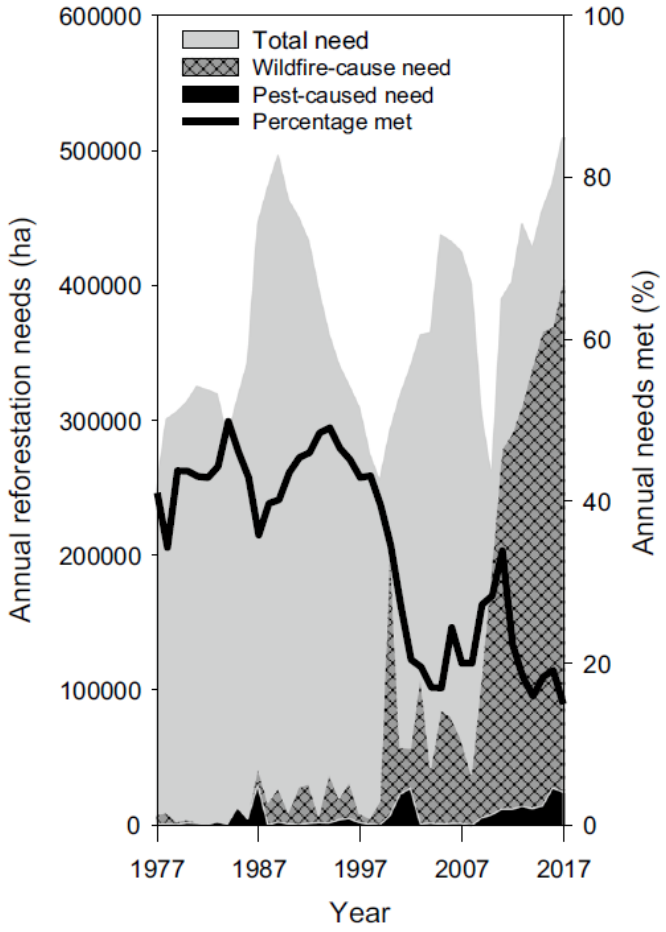


Figure 1 Annual reforestation needs on US Forest Service lands.
(Source: Dumroese et al. 2019)

Native American Tribal reservations include the remaining 2% of the forests and woodlands, a mixture of ownership by Tribal organizations and individuals (Oswalt *et al.*, 2019).

5.2.2 Forest Condition

Fully 67% of the forest land in the USA is productive enough to grow timber and 88% of the 280 billion cubic meters of live-tree volume is considered growing stock. Softwoods (54%) are slightly more than hardwoods (46%). Insects, drought and wildfire have increased average annual mortality rates in all regions since 2006. Net annual growth rates in hardwood forests have declined slightly and increased in softwood forests.

Wildfires are a dominant disturbance in boreal and temperate forests and wind storms are common in coastal areas and in interior relatively flat terrain (Stanturf *et al.*, 2020). The area burned in wildfires is increasing; over 18.5 million ha burned in the period 1960 to 1969, compared to more than 27.7 million ha in 2010 to 2019[6]. Extreme events such as a cyclone (hurricane in North America) can result in significant financial loss to forest land owners. For example, Hurricanes Katrina and Rita in 2005 caused an estimated $US 2 billion to $US 3 billion in damage from wind alone, damaging a total of 2.23 million ha of timberland in the coastal states of Texas, Louisiana, Mississippi, and Alabama (Stanturf *et al.*, 2007). Hurricane Laura in 2020 damaged timber on 306,565 ha in one state, Louisiana, at a $US 1.1 billion loss to the timber industry[7], with the hard-hit area suffering further loss from Hurricane Delta.

[6] National Interagency Fire Center (NIFC), Total Wildland Fires and Acres (1926-2019), https://www.nifc.gov/fireInfo/fireInfo_stats_totalFires.html

[7] Louisiana State University AgCenter, AgCenter estimates ag, forestry losses from Hurricane Laura exceed $1.6 billion, https://www.lsuagcenter.com/profiles/rbogren/articles/page1600176520446

5.2.3 Forest Management

Private lands are the source of most of the timber harvested annually in the USA (89%). Southern forests dominate timber production (58% of removals), followed by private lands in the North (15%) and the Pacific Coast (14%). In general, growth to removal ratios exceed 1.0 (Oswalt *et al.*, 2019). Most of the timberland is naturally regenerated (87%), with 13% planted forest (Oswalt *et al.*, 2019). Planted forests are comprised of plantations, underplanting, and restoration plantings. Most of the planted timberland is in the southern USA (71%) with most of the remaining planted timberland in the Pacific Northwestern states (i.e., Washington and Oregon).

Planting delays on forest lands in the USA have been a long-term problem; of the 78 million ha managed by the U.S. Forest Service (about one-third of the Nation's forested land), potential restoration needs (fire regime and reforestation) are between 26 and 32 million ha (Buford *et al.*, 2015). The annual area of land managed by the Forest Service in need of reforestation averages 400,00 ha, mostly in areas burned by wildfires (81%) rather than harvesting (Fig. 1). During the past 20 years, only about 25% of the reforestation need has been met (Dumroese *et al.*, 2019).

On private land in the southern USA, one of the most important timber producing regions of the world, 31% of the non-industrial owners do not reforest after harvest, compared to the non-reforestation rate of 18% of industrial and institutional forest owners (Sun *et al.*, 2015). Some delay in reforestation may be unavoidable because of other priorities, but recognizing and including environmental benefits such as carbon sequestration (Domke *et al.*, 2020) associated with reforestation justifies speedy action (Zhang, 2019).

A recent Harris poll [8] suggested that nearly two in five urban residents are considering a move to a less crowded place. The rise of telecommuting enables more people to seek the open space and lower housing costs of rural areas. Outmigration from cities into rural areas due to the COVID-19 pandemic could have multiple impacts on rural communities near forests and on forest management, specifically from exacerbating the impacts of expanding the wildland-urban interface (WUI) on wildland firefighting, wildlife conflicts, and changing expectations of forest management (Wagner *et al.*, 1998; Bliss, 2000; Radeloff *et al.*, 2005; Hammer *et al.*, 2009; Abrams *et al.*, 2014). A recent survey of the rural western states in the USA is an example of changing expectations; it showed weak support for logging (41%), as opposed to 81% who supported traditional farming and ranching (Farrell *et al.*, 2020).

5.2.4 Forest Sector

The forest products industry in the USA accounted for more than 20% of the 2018 global production of pulp for paper, recovered paper, and pellets and a significant share of other products (Table 2). The share of global wood products produced by the USA forest products

[8] Harris Poll, 8/28-30/2020. Coronavirus may Prompt Migration out of American Cities. https://theharrispoll.com/coronavirus-may-prompt-migration-out-of-american-cities/

sector has declined since peaking in the 1990s, driven by a combination of long-term trends and cyclical factors. The peak came in 1998 at about 28%, declining to about 24% in 2006. The 2007–2009 recession low of about 17% was stable through 2013 (Prestemon *et al.*, 2015).

The decline in the U.S share of global production has been caused by the growth of industrial roundwood production in other countries (including Russia, China, Brazil, and New Zealand); this shift also decreased the market share of Canada. The decline was exacerbated by the 2007–2009 economic recession; the contraction of the housing market severely reduced roundwood consumption. The shift to electronic media has caused a decline in domestic use of paper including newsprint. Manufacturing in some sectors such as furniture has reduced employment as factories have been moved to other countries (offshoring), usually to take advantage of lower wages.

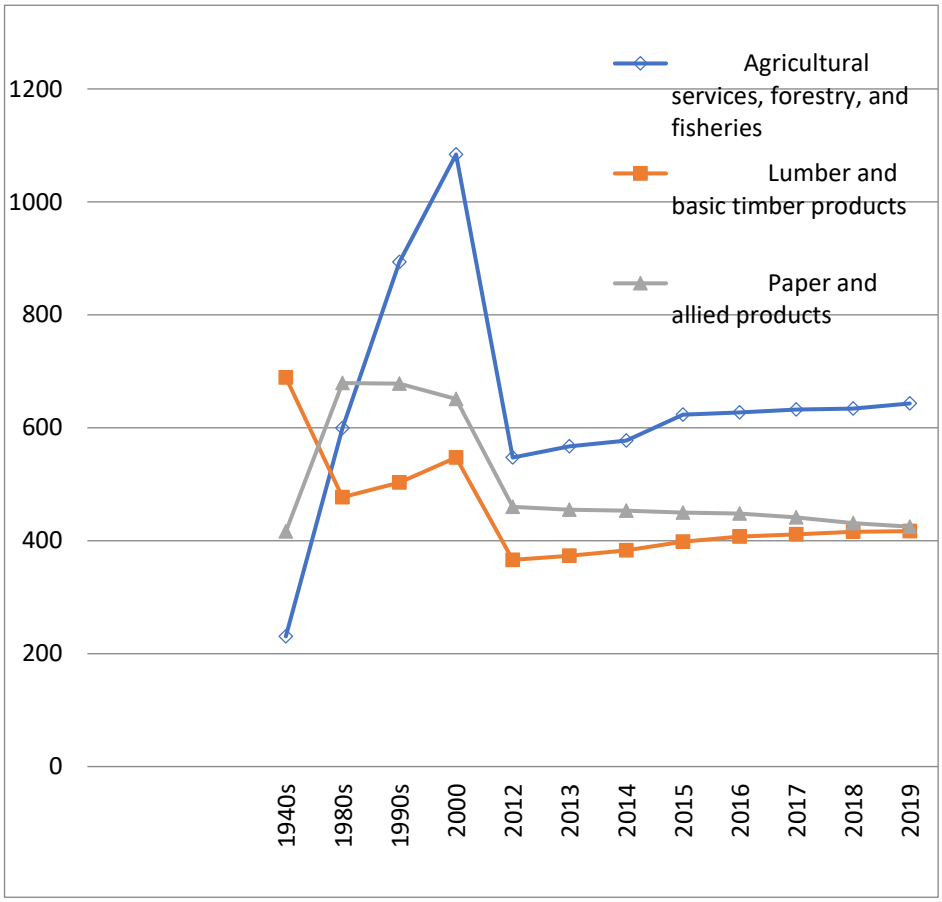
Table 2. The USA's share of global forest products production and consumption in 2018.

Product category	Percentage of global production	Percentage of global consumption
Industrial roundwood	18	18
Wood pellets	20	5
Sawnwood	17	21
Wood-based panels	9	12
Pulp for paper	25	24
Recovered paper	21	13
Paper and paperboard	18	17
Wood fuel	4	<1

Source: FAOSTAT [9].

The southern USA accounts for 98% of wood pellet manufacturing capacity nationally (Wang *et al.*, 2015) estimated variously as 9 million metric tons per year (United States Energy Information Administration, 2020) to 12.6 million metric tons per year (Lamers, 2017). Of the 7.5 million metric tons of wood pellets produced in 2018 (FAO 2019), 6 million metric tons were exported, valued at almost $US 810 million (FAO, 2019). Exports of wood pellets from the southern USA increased from near zero in the early 2000s to 4.6 million metric tons in 2015

[9] FAOSTAT. 2020. Forest product consumption and production. http://www.fao.org/forestry/statistics/80938@180723/en



(USITC, 2020). Renewable energy is likely to expand post-COVID-19, with biomass energy companies expected to do well[10].

Over the last 30 years, the once fully integrated forest products manufacturing sector that was dominated by several large and medium-sized corporations, has changed drastically as corporations divested of their land base and harvesting operations.

The Figure 2. Employment (in thousands) of full- and part-time employees, by sector. Source: Bureau of Economic Analysis; data last revised on: July 31, 2020. Data points for the 1940s-1990s are averages for the decade[11]

No industry segment controls all of its manufacturing supply chain. The logging workforce may be the weakest link in the supply chain. The logging sector is closely tied to the manufacturing and exporting sectors. The number of logging firms has been declining steadily (by 34% between 2001 and 2020[12]); the number of firms has declined by 8% and capacity by 25% just since 2009 (Fig. 2). Almost all logging companies are small, independent firms that have struggled since the 2008 recession, squeezed between the high cost of equipment, difficulty securing financing, and low stumpage rates that cause landowners to defer harvesting. Attracting new employees has been difficult due to the demanding nature of the work and low wages[13].

[10] Seeking Alpha. The Green, Green Biomass of Home. Oct. 21, 2020. https://seekingalpha.com/article/4380319-green-green-biomass-of-home?utm_source=news.google.com&utm_medium=referral

[11] Bureau of Economic Analysis, National Income and Product Accounts, Tables 6.4a-d, Full and part-time employees by industry; https://apps.bea.gov/iTable/iTable.cfm?reqid=19&step=2&isuri=1&1921=survey

[12] Bureau of Labor Statistics. 2020. Number of Establishments in Private NAICS 113 Forestry and logging for All establishment sizes in U.S. https://data.bls.gov/timeseries/ENUUS000205113?amp%253bdata_tool=XGtable&output_view=data&include_graphs=true

[13]USC Consulting Group, 2019. 3 Challenges Facing the American Forestry Industry http://www.usccg.com/blog/3-challenges-facing-american-forestry-industry/

Nature-based outdoor recreation is a significant industry in Canada and the USA and public lands are significant resources, generally the most accessible to the general population. The land base suitable for outdoor recreation is stable but demand has been increasing with the likelihood of a decline in availability and quality of the recreation experience (White *et al.*, 2016). In the USA, demand for nature-based outdoor recreation has been rising, in line with long-term trends. Although not all segments of the population participate equally, with the non-Hispanic white population participating more than other groups (White *et al.*, 2016), all groups like generalist activities (e.g., hiking, viewing nature, and visiting developed recreation and historic sites). Projections through 2030 are for continuing growth for most recreation activities (especially skiing, visiting interpretive sites, day hiking, birding, and equestrian activities) but demand from rural residents is expected to decline due to shifting of the population to urban/peri-urban areas (White *et al.*, 2016).

6 Methods

Information on the effects of COVID-19 was derived from existing published studies and reports, news items, and policy briefs, amplified by information from interviews. Existing published studies and reports, news items, policy briefs were identified by searching on Google (COVID 19 effects forest industry, COVID 19 effects forest, COVID 19 impact on forests), (Canada COVID 19 impact on forests, USA COVID 19 impact on forests) and Google Scholar (search terms included USA COVID 19 impact on forests, Canada COVID 19 impact on forests, COVID 19 forest fires).

Additional information was solicited from UNFF national focal points in the region through a short questionnaire. The same semi-structured questionnaire was used to solicit information from relevant stakeholders, including civil society, local community and forest associations, private sector, academia and research practitioners, development partners, intergovernmental and other regional/sub-regional organizations, and relevant international organizations including members of the Collaborative Partnership on Forests (CPF). A list of the contacts made can be found in the Annex. Some contacts provided written responses; all were interviewed on-line. More people were asked for an interview than responded.

7 Results

The emergence of the COVID-19 pandemic had an immediate impact on major elements of the forest sector in both Canada and the USA, disrupting forest management and research activities, causing mill closures and production pauses, impacting employment. Uncertainly delayed capital investments. Responding to the pandemic incurred significant incremental costs to implement health and safety measures in facilities and operations in order to protect workers and local communities safe (e.g., personal protective equipment, sanitizing stations, and accommodations to maintain social distancing in transportation, facilities and services).

7.1 Environmental and Health Impacts

Closing borders and confining populations to their houses drastically reduced the consumption of fossil fuels. By one estimate, daily global CO_2 emissions decreased by –17% by early April

2020, compared to 2019 mean level (Le Quéré *et al.*, 2020). The reduction of short-lived chemical species in the USA, however, had minimal impact on global levels (Forster *et al.*, 2020). The overall impact was limited and probably won't last as many travel restrictions were lifted[14] during the summer but are being re-instituted in some countries.

The greatest immediate forestry impact in the USA has been on wildfire prevention and suppression (Henderson, 2020)[15,16]. Risk reduction activities, such as prescribed burning and trimming vegetation near power lines have slowed due to social distancing policies[17]. Firefighter safety needs have dictated different social distancing measures to reduce the risk of contracting and spreading the virus. In the USA, medical experts from the Department of the Interior, US Forest Service, the CDC, and state public health representatives developed COVID-19 safety guidelines for wildfire operations[18]. More vehicles are required to reduce personnel density when traveling to fires, agencies must provide personal protective equipment, as well as mandating increased isolation and self-sufficiency in the field (Thompson *et al.*, 2020). The US Forest Service has canceled in-person training required for fire crews[19] and preseason meetings of fire teams held for information sharing and preparation have been canceled[20]. Despite these measures, 405 firefighters tested positive by the end of November (219 USFS, 141 CalFIRE, 45 BLM). In September, BLM had one person in critical condition and one fatality related to COVID[21].

Despite expecting an above average fire season [22], by September most of Canada was experiencing below average numbers of fires and area burned (Figure 3) and the national wildfire preparedness level at Level 1 most of the summer. Fire prevention policies such as fire bans were applied more frequently in anticipation of an above-average fire season [23].

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[14] CNBC, 6/18/2020. Carbon emissions sharply rebound as countries lift coronavirus restrictions. https://www.cnbc.com/2020/06/18/coronavirus-carbon-emissions-rebound-sharply-as-countries-states-open.html

[15] Union Concerned Scientists. 5/11/2020. COVID-19 collision with the 2020 fire season will ignite multiple threats. https://blog.ucsusa.org/carly-phillips/covid-19-collision-with-2020-fire-season-will-ignite-multiple-threats

[16] National Geographic, 8/24/2020. COVID-19 complicates an already dire wildfire season. https://www.nationalgeographic.com/science/2020/06/covid-19-complicates-already-dire-wildfire-season.htm

[17] Greenwire, 4/3/2020. Officials cut back on controlled burns due to COVID-19. https://www.eenews.net/greenwire/2020/04/03/stories/1062777803

[18] National Wildfire Coordinating Group, 8/10/2020. Guidance for Prevention and Management of COVID-19 During Wildland Fire. https://www.nwcg.gov/partners/fmb/guidance-prevention-management.

[19] US Forest Service, 9/9/2020. Forest Service Coronavirus (Covid-19) Updates. https://www.fs.usda.gov/about-agency/covid19-updates; US Department of the Interior. Wildfires & COVID-19. https://www.doi.gov/wildlandfire/wildfires-covid-19

[20] New York Times, 3/20/2020. How the Coronavirus Crisis May Hinder Efforts to Fight Wildfires. https://www.nytimes.com/2020/03/20/climate/coronavirus-firefighters-wildfires.html; US Department of the Interior. Wildfires & COVID-19. https://www.doi.gov/wildlandfire/wildfires-covid-19

[21] Wildfire Today, 8 November 2020; https://wildfiretoday.com/2020/11/05/over-200-forest-service-forestry-technicians-have-tested-positive-for-covid-19/

[22] National Wildland Fire Situation Report, Natural Resources Canada, https://cwfis.cfs.nrcan.gc.ca/report.

[23] Interview with Margot Downey, Natural Resources Canada, based on COVID-related survey for the Montreal Process Working Group, 20 November 2020.

Nevertheless, physical distancing measures imposed by provincial governments have complicated how firefighters would be housed and transported when travelling to regions affected by fires[24]. Of particular concern was the potential for workers traveling from one region to another to transmit the virus to local, mostly indigenous communities. Addressing these safety concerns was a priority for Natural Resources Canada in the early days of the pandemic, and agencies developed rigorous protocols that are in place to protect rural communities, especially Indigenous peoples [25]. The importance of these measures was borne out by the several Canadian wildland firefighters that returned from the USA who tested positive for COVID 19 [26].

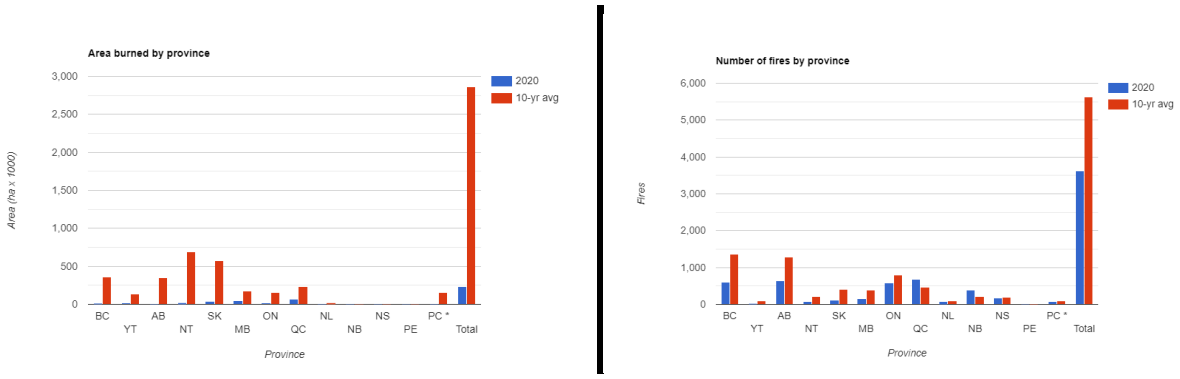

Figure 3. 2020 Fire season in Canada in terms of number of fires and area burned, by province (Source: NRCan[27]).

The wildfire picture in the USA has been quite different, with California experiencing the worst fire season on record. By late September, 8,136 fires burned over 1.5 million ha[28]. California has in the past relied on well-trained prisoner crews to augment other firefighters but COVID-19 disease clusters in crowded prisons have impacted the state's ability to rely on inmate fire crews[29]. In response, the state has turned to the US Army[30]. The situation was so dire that on September 9th, all National Forests in California and state forests in Oregon were closed to visitors. Some NF later re-opened. Nationally as of September 29, 2020, 44,091 fires had burned 3,022,328 ha, exceeding the 10 year-to-date average of 2,470,277 [31]. The nationwide preparedness level was at the maximum (level 5), indicating significant commitment of shared resources. Smoke from wildfires caused significant air quality hazards in western metropolitan

[24] GlobalNews, 5/4/2020.Canada's wildfire season expected to be 'well above average': Natural Resources Canada. https://globalnews.ca/news/6904825/coronavirus-canada-wildfire-season-2020/
[25] Interview with Maureen Whelan, Natural Resources Canada, 30 October 2020.
[26] Firefighters responded to the extreme fire season in the USA under mutual-aid agreements; Interview with Maureen Whelan, Natural Resources Canada, 30 October 2020.
[27] Natural Resources Canada, https://cwfis.cfs.nrcan.gc.ca/report/graphs#gr5
[28] CalFire, 9/8/2020. 2020 Incident Archive. https://www.fire.ca.gov/incidents/2020/
[29] Insider, 8/20/2020. As wildfires sweep through California, COVID-19 impacts the state's ability to rely on inmate fire crews. https://www.insider.com/california-facing-a-shortage-of-inmates-to-fight-wildfires-2020-8
[30] Sierra News Online, 9/1/2020. U.S. Army Joining USDA Forest Service Wildland Fire Operations in California. https://sierranewsonline.com/u-s-army-joining-usda-forest-service-wildland-fire-operations-in-california/?MvBriefArticleId=44289
[31] Year-to-date statistics, National Interagency Fire Center (NIFC) https://www.nifc.gov/fireInfo/nfn.htm .

areas such as the Bay Area in California[32] and caused the closing of national parks (Sequoia, Yosemite, and Kings Canyon National Parks) due to smoke levels and fire danger[33]. State parks in California were also affected by fires and smoke; 33 were closed in August and 16 remained closed by late September[34].

Smoke from wildland fire poses a significant health hazard to vulnerable populations, most concerning to those with respiratory problems (Naeher *et al.*, 2007; Henderson, 2020). Guidance for reducing transmission of the SARS COV-2 virus conflicts with health advice for smoke. Because distancing guidelines limit the number of people who can access community shelters, sheltering at home with portable air cleaners has been emphasized, along with closing windows and doors. Being outdoors and improving indoor ventilation, however, is recommended for avoiding COVID-19. Mask wearing is another method for reducing virus transmission but cloth masks provide almost no protection from particulates in smoke (PM2.5) that cause respiratory distress. Well-fitting N95 respirators offer protection but they have been in short supply and potentially increase risk to the most vulnerable populations because of breathing fatigue (Henderson, 2020).

7.2 Forest Management

Forestry has been identified in both countries nationally as an essential service. In Canada, the COVID-19 pandemic has affected forest pest management activities. Some agencies have maintained a level of operations in 2020 by developing work safety measures to mitigate potential spread of the virus among workers and communities where pest management operations take place. In the provinces most affected by the pandemic, safety measures forced agencies to scale back operations in the spring and summer of 2020. The Ontario Ministry of Natural Resources and Forestry cancelled a jack pine budworm aerial spray program. Some provinces operated their programs at reduced capacity; Saskatchewan, Manitoba and Nova Scotia prioritized forest pest survey and control activities, focusing on areas that could be accessed within day trips. Others, including Alberta and New Brunswick, conducted their regular forest health protection programs. Although it was challenging to work under the safety restrictions, there was little impact because most of the work was conducted outside, by individuals or small teams[35].

Forest management operations are seasonal and occur mostly in remote areas of Canada. Early in the pandemic, operations were delayed. A new government program designed to help the forest sector adjust to the new requirements and associated costs of new health and safety measures for workers provided C$30 million over one year. Included in this program was support for the tree planting season to continue in 2020 and meet forest regeneration

[32] San Francisco Bay Area choked by toxic smoke-filled air, SFGATE September 11, 2020 https://www.sfgate.com/california-wildfires/article/San-Francisco-air-quality-wildfire-smoke-worst-15559404.php

[33] Yosemite National Park to be closed due to heavy smoke, Mercury News September 18, 2020; https://www.mercurynews.com/2020/09/17/yosemite-national-park-to-close-due-to-heavy-smoke/

[34] California Department of Parks and Recreation, Incident Overview September 28, 2020, https://www.parks.ca.gov/?page_id=30009

[35] Interview with Maureen Whelan, Natural Resources Canada (UNFF Point of Contact), October 30, 2020

requirements in Canada's Sustainable Forest Management regimes[36]. Over 600 million seedlings were planted[37]. Tree planting camps reported no cases of COVID-19 because of the physical distancing measures in place[38]. Anticipating an active wildfire season and experiencing restrictions related to COVID-19, many jurisdictions in Canada banned prescribed burning in the spring that continued through the year[39]. Salvage operations in western Canada following wildfires and bark beetle outbreaks have proceeded[40].

In the USA, much of the work of the federal workforce moved to teleworking. Exceptions were law enforcement and wildfire suppression. Meetings were held online or virtually for activities such as grazing permits, but timber sales, harvesting inspections, timber surveys, permit inspections, prescribed fires, scientific surveys and forest health monitoring have been postponed or halted. Prescribed burning to reduce fuel loads has been suspended in most regions[41]. National forests are subject to extensive planning that requires much public participation; it is unclear how to accomplish that virtually, especially given that many of the public meetings are held in rural communities that are underserved with internet connectivity. One potential impact of concern is how will moving from in-person to virtual meetings impact project implementation, litigation, and objections to forest management or harvesting activities. As has been demonstrated by several cooperative conservation partnerships with other public and private sector actors, building trust is critical to effective cooperation, a process that is best accomplished by multiple, in-person interactions (Walpole *et al.*, 2017).

The US Forest Service (USFS) responded the multiple threats of the pandemic, wildfire, and other disturbances with Operation Care and Recovery[40] that includes a Pandemic Response Branch that will

- Assist the agency in managing a unified and consistent response to the COVID-19 pandemic, identifying and responding to novel issues as the pandemic evolves.
- Provide a high level of communication and coordination with the department, the Washington Office, and with regions and stations to ensure timely response to requests for information.
- Track status of COVID response in the agency, including employee COVID cases and facilities status and trends across the nation, advising agency leadership based on those trends and data.
- Leverage a focused and deliberate use of agency resources to help maintain operations and mission delivery throughout the course of the pandemic.

[36] Interview with Margot Downey, Natural Resources Canada, based on COVID-related survey for the Montreal Process Working Group, 20 November 2020.
[37] Interview with Derek Nighbor, Forest Products Association of Canada, 28 October 2020.
[38] Interview with Maureen Whelan, Natural Resources Canada (UNFF Point of Contact), October 30, 2020
[39] National Wildland Fire Situation Report, Natural Resources Canada, https://cwfis.cfs.nrcan.gc.ca/report.
[40] Interview with Darren Miller and Kirsten Vice NCASI, 4 November 2020.
[41] Blue Mountain Eagle, 8/28/2020. Pandemic slows progress on forest planning. https://www.bluemountaineagle.com/news/pandemic-slows-progress-on-forest-planning/article_a4a5944c-d699-11ea-9e74-af241c677c3c.html?MvBri ; AgALert, 4/1/2020. USFS outlines operations during COVID-19 pandemic. https://www.agalert.com/story/?id=13857 .

The USFS has not issued a blanket halt on all prescribed burning activity; instead, the USFS has taken a risk-informed approach by evaluating the following factors: (1) the ability to maintain fire responder viability and sustainability; (2) potential smoke impacts to communities from prescribed fire and how that interacts with COVID-19 effects; and (3) the ability to use local resources so that inter-state travel is unnecessary[42].

The health and safety measures for workers to counter COVID-19 could potentially delay even further reforestation on all lands because of worker shortages that are already problematic because of current immigration policies limiting guest workers. Planting crews are predominantly comprised of migrant laborers that enter the USA under H-2B guest worker visas. The Presidential Proclamation 10014 and its subsequent amendment suspended the H-2B visa program that includes forestry workers who plant nearly all seedlings in the USA, collect and sow seeds for future tree seedling crops, clear fuels to reduce wildfire risk, and complete forest health work (e.g., vegetation management, thinning, and other treatments). By one estimate, 650,000 ha could go unplanted, resulting in the loss of $US336 million in sunk seedling costs, $US109 million in increased costs from delaying or cancelling forestry work through the end of the year, costing the forest sector and rural communities $725 million in total[43]. Based on these impacts, a National Interest Exemption was granted on August 12th and visas have been processed, averting this impact[44].

Open spaces such as forests have taken on increased value for recreation and leisure as COVID-19 has severely restricted international travel. The pandemic has revealed the importance of forests as critical infrastructure (Derks *et al.*, 2020). Relatedly, there has been an upsurge in the sale of hunting and fishing licenses and outdoor equipment[45]. In the USA, urban residents are flooding into rural areas including public lands, particularly where large urban populations are within easy driving distance of forests. For example, during the early months of the pandemic, 26% of people visiting parks around Burlington, Vermont had rarely, if ever, visited nature in the previous year (Grima *et al.*, 2020). This has been particularly true for national and state forests that have seen dramatic increases in visitors that are placing increased pressure on ecosystem services. The increased utilization of recreation facilities has led to increased vandalism, garbage accumulation, and the danger of fire ignitions. As USFS Chief Victoria Christiansen said about impacts on USFS recreation sites, "Every day is like a weekend, and every weekend is like the Fourth of July"[46].

[42] US Forest Service. 9/10/2020. Forest Service coronavirus (COVID-19) Updates. https://www.fs.usda.gov/about-agency/covid19-updates.
[43] National Association of Forest Owners. August 20, 2020. The importance of H-2B guest workers for forests and rural communities. https://nafoalliance.org/survey-data-h-2b-forest-sector-impacts/
[44] Interview October 21, 2020 with Tim O'Hara, Forest Resources Association and Charlie Blinn, University of Minnesota.
[45] Interviews with Darren Miller and Kirsten Vice NCASI, 4 November 2020.
[46] Interview with Dr. Susan Charnley, US Forest Service, 2 September 2020.

There has been a similar upsurge in use of outdoor facilities in Canada, specifically in urban and peri-urban areas as well as provincial and national parks. This trend is expected to continue in the coming years[47]. For example, campground reservations in provincial parks in Alberta increased 5400 % in 2020 versus 2019 (Fig. 4)[48].

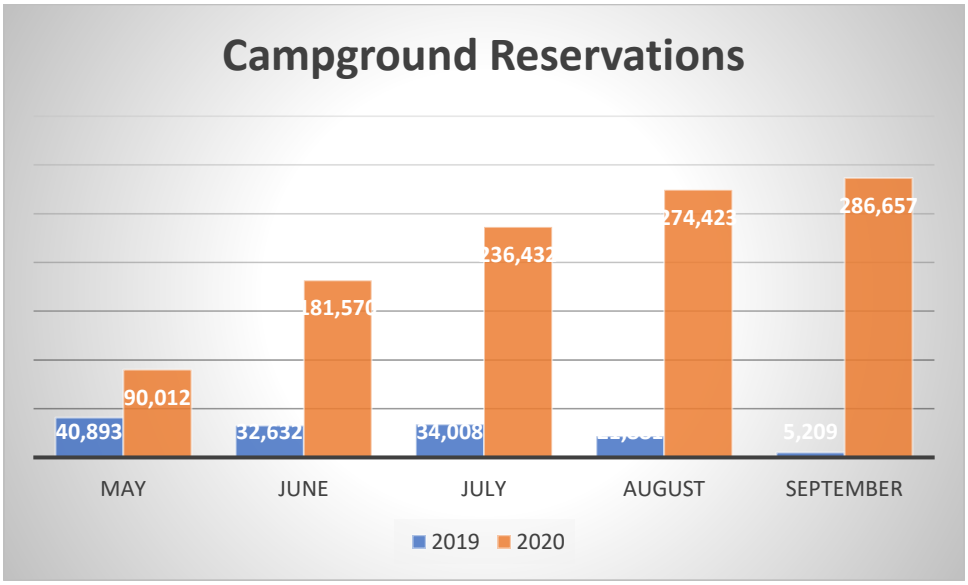

Figure 4. Campground reservations in Alberta provincial parks increased 5400% in the pandemic as people sought respite from isolation. (Source: Dave Dormer, CTV News)

Federal land management agencies in the USA collect significant revenues for resource extraction and other activities on forest lands that are likely to be affected by COVID-19 (Table 3) as these activities require personnel on-site for permitting, monitoring, and fee collection. For example, the four major land management agencies (*BLM, FS, FWS, NPS*) collected US$442 million in 2019 for recreation fees and the Forest Service and Bureau of Land Management collected US$217.1 in timber receipts (Table 3). The National Park Service has about 500 concessionaires in 100 park units, employing around 25,000 full-time and seasonal employees. Delayed park openings, services limited in order to comply with federal, state and local health guidelines, and reduced international and domestic travel have caused a significant decline in revenues for January through July 2020. The estimated 70% (ranging from 17% to 100%) drop in revenue is projected to be more than US$1.1 billion nationally for 2020, translating into a US$100 million decline in fees paid to the National Park Service[49].

[47] Interview with Margot Downey, Natural Resources Canada, based on COVID-related survey for the Montreal Process Working Group, 20 November 2020.

[48] Dave Dormer, CTV News, 27 October 2020; https://calgary.ctvnews.ca/alberta-camping-reservations-skyrocketed-5000-during-pandemic-1.5163226

[49] National Park Hospitality Association. ORR Member Survey Shows Pandemic's Catastrophic Impact to Outdoor recreation Industry. http://parkpartners.org/Latest-News.html

Table 3 Revenue Generating Programs and Activities of Federal Land Management Agencies (Source: (CRS, 2020a)

Activity	*Agencies*	*Revenue Basis*	*Collected Amounts (US$ millions)*	*Allocation of Receipts*
Recreation Fees	*BLM, FS, FWS, NPS*	*Fees for entrance and/or use of amenities*	*442.0*[a]	*100% to collecting agency*
Concessions and Commercial Visitor Services	*BLM, FS, FWS, NPS*	*Fees for concession franchises, permits, leases*	*134.3*[b]	*For NPS concession franchise fees,100% to NPS Allocation of other fees is variable; some agencies can only retain cost-recovery amounts*[e]
Energy Production and Mineral Extraction (Onshore)	*BLM, FS*	*Rents, bonuses, royalties, permit fees, material disposal*	*4,850,000*[c]	*Varies by applicable authorization*
Livestock Grazing	*BLM, FS*	*Permit/lease fees*	*21.0*[d]	*Split among agency, Treasury, and state (to benefit counties where receipts were generated)*
Timber Harvesting	*BLM, FS*	*Sale*	*217.1*[a]	*Varies by individual sale, with options for 100% agency retention; revenue-sharing requirements with communities also varies*

[a] *FY 2019*
[b] *FY 2019 in NPS concession franchise fees; amounts in other collections unavailable*
[c] *This amount does not include funds recovered in FY 2019 for exploration, material disposal, and wind and solar rights-of- way as data not available. In FY 2018, this amounted to US$ 103 million.*
[d] *FY 2018*
[e] *For example, in FY 2019 the USFS returned US$55 million to the Treasury from revenue generated by ski resorts on NFS lands.*

The pandemic affected research by reducing the length of the field season. In addition, access to research labs was also reduced that negatively impacted the work of researchers and scientists. The Government of Canada softened the impact by adjusting the current suite of forest sector specific programs. For example, an additional C$5.6 million was allocated in 2020-

21 to forest sector research and development to compensate for lost industry contributions and accelerated COVID-19 related research (e.g., facemasks and filtration). Other programs increased flexibility of the application process and reduced industry cost-share requirements[50].

Social distancing has affected forestry research in the USA. Laboratories have closed, researchers are working remotely, and some projects have closed or been suspended (CRS, 2020). Forestry research is heavily dependent on field measurements that in some cases have been able to continue but with added costs and time, for example sending multiple vehicles to transport crews to the field instead of a single vehicle and the inability to remain at remote locations overnight because of motel and restaurant closures. Of greater concern to many researchers is the uncertainty about future federal R&D budgets if COVID-19 causes reduced funding or shifting priorities towards other research (CRS, 2020).

Forest industry research with universities through NCASI experienced some delays initially but only 3 out of 50 projects were delayed until 2021[51]. Forest certification audits were adjusted to be done remotely. For example, in April FSC announced options of postponing audits or conducting desk audits in order to avoid certificate holders losing their certification status because auditors and staff were unable to conduct on-site audits[52].

In the short-term, students, postdoctoral researchers, and early-career faculty are likely to be impacted by shifts toward virtual or hybrid classes without field labs or interrupted research. The longer-term impact of cancelled scientific and technical conferences[53] and the inability to gather and share knowledge is harder to gauge. Some conferences are continuing virtually although the critical informal exchanges of information that occur at such gatherings will not occur. The full extent of these impacts will not be clear for some time, however, and may depend on a host of independent decisions by individuals, organization, agencies and Congress (CRS, 2020). Subsequent waves of the pandemic are having significant impacts on investments in capital and innovation in the forest sector. The pressures to maintain operations and meet bottom lines is taking away from longer-term investments in the sector, including research[54].

7.3 Forest Sector

The immediate economic disruption of the COVID-19 pandemic on the forest products sector was due to supply-side reductions caused by the closure of non-essential industries and workers not being able to remotely perform their activities. Demand-side changes were due to consumers responding to the pandemic by increasing demand for some goods and services,

[50] Interview with Maureen Whelan, Natural Resources Canada (UNFF Point of Contact), October 30, 2020.
[51] Interview with Darren Miller and Kirsten Vice, NCASI, 4 November 2020
[52] Forest Stewardship Council (FSC), 28 April 2020; https://www.fsc.org/en/newsfeed/new-covid-19-update-for-certification-bodies
[53] The Wood Industries News site lists 45 technical conferences that have been cancelled or postponed as of August 13, 2020 (https://www.woodbusiness.ca/heres-a-list-of-cancelled-forestry-events-in-north-america-due-to-coronavirus/).
[54] Interview with Margot Downey, Natural Resources Canada, based on COVID-related survey for the Montreal Process Working Group, 20 November 2020.

e.g., toilet paper or healthcare, and overall reduced demand for goods or services because of restrictions, e.g., restaurants or tourism (del Rio-Chanona *et al.*, 2020; Walmsley *et al.*, 2020). Increasing demand and production of hygiene products using ethanol has had a knock-on effect, causing shortages of other products such as printer ink. Depending upon the length of the pandemic and government responses to ease effects, workers who are laid off, have their wages reduced, or jobs eliminated due to firms closing or failing will have less disposable income that translates into further reductions in consumer demand.

The forest products industry has already experienced some of these immediate effects. Demand increased immediately for hygiene products such as toilet paper, due in part to panic buying by consumers and by employees working from home [55]. On March 12, toilet paper sales in the USA were 734% compared with the same day the previous year[30]. Shortages continued through to summer, illustrating the down-side of lean supply-chain management. Because of the consistent demand for toilet paper the cost of warehousing such a bulky product, just-in-time manufacturing dominates the industry. The immediate response was to increase production and switch to producing only large packages. Nevertheless, the ability to increase production had limited effect as toilet paper machine capacity could only be increased from 92% to 99.8%. The longer-term response will be to redesign manufacturing systems for a more volatile, less predictable environment[30].

Supply side effects

Forest2Market research shows that wood raw material consumption between January-July 2020 was 6.7% lower than the same period in 2019 – dropping by 21.4 million tons of material. This resulted in a 13% reduction ($1.83 billion) in value of the delivered wood. That $1.83 billion dollar loss in value has had a significant impact throughout the forest supply chain, from timberland owners to loggers and truckers.

More than 130 Mills in Canada shut down or reduced production in response to the COVID-19 pandemic[56] and other factors including lingering effects of wildfires from the previous year. Reduced production resulted from declining demand for newsprint and specialty paper, sawmill downtime, and reduced availability of the workforce due to safety precautions. As of August 2020, three lumber mills and five pulp/paper mills in Western Canada have closed or reduced capacity. Two pulp/paper mills, 6 sawmills, and a newsprint plant in eastern Canada have reduced capacity due to reduced demand and/or COVID restrictions (Table 4).

The Canadian forest products sector is more dependent than the USA on exports; Canada has a larger forest product trade balance than any other country, C$ 26.7 against C$36.8 billion in

[55] Fortune 500. 2020. The case of the missing toilet paper: How the coronavirus exposed U.S. supply chain flaws. https://fortune.com/2020/05/18/toilet-paper-sales-surge-shortage-coronavirus-pandemic-supply-chain-cpg-panic-buying/

[56] Interview with Margot Downey, Natural Resources Canada, based on COVID-related survey for the Montreal Process Working Group, 20 November 2020.

total forest products exports in 2018 (pulp 26%, paper 28%, and wood 50%)[57]. In addition to the economic impact, the pandemic has affected export regulations. For example, the British Columbia government delayed imposing regulations on coastal log exports because of the market effects of the COVID-19 pandemic[58].

In the spring of 2020, demand for wood products dropped suddenly but this was short-lived; demand has since increased substantially, as indicated by recent record lumber prices (Fig 5). Longer-term, the changes imposed on society by COVID-19 have accelerated the declining demand for paper products. Indeed, there has been an on-going trend to re-purpose pulp mills; for example, Domtar has changed some mills from paper to make fluff[59] or containerboard [60]. Production of softwood lumber and wood pellets are expected to grow, while other products are expected to decline[61]. The Canadian pellet industry has been minimally impacted by the COVID-19 pandemic and pellet exports have increased significantly. Domestic demand for pellets has remained stable because pellet mills provide fuel for other essential industries such as heat and electricity. Most of the pellets produced in Canada are under long-term contracts ensuring long-term sales and demand for the industry[61].

The forest products industry in the USA is integrated with the larger economy through housing, manufacturing, and consumer goods. Since the end of the 2007-2008 recession, total lumber capacity in North America increased 9% from a low-point in 2010 just as pulping capacity fell 9%, mostly due to contraction of newsprint and printing and writing mills in the northern US and eastern Canada (Forisk Consulting: August 18, 2020). The immediate effect of the COVID-19 pandemic has been disruption of the value chain as companies restricted access to offices, mills, and plants and reduced field operations to protect their employees. The impact varied by industry sector with some mill shut downs (Table 5) offset by production increases to meet increased demands for tissue and other paper products[62]. Longer term, effects are likely to be delayed and recovery for domestic demand and exports is expected to take until 2021, with stumpage markets remaining weak through 2022[63].

[57] Canada Forest Products Industry Association, Industry by the Numbers, https://www.fpac.ca/canadian-forestry-industry/forest-products/)
[58] Victoria News June 11 2020, B.C. delays increase to log export restrictions in COVID-19 crisis, https://www.vicnews.com/business/b-c-delays-increase-to-log-export-restrictions-in-covid-19-crisis/
[59] Interview with Darren Miller, NCASI, 4 November 2020.
[60] Domtar Corporation announced on October 28, 2020 a agreement with Voith to provide equipment and technical services to convert the paper machine at its Kingsport, Tennessee, mill to produce recycled containerboard including high-performance lightweight packaging grades, as well as industry standard grades.
[61] Interview with Maureen Whelan, Natural Resources Canada (UNFF Point of Contact), October 30, 2020.
[62] Accenture, 8 May 2020, https://www.accenture.com/us-en/insights/natural-resources/coronavirus-navigating-disruption-forest-products.
[63] University of Arkansas Extension Service, 10 April 2020, https://www.uaex.edu/media-resources/news/april2020/04-10-2020-Ark-COVID-forestry-impacts.aspx

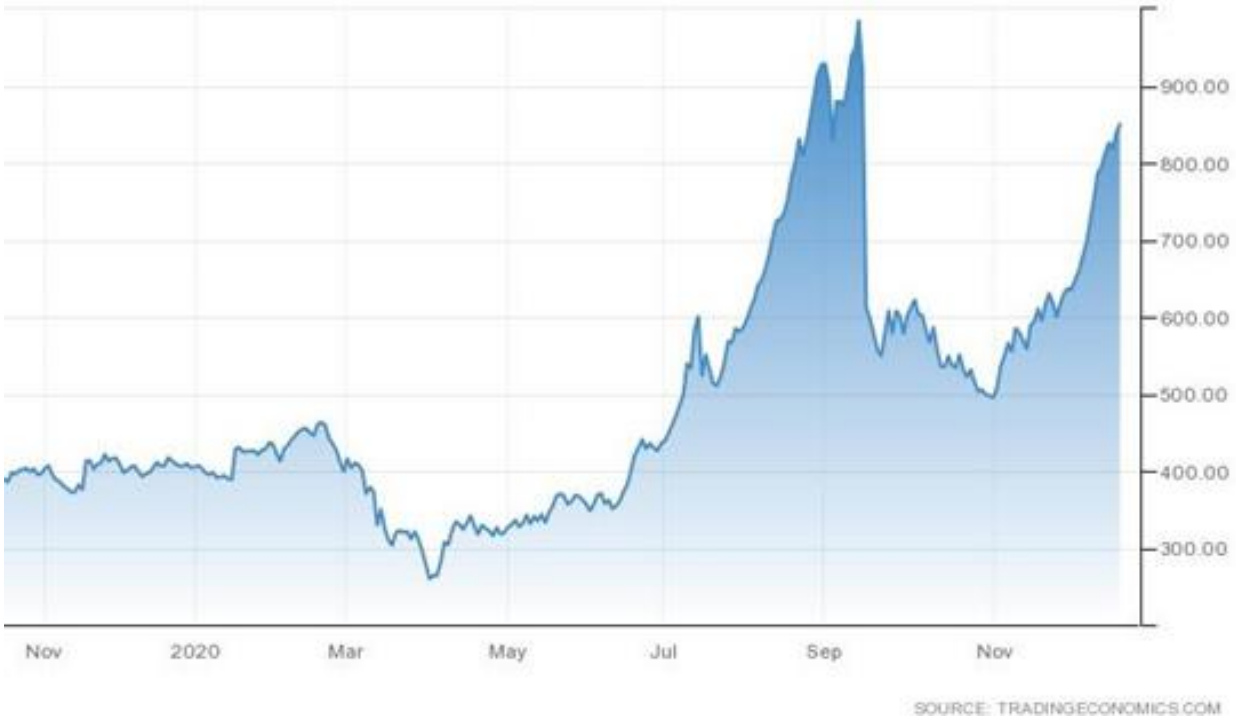

Figure 5. Lumber prices (US$/100 board feet), November 2019-2020[64]

[64] Source: Forest2Market, 8 December 2020, https://www.forest2market.com/blog/southern-timber-prices-jump-nearly-10-in-3q2020?utm_medium=email&_hsmi=102364988&_hsenc=p2ANqtz-8Lu7QjfQave2BQtLLzIPBvKn8zU1qT8exVaX3GAAN91aZ8SHn6sXbwYWsrZsCZpoedfuOGIsqbr-pm-NYhYZvAvvTDqA&utm_content=102364988&utm_source=hs_email

Table 4. Mill closures in Canada due to the COVID-19 pandemic. (Source: Forisk Consulting, Aug. 2020)

Mill Name	Company	City	Prov	Region	Product	Reasons
C&C Wood Products	C&C Resources	Quesnel	BC	West Canada	lumber	On May 29th, firm filed for bankruptcy due to COVID effects on operations, mill originally closed two weeks in June, indefinitely idling
Canfor Isle Pierre	Canfor	Isle Pierre	BC	West Canada	lumber	Announced it will be permanently closing its Isle Pierre sawmill, which is located near Prince George, British Columbia. The closure will take effect in the third quarter of 2020 following an orderly wind down of operations.
Conifex MacKenzie	Conifex	MacKenzie	BC	West Canada	lumber	Conifex extends temporary production curtailment at Mackenzie, British Columb sawmill for five weeks to July 6 as COVID-19 impacts continue to weaken global demand for forest produ
Canfor Prince George Pulp & Paper and Canfor Intercontinental Pulp	Canfor	Prince George	BC	West Canada	pulp/ paper	Canfor Pulp Products Inc. is announcing the curtailment of Prince George Pulp a Paper and Intercontinental Pulp for approximately four weeks starting July 6, 2020.The curtailment will reduce Canfor Pulp's production output by approxima 38,000 tonnes B.C.'s timber shortage and the COVID-19 crisis
Mercer International Celgar	Mercer Intl.	Castlegar	BC	West Canada	pulp/ paper	Took approximately 30 days of additional downtime, due to COVID-19, in July 20 citing COVID-19 related sawmill curtailments and stumpage fees
Paper Excellence Crofton	Paper Excellence	Crofton	BC	West Canada	pulp/ paper	Crofton mill to be curtailed until midsummer, starting late April
Paper Excellence - Mackenzie	Paper Excellence	Mackenzie	BC	West Canada	pulp/ paper	Paper Excellence closing Mackenzie pulp mill due to lower demand for pulp fror COVID-19 and shrinking fiber supply affecting 253 jobs COVID-19, timbre shorta in B.C. and the closure of area sawmills
Paper Excellence - Powell River	Paper Excellence	Powell River	BC	West Canada	pulp/ paper	Mill to be curtailed until mid-summer, starting early May

Rayonier Advanced Materials		Kapuskasing	ON	East Canada	newsprint plant	Curtailed production at its for at least two weeks starting the week of Mar. 26
			ON and QC	East Canada	Six of the company's softwood sawmills	Halted or reduced production for at least two weeks
Resolute FP Amos	Resolute Forest Products	Amos	QC	East Canada	pulp/ paper	Mill has been curtailed because of weakened demand. Resolute explained that t outbreak of the coronavirus and the associated lockdown measures led to a collapse in demand for newsprint as well as for the company's specialty papers.
Resolute FP Baie-Comeau	Resolute Forest Products	Baie-Comeau	QC	East Canada	pulp/ paper	Mill has been curtailed because of weakened demand. Resolute explained that t outbreak of the coronavirus and the associated lockdown measures led to a collapse in demand for newsprint as well as for the company's specialty papers. early May, Resolute temporarily laid off 1,000 workers, mostly in Quebec in its newsprint, specialized pulp, wood products and head office divisions.

Table 5 Mill closures or production curtailments in the US due to the COVID-19 pandemic. (Source: Forisk Consulting, Aug. 2020)

Mill Name	Company	City	State	Region	Product	Reasons
Gutchess Lumber - Brookville	Gutchess Lumber	Brookville	PA	North	lumber	Production and logging have stopped; cannot run Cortland mill during pandemi to unemployment extra benefits; increasing virus rates have hurt orders.
IP Ticonderoga	International Paper	Ticonderoga	NY	North	pulp/ paper	Closed initially for two months in May; closures due to declining demand for its product, freesheet paper.
Sappi Westbrook	Sappi North America	Westbrook	ME	North	pulp/ paper	Sappi permanently closing PM9 machine In Westbrook and redistributing produ to Skowhegan and Cloquet mills
Verso Duluth and Wisconsin Rapids	Verso Corporation	Duluth and Wisconsin Rapids	MN	North	Pulp /paper	Verso indefinitely idling Duluth and Wisconsin Rapid mills due to COVID effects printing and writing (Graph paper)
Hood Metcalfe	Hood Industries	Metcalfe	GA	South	lumber	Metcalfe mill took downtime due to COVID-19, extended through July 1, 2020
Domtar Ashdown	Domtar	Ashdown	AR	South	pulp/ paper	Paper machine initially idled In April; mill permanently shuttering paper machin operations in Q3; transitioning to softwood and fluff pulp production
Domtar Kingsport	Domtar	Kingsport	TN	South	pulp/ paper	Kingsport (uncoated freesheet) to be shuttered and converted to linerboard in 2
Evergreen Packaging Canton	Evergreen Packaging Co.	Canton	NC	South	pulp/ paper	Paper machine currently idled that makes graphic paper

GP Foley Cellulose	Georgia-Pacific Co	Perry	FL	South	pulp/ paper	GP's Foley cellulose mill to scale back production, lay off 150 employees amid decline in product demand due to COVID-19 pandemic. The mill makes specialty fibers
GP Muskogee	Georgia-Pacific Co	Muskogee	OK	South	pulp/ paper	80 production line employees are being laid off due to short term and temporar affects due to COVID
Graphic Packaging West Monroe	Graphic Packaging	West Monroe	LA	South	pulp/ paper	Closure of the 120,000-ton West Monroe, Louisiana PM1 containerboard machi effective June 30, 2020.
PCA Jackson	Packaging Corporation of America	Jackson	AL	South	pulp/ paper	Initially idled both paper machines and the sheet-converting operation for the months of May and June 2020; curtailment extended through September
Interfor Gilchrist	Interfor	Gilchrist	OR	West	lumber	Interfor curtailed Gilchrist, Oregon, sawmill in late June, laying off 130 workers, citing weak economic conditions, challenges of COVID-19 lockdown
Cosmo Specialty Fibers	Cosmo Specialty Fibers	Cosmopolis	WA	West	pulp/ paper	Mill temporarily shut down starting early May; expected to last 90 days
GP Toledo	Georgia-Pacific Co	Toledo	OR	West	pulp/ paper	Temporary downtime for one week (May 21- 28) at containerboard mill due to reduced demand; shuttering of two paper machines starting July 13for seven to days
Ponderay Newsprint Co.	Ponderay Newsprint Co.	Usk	WA	West	pulp/ paper	Indefinitely shut down paper mill after initially idling for 2 weeks in June due to COVID.

Log exports from the US (primarily from the Pacific Coast) have declined over the last decade and the disputes with China further weakened the export market[65]. The pandemic has compounded the impact of the U.S.-China trade war. The tariffs on Chinese woodworking and furniture industries imposed by the US reduced imports of furniture and other finished wood products from China, which decreased Chinese demand for logs and lumber from the US and Canada. The Chinese retaliated to the US tariffs by imposed their own 25% tariffs on U.S. logs and lumber (Pryor, 2019).

Continued disruption of the economy and high unemployment could reduce consumer demand for some time[66]. In the short-term, the impact on the forest products industry has varied by segment. Wood consumption through July 2020 was 6.7% lower than the same period in 2019 with a loss of US$1.83 billion in value of delivered wood. That loss in value flowed through the supply chain, from timberland owners to loggers and truckers. The impact of these reductions on timber markets varies by region; the impact is greater in the US West than South because lumber is a larger component of total solid wood timber demand in the West. In the Northwest, lumber demand has increased with spruce, pine, and fir lumber composite prices rising 239%[67]. To further roil timber markets in the US South, Hurricane Laura hit the Gulf of Mexico and passed through a dense wood product manufacturing region, causing an estimated US$ billion in damage to timber stumpage in Louisiana alone.

Supplies of lumber declined in March and April because of restrictions tied to stemming the spread of COVID-19. By September 2020, lumber prices had soared to record prices in response to high demand from housing and DIY markets (Fig. 5). Oversupply of southern stumpage has delayed the process for stumpage prices to respond to the increased lumber demand. In spite of the initial response of producers to COVID 19 to cut production, anticipating a fall in lumber demand, shelter-in-place orders spurred home repair and renovation activity. This segment, including do-it-yourself (DIY) sales, has accounted for about 50% of softwood lumber consumption in the US[68]. Lumber prices began a sharp decrease in late September; for example, southern yellow pine lumber price was $US 569/MBF on October 16, a drop of 17% from the $US690/MBF the previous week[69]. Prices rebounded through November (Figure 5).

The pulp and paper sector has shown mixed response. The demand for sanitary paper products has been exceptionally strong as consumers have rushed to buy toilet paper, paper towels, and cleaning products. Markets for finished paper, containers, and packaging have declined from 2019 levels[68] and the pandemic has accelerated trends toward on-line instruction and reduced photocopying, thereby decreasing demand for finished papers.

The long-term effects of the pandemic on the forest products sector will continue to vary among market segments. Production cuts that were taken at the beginning of the pandemic will be hard to add back. Labor

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[65] Forest2Market, 16 December 2020, https://www.forest2market.com/blog/2020s-impact-on-the-pnw-forest-sector?utm_medium=email&_hsmi=103358633&_hsenc=p2ANqtz-_A3oMyhej2AahooHHskdaJE7OGfznPHPh00DBdNVfxYslekli5uYFnYUatxT-ypY-_UP5v4MJtoptBRIamsnE0SJjEow&utm_content=103358633&utm_source=hs_email.

[66] University of Arkansas Extension Service, 10 April 2020, https://www.uaex.edu/media-resources/news/april2020/04-10-2020-Ark-COVID-forestry-impacts.aspx.

[67] Freres Lumber, 14 September 2020, https://frereslumber.com/blog/wood-product-shortages/ .

[68] [Hancock NRG April 2020 Scenario Analyses--Timber Market Outlook: COVID-19 Scenario Analysis. V versus K recovery projections]

[69] Forest2Market. Lumber prices continue to freefall. October 22, 2020. https://www.forest2market.com/blog/lumber-prices-continue-to-freefall?utm_campaign=Lumber%20Email%202017%20-%20Mills&utm_content=143598319&utm_medium=social&utm_source=linkedin&hss_channel=lcp-831906

continues to be a constraint even with high unemployment[70]. Extremely low-interest rates will likely continue and spur housing construction; July total housing starts increased by 22.6% to 1.496 million units[71]. Over the long-term, however, high levels of government debt incurred to fund economic stimulus will influence economic growth for decades and even bright spots such as housing will fall off [72].

7.4 Livelihoods

7.4.1 Work Force

Disruptions of the value chain in forestry from the COVID 19 pandemic include effects on labor markets, employment, and wages (Gallacher and Hossain, 2020; Lund *et al.*, 2020; Nikolopoulos *et al.*, 2020). Federal and state/provincial governments in both countries have designated forestry and forest products workers essential, with teleworking offered to those whose duties were suitable. The mill closures and interruptions in Canada, noted above, have caused short-term employment impacts. As production decreased, so did employment. Investments required by companies to ensure health protocols have been put in place are having a negative impact on current hiring capacity. This is evidenced by vacant positions not being re-staffed and increasing workloads on those capable of working both remotely or physically in the workplace[73]. For example, in May, Resolute Forest Products announced it would temporarily lay off more than 1,000 employees as a result of the COVID-19 crisis, mostly located in Quebec[74]. The layoffs impacted the newsprint, specialized pulp and wood products division, as well as the Montreal head office.

Some of these impacts will be long-term (especially in the pulp and paper sub-sector). Other industry segments, however, increased production, such as the Canadian paper mill that doubled its production of medical-grade pulp suitable for masks and gowns[75].

Governments, employers and employers' organizations have developed general and specific safety and health regulations and advice for the workplace relative to COVID 19[76]. Physical distancing is one critical safety and health measures but it is often difficult to maintain the recommended 2-meter distance between workers in manufacturing facilities such as sawmills.

Forest workers, especially loggers, engage in tasks that are inherently risky that can be compounded by contagious diseases, such as COVID-19 (ILO, 2020). In Canada, such work often requires living in temporary camps in remote areas. Workers often live in shared accommodation with a high level of social contact that increases their risk of infection (ILO, 2020). These jobs are closely tied to the manufacturing sector and the short-term disruptions in some processing facilities transferred into the logging workforce. One example was in North Carolina, where a survey of loggers suggested there was a 30-35% reduction in logging activities in

[70] Accenture, 8 May 2020, https://www.accenture.com/us-en/insights/natural-resources/coronavirus-navigating-disruption-forest-products.

[71] Forest2Market, 30 September 2020, https://www.forest2market.com/blog/housing-starts-stalled-in-august-despite-hot-national-housing-trend?utm_medium=email&_hsmi=96453029&_hsenc=p2ANqtz-8Q8f8QumNhTZY5jgB05F1DfSm2eJy58HIFMNcphXbDDtJvCGSeHFUMhSK9551h1k10JcBAEmXek8LT3DhHhb9cRX7Kgg&utm_content=96453029&utm_source=hs_email.

[72] University of Arkansas Extension Service, 10 April 2020, https://www.uaex.edu/media-resources/news/april2020/04-10-2020-Ark-COVID-forestry-impacts.aspx.

[73] Interview with Margot Downey, Natural Resources Canada, based on COVID-related survey for the Montreal Process Working Group, 20 November 2020.

[74] https://www.pulpandpapercanada.com/resolute-temporarily-lays-off-more-than-1000-workers-citing-covid-19/

[75] https://nationalpost.com/news/canada/covid-crisis-prompts-b-c-mill-to-boost-medical-pulp-production

[76] See, for example: https://www.forestresources.org/safety-best-practices-during-covid-19 , United States; https://www.worksafebc.com/en/about-us/covid-19-updates/covid-19-industry-information/forestry British Columbia; https://www.pemac.org/mill-managers-collaborate-covid-safety-response Canada

the third week of May[77]. In the USA, the logging profession has low social status, perceived as demanding physical work, low wage, requiring frequent travel, seasonal layoffs, and a significant risk of serious injury (Goldstein *et al.*, 2005). Out of 250 occupations, logging was ranked 248th (Krantz, 1999). There were about 56,900 jobs in the logging sector in 2019, with projected declining employment opportunities (13% from 2019 to 2029). Nevertheless, there will be a shortage of some 7,000 loggers by 2026 because of the need to replace workers who leave the occupation for retirement or for other jobs that are less physically demanding[78].

Other forest work in the USA is typically done by migrant workers, historically coming to the country under temporary H-2B guest worker visas. These forestry jobs are unattractive to citizens even though widely advertised. In FY2020, of the 6,350 positions advertised, only 1.9% of the applicants for these jobs were local [79]. The work is arduous and requires that the workers are constantly on the move for 6-8 months. Anecdotally, the contractors report that workers are observing masking and social distancing when traveling and outside of work (but not while planting)[80].

Wildland firefighters work under similarly difficult conditions, particularly those responding to large, on-going fires and staying in camps. The potential for COVID-19 outbreaks in fire camps has been modeled by (Thompson *et al.*, 2020). They examined two interventions using a COVID-19 epidemic model of contagion: screening firefighters arriving on an incident, and social distancing in the camp. Screening was relatively more effective on short incidents, but social distancing worked better during extended campaigns. Testing was critical to the effectiveness of screening, due in large part to the risk of asymptomatic individuals and the high turnover of firefighters coming from many places with different levels of viral loads.

Outbreaks could also have implications beyond the health effects in the camps. Outbreaks could also affect the ability of the firefighting community to respond to multiple fires in an active season. Large wildfires have been the norm in recent years and resources have been strained when several fires occur simultaneously (Belval *et al.*, 2020). Infected personnel who leave a fire are not easily replaced or worse, infected but asymptomatic individuals may leave one fire and spread the infection to another camp; if a large proportion of the workforce is recovering or quarantined, the entire system comes under significant strain (Thompson *et al.*, 2020). Safety measures were by and large, effective.

7.4.2 Effects on Indigenous Peoples

In Canada, indigenous tourism is one industry that has been facing unique economic and social/cultural impacts from COVID-19. Indigenous Tourism Association of Canada (ITAC 2015a, 2015b), defined Indigenous tourism as, "all tourism businesses majority owned, operated and/or controlled by First Nations, Métis or Inuit peoples that can demonstrate a connection and responsibility to the local Indigenous community and traditional territory where the operation resides" (Swaikoski, 2020). Indigenous tourism had outpaced Canadian tourism activity overall but with the pandemic, it came almost to a complete standstill. In response, Indigenous Services Canada, a federal government agency, partnered with ITAC to stand up ITAC's COVID-19 Stimulus Development Fund. Since March, 678 tourism businesses have received grants from the fund, of up to $25,000 per applicant, totaling C$16.21 million. These grants have gone to export-, market- and visitor-ready Indigenous tourism businesses in Canada[81].

[77] https://content.ces.ncsu.edu/a-close-look-at-the-north-carolina-logging-industry-historical-trends-and-impacts-of-the-covid-19-p?x=78900
[78] https://www.bls.gov/ooh/farming-fishing-and-forestry/logging-workers.htm
[79] https://forestresources.org/pdf/H-2B_Guest_Worker_Ban-Impacts_on_Forests_and_Rural_Communities.pdf
[80] Interview October 21, 2020 with Tim O'Hara, Forest Resources Association and Charlie Blinn, University of Minnesota.
[81] ITC 2020, https://indigenoustourism.ca/corporate/tourism-development-funding-support-program/

Forest industry in Canada is located mostly rural communities and the potential for COVID 19 transmission by workers coming in from other parts of the country was a concern. For example, seasonal tree planting crews are drawn largely from other regions. These communities generally have limited access to health care. Rigorous protocols were put in place to protect rural communities, especially Indigenous peoples. One early response was to shut down trucking that could have impacted food supply for remote communities but this was quickly relaxed[82].

7.4.3 Effects on Gateway Communities and Recreation Providers

Travel restrictions and social distancing requirements severely impact tourism and outdoor recreation (Gössling *et al.*, 2020).Recreation and resource user fees collected by federal agencies in the USA are significant (Table 3) and likely to be affected by COVID-19. For example, the four major land management agencies (*BLM, FS, FWS, NPS*) collected US$417 million in 2019 in fees for entrance, use of amenities or both with all the collected fees retained by the agencies. State parks in the USA are facing multiple threats to their funding as COVID-19 strains budgets and revenue is lost because of reduced tourism caused by travel restrictions. Some states such as Pennsylvania, are contemplating user fees, a departure from long-standing tradition of free access[83].

The economic impact of outdoor recreation visitors on local economies (termed Gateway Communities) is significant; visitors spent an estimated US$51 billion in the communities around the federal lands (White *et al.*, 2016). The reduced visitation to National Parks and National Forests caused by travel restrictions, particularly international travel, has impacts beyond the natural features. Gateway communities, located outside the park boundaries or within national forests, depend upon spending by visitors for services as well as state and local sales and tourism taxes bases on concessioner sales. The impact extends beyond the peak summer vacation season. There are 460 ski areas in 37 states, many in the western USA located on National Forest System lands; most were deemed non-essential and closed in February/March. The impact has been estimated by the National Ski Areas Association and RRC Associates at US$2 billion from revenue losses at the end of the 2019-20 season and an expected drop in future season pass sales[84].

Many small seasonal recreational businesses that provide outdoor recreation services or equipment are at risk of bankruptcy. These include outfitters and guides whose customers come from outside the local area, usually by air. There are an estimated approximately 40,000 small businesses nationwide providing outdoor recreation services; 15,000 of them operate under permit, contract or other authorization on federal lands. Reservations in March had declined by over 25%[85]. Longer-term impacts are due to reduced or delayed spending on equipment, marketing and recruitment of seasonal employees[86].

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[82] Interview with Nicholas Mansuy, Natural Resources Canada, 4 September 2020.

[83] How will America's state parks survive 2020? National Geographic September 18, 2020, https://www.nationalgeographic.com/travel/2020/09/state-parks-face-budget-cuts-wildfires-coronavirus/?cmpid=org=ngp::mc=crm-email::src=ngp::cmp=editorial::add=Travel_20200922&rid=01E9832ADC4F068C1A0A456F17AD889D

[84] Forbes. May 6, 2020. Will Ski Resorts Reopen? How Coronavirus Will Affect Season Passes, Capacity. https://www.forbes.com/sites/michellebruton/2020/05/06/will-ski-resorts-reopen-how-coronavirus-will-affect-season-passes-capacity/#271cda421894

[85] America Outdoors, March 18, 2020. Letter to Senate Leadership. https://www.americaoutdoors.org/assets/1/27/AO_letter_to_Senate_leadership_re_coronavirus_relief.pdf?6482

[86] America Outdoors, April 10, 2020. Pulse of the Outfitter Industry During COVID-19. https://www.americaoutdoors.org/assets/1/27/pulse_of_outfitter_industry_comparison_report_April_10.pdf?6528

7.5 Financial Support

Financial support from government to businesses and agencies to help survive the COVID -19 pandemic have included direct subsidies, favorable interest rates, tax reductions and delayed payments, additional credit lines, and regulatory changes. The federal government in the USA has responded to the COVID-19 pandemic by providing financial relief to some sectors of the economy through the CARES Act (Coronavirus Aid, Relief, and Economic Security Act)[87]. The Act provided funding for numerous agricultural commodities, but timber did not yet qualify for COVID-19 assistance. Nevertheless, at least one state, Alabama, directed support to timber owners. Alabama has awarded $10 million of the Coronavirus Relief Fund for a statewide program to help Alabama timber owners impacted by the COVID-19 pandemic. The Alabama Forestry Commission administered grants of up to US$10,000 to qualifying timber owners who harvested timber in Alabama during the months of March through July. The payment rate was US$1 per ton of timber sold.[88]

Many small businesses in the forest sector qualified for other assistance programs under the CARES and other acts such as the Paycheck Protection Program that provides a forgivable loan to help small businesses retain their employees[89]. Other bills were introduced that would make economic relief payments to logging and log trucking businesses who experienced losses of greater than 10% in the first two quarters of 2020 (compared to 2019)[90] but these were not enacted until inclusion in the Emergency Coronavirus Relief Act of 2020 COVID relief package that was signed on 28 December 2020. The second act added timber to supported commodities and includes $200 million in funding for logging and log trucking businesses who saw a greater than 10 percent loss in revenues from January 1 through December 1, 2020 related to the COVID-19 pandemic, as compared to revenues for the same period in 2019[91].

The CARES Act provided the USFS with US$70.8 million in supplemental funding to over extraordinary costs of the pandemic. This included US$3 million to re-establish scientific experiments impacted by travel restrictions, such as the Forest Inventory and Analysis program. The National Forest System received US$34 million for daily cleaning and disinfecting of recreation facilities, increased supply of personal protective equipment, and baseline testing for first responders. Facilities received capital improvement and maintenance funding of US$26.8 million for cleaning needs related to the coronavirus. Additional personal protective equipment and baseline testing for first responders, including wildland firefighters, was funded at US$7 million[92]. The Forest Service allowed loggers more time to fulfill their contracts in national forests[93].

[87] US Senate Committee on Small Business and Entrepreneurship, 9/10/2020. CARES Act. https://www.sbc.senate.gov/public/index.cfm/guide-to-the-cares-act

[88] WTVY, $10M from CARES Act awarded to help Ala. timber owners. https://www.wtvy.com/2020/09/01/10m-from-cares-act-awarded-to-help-ala-timber-owners/?MvBriefArticleId=44294

[89] Forest Resources Association. SBA Paycheck Protection Program. https://www.forestresources.org/sba-paycheck-protection-program

[90] Forest2market. 2020. BREAKING: Impact of COVID-19 on America's Forest Supply Chain https://www.forest2market.com/blog/breaking-impact-of-covid-19-on-deliveries-of-us-forest-products

[91] American Loggers Council, 21 December 2020, https://www.amloggers.com/news/loggers-celebrate-passage-of-emergency-coronavirus-relief-act-of-2020.

[92] Senate Committee on Appropriations, "$340 Billion Surge in Emergency Funding to Combat Coronavirus Outbreak," https://www.appropriations.senate.gov/imo/media/doc/Coronavirus%20Supplemental%20Appropriations%20Summary_FINAL.pdf

[93] US Forest Service April 16, 2020. USDA Forest Service moves to support timber market, offers extension of timber contracts to address falling timber markets amid the COVID-19 pandemic. https://www.fs.usda.gov/news/releases/usda-forest-service-moves-support-timber-market-offers-extension-timber-contracts

Responding to the scarcity of personal protective equipment for health care workers and the public, the Canadian government is funding development of paper-based protective mask[94]. The Canadian Forest Products Association has recommended increased federal spending (CFPAC, 2020) based on supporting a bioeconomy (CCFM, 2017). The Government of Canada on 30 November 2020 released an economic statement that included funding for the forest sector [95]. The Nature Based Solutions to Climate Change provides C$3.16 billion over ten years starting in 2021-2022 to NRCan to partner with provinces, territories, and other stakeholders to plant 2 billion trees. An additional $30 million is to help small and medium-sized forest businesses to manage increased costs of safe operations, including tree-planting operations during the pandemic. In support of gender-centric provisions, the funding for commercial tree planting in 2020 and 2021 seeks to create opportunities for younger planters, as well as increased female representation. Beginning in 2021-22, C$631million will be provided over ten years to restore degraded ecosystems, protect wildlife, and improve land and resource management practices. The provincial government of Alberta has deferred the payment of timber dues for up to six months[96] and the British Columbia government delayed imposing regulations on coastal log exports because of the market effects of the COVID-19 pandemic[97].

The Canada Emergency Wage Subsidy, the federal government's wage subsidy program, has provided limited benefit to the forestry sector [98]. Forestry ranked fourth last in terms of share of private sector workers covered by the subsidy. Compared to other industries, the forest industry has not faced a large change in employment from April to August 2020. The governmental response has been criticized for the rescue package containing a massive road expansion and tax relief for fossil fuel companies[99].

7.6 International Cooperation

Recognition that deforestation and forest fragmentation have increased incidence of zoonotic diseases or zoonoses (Wolfe *et al.*, 2005; Wilkinson *et al.*, 2018; Everard *et al.*, 2020), diseases transferred from animals to humans[100]. Although the current emphasis is on diseases emerging from the Tropics, the USA and Canada have experienced Lyme Disease that is transferred from deer to humans (Wilcox and Ellis, 2006). Climate change is accelerating the emergence of mosquito borne diseases typical of warmer climates into northern latitudes (Burkett-Cadena and Vittor, 2018).

International cooperation has not been negatively impacted. Initially travel restrictions disrupted meetings, however, meetings, negotiations, and multilateral initiatives have resumed and moved to virtual platforms. For example, the 25th Session of the FAO Committee on Forestry (COFO) was entirely virtual with

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[94] Pulp and Paper Canada. August 7, 2020. FPInnovations receives $1.3M from feds to develop forest-fibre filters for face masks. https://www.pulpandpapercanada.com/fpinnovations-receives-1-3m-from-feds-to-develop-forest-fibre-filters-for-face-masks; Canadian Biomass Magazine. August 4, 2020. Feds invest $300K in prototype face mask using wood pulp. https://www.canadianbiomassmagazine.ca/feds-invest-300k-in-prototype-face-mask-using-wood-pulp/

[95] "Supporting Canadians and Fighting Covid-19" https://www.budget.gc.ca/fes-eea/2020/report-rapport/toc-tdm-en.html

[96] Jo English, International Forest Industries. April 14, 2020. Forest Industry Commends Government for Dues Deferral. https://internationalforestindustries.com/2020/04/14/forest-industry-commends-government-dues-deferral/#:~:text=Edmonton%2C%20April%207%2C%202020%2C,for%20up%20to%20six%20months.&text=%E2%80%9CThis%20is%20not%20free%20money%20for%20the%20forest%20sector

[97] Victoria News June 11 2020, B.C. delays increase to log export restrictions inCOVID-19 crisis, https://www.vicnews.com/business/b-c-delays-increase-to-log-export-restrictions-in-covid-19-crisis/

[98] Interview with Derek Nighbor, FPAC. Nighbor said the association was frustrated that members were unable to access the wage subsidy program. He recommended that the program expanded to include individual mills and segments. There is no indication in the fiscal update that these recommendations were taken into consideration.

[99] The Guardian, November 2020, https://www.theguardian.com/environment/2020/nov/09/revealed-covid-recovery-plans-threaten-global-climate-hopes?utm_source=Nature+Briefing&ut%E2%80%A6.

[100] CDC, Zoonotic diseases. https://www.cdc.gov/onehealth/basics/zoonotic-diseases.html; WHO, Zoonoses. https://www.who.int/zoonoses/en/

approximately 200 participants. There have been benefits and costs from the necessary shift to virtual meetings. On one hand, they have enabled increased engagement and participation from member states and improved attendance, despite different time-zone making it difficult for some member states to participate. New people are brought into the discussion, expanding expertise at no additional cost. On the other hand, relationship building and networking are challenging to impossible without opportunities for informal conversations[101].

Developing country debt of more than US$8 trillion could be swapped by governments in pandemic economic rescue packages to address climate and biodiversity destruction (Steele and Patel, 2020). Past efforts have been designed by the Nature Conservancy, Conservation International and WWF to swap debt for climate and nature projects. Canada is seen as a progressive member of the G7 that could lead such efforts (Steele and Patel, 2020), but as yet there has been no discussion of this[101].

8 Synthesis

The COVID-19 global pandemic has elicited extraordinary responses from governments worldwide. In order to contain the spread of the disease, individual and economic mobility has been increasingly restricted, with country-to-country mobility all but halted. The Canada-USA border was closed for most traffic in March 2020, and remains a barrier at least through 2020. The USA passport is essentially worthless at this time with most countries restricting access from the USA. The long-term effects of COVID 19 are open to speculation as epidemiologists and virologists are just beginning to understand the mechanisms of infection and causes of morbidity[102]. What seems evident is that COVID 19 will always be with us at some level, like influenza. How quickly life will return to "normal" depends on when vaccines, available only since December 2020, will be deployed and accepted widely enough that the entire population achieves some level of immunity. For the short-term (through at least 2021), it seems likely that social distancing, wearing masks, and limited mobility will continue to be necessary.

The effects of the COVID-19 pandemic on forests and the forest sector in Canada and the USA are driven by the effects on people, communities, and international relations and measures implemented to control the spread of the virus. At the most immediate level, the consumer behavior that drives the forest products sector has been rapidly transformed by the pandemic and steps taken to contain its spread. Business closures, layoffs and increased reliance on remote work (teleworking and on-line learning) have had multiple, profound effects that are likely to continue [103]. Consumers have responded with higher price sensitivity, accelerated online shopping, and a greater focus on health, wellness, and hygiene[104]. Governments have intervened with fiscal stimuli including unemployment benefits, tax reductions and deferments, or direct payments to employers to prevent layoffs as well as social distancing and masking requirements, and restrictions on businesses. Monetary stimuli have sought to buoy the economies. Low interest rates, increased government debt, and purchases of private sector assets have been accompanied by other market interventions such as direct

[101] Interview with Maureen Whelan, Natural Resources Canada (UNFF Point of Contact), October 30, 2020.
[102] Kenneth McIntosh, Update. October 12, 2020. Coronavirus disease 2019 (COVID-19): Epidemiology, virology, and prevention. https://www.uptodate.com/contents/coronavirus-disease-2019-covid-19-epidemiology-virology-and-prevention
[103] Major companies in the US and other countries have announced plans to continue remote working arrangements well into 2021 or even permanently for some employees. (https://www.wsj.com/articles/for-many-remote-work-is-becoming-permanent-in-wake-of-coronavirus-11590100453 ; https://www.forbes.com/sites/jasonwingard/2020/05/22/remote-working-how-to-succeed-over-the-long-term/?sh=771034745469 ; https://www.flexjobs.com/blog/post/companies-switching-remote work-long-term/
[104] McKinsey. October 21. 2020 Sustainability in Packaging. Inside the Mind of US Consumers. https://www.mckinsey.com/industries/paper-forest-products-and-packaging/our-insights/sustainability-in-packaging-inside-the-minds-of-us-consumers

purchases of supplies, mandated closures of businesses, environmental regulations, and restrictions on imports/exports.

In many ways, the changes in consumer behavior are simply an acceleration of long-term trends towards on-line working, learning, and shopping and a sharpened focus on sustainability. The pandemic has accelerated the decreased demand for newsprint, and commercial copying and printing paper while at the same time, increased demand for containerboard used in shipping packaging. What was not foreseen was the spike in demand for hygiene and personal protective equipment (PPE) such as masks and gowns. Although the economic shock of the pandemic caused US housing starts to sharply decline by 30% in April, demand has rebounded but with more emphasis on single family rather than multiple family units in both the USA and Canada[105]. With people spending more time at home, along with stimulus payments that provided greater support for consumer income and spending, there was a jump in remodeling and demand for DIY wood products, leading to higher lumber prices and local shortages through the summer that was expected to decline in the fall as sawmills increased production and the construction season typically wound down[106]. Surprisingly, single-family housing starts in November 2020 were 12.8% above the November 2019 rate[107].

Sustainability affects the forest sector and forests in multiple ways. Efforts to reduce emissions, plastic pollution, and waste in general preceded COVID 19. The trend towards paper packaging was interrupted, however, by the perceived greater cleanliness and affordability of plastics. More single-use containers are in use by food retailers and restaurants. Local governments have banned reusable shopping bags at grocery stores. New York State, for example, has re-implemented its ban on single-use plastic bags at grocery stores that was interrupted by COVID 19. Major food and beverage producers continue to explore development of paper-based containers[108]. A survey of consumers by McKinsey and Company showed that although the public was increasingly aware, pre-pandemic, of the potential for packaging to pollute the environment, they ranked price, quality, brand, and convenience ahead of sustainability[109]. Additionally, economic disruption of COVID 19 and recession likely will diminish the willingness of consumers to pay a premium for eco-friendly packaging. Nevertheless, sustainability and the circular economy are in the forefront of policy circles and eventually should drive up paper demand[110].

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[105] Interview with Derek Nighbor, FPAC, October 27, 2020; Forest2Markets October 27, 2020. Single-Family Building Boosts Housing Starts Higher in September. https://www.forest2market.com/blog/single-family-building-boosts-housing-starts-higher-in-september?utm_medium=email&_hsmi=98433943&_hsenc=p2ANqtz-9QhLGgqVJ3JVDQr2PXqPI3Ph2ZX0BKWOJPsrneIjv05mYEPrWaqiGCUYhG_45pvhSKxpXcenisVzToWDB0scotyoegJg&utm_content=98433943&utm_source=hs_email

[106] Forest2Market, September 21, 2020. BREAKING: Have North American Lumber Prices Peaked? https://www.forest2market.com/blog/breaking-have-north-american-lumber-prices-peaked

[107] US Census Bureau, 17 December 2020, https://www.census.gov/construction/nrc/pdf/newresconst.pdf?#:~:text=Privately%2Downed%20housing%20starts%20in,November%202019%20rate%20of%201%2C371%2C000.

[108] Food Engineering. July 15, 2020. Paper bottles for drinks: Diageo, PepsiCo pursue plastic-free package. https://www.foodengineeringmag.com/articles/98999-paper-bottles-for-drinks-diageo-pepsico-pursue-plastic-free-package; Stora Enso October 13, 2020. Stora Enso and Tingstad launch unique formed fiber food service bowls to replace plastics. https://www.storaenso.com/en/newsroom/news/2020/10/stora-enso-and-tingstad-launch-unique-formed-fiber-food-service-bowls-to-replace-plastics?utm_campaign=PS%2FFormed%20fiber%20&utm_content=142301252&utm_medium=social&utm_source=linkedin&hss_channel=lcp-4902

[109] McKinsey. Sustainability in packaging: inside the minds of US consumers. October 21, 2020. https://www.mckinsey.com/industries/paper-forest-products-and-packaging/our-insights/sustainability-in-packaging-inside-the-minds-of-us-consumers

[110] RISI Info. July 2020. Uncertainty in forest products markets. https://insights.risiinfo.com/ufpm-report-2020/index.html

Longer-term effects of COVID 19 will potentially affect segments of the forest sector differently, depending upon the effects on markets or government policies[111]. Continued remote work and on-line schooling will drive a further decline in demand for graphic paper that will cause mills to shut down or switch to making other products. Waste office paper is important for the recovered paper markets and lower levels of recovery from remote workers will disrupt global fiber supply chains although this has already been affected by the Chinese ban on importing waste paper that has reduced imports since 2016 and supposed to be total in 2021[112].

Tissue and nonwovens will continue to be in demand for hygiene and personal protection products. Shifts in demand from away-from-home tissue and hygiene to at-home use products, manufacturers will have to accommodate packaging products in smaller quantities[112]. At-home products generally require higher-quality fiber than away-from home products, causing a shift toward pulp with more virgin fiber. Governments may impose restrictions on the export of masks and PPE.

Building construction is the primary driver of demand for lumber, plywood and related materials. The housing market is the primary driver and if remote working and learning continue to grow, demand for solid wood and panel products will increase. People relocating to suburbs and rural areas, where housing is less expensive or simply to access more outdoors, will fuel this demand. Continued government intervention to keep interest rates low will support new home buyers. The effect on lumber demand should be substantial as a median-sized single-family home uses about three times more lumber than the median multi-family building[112]. As well, continued US tariffs on Canadian lumber imports will constrain supply as will the loss of timber from wildfires in the Pacific Northwest. Without the continued government stimulus to support consumers and businesses, however, there is the risk of a collapse similar to the one in 2008[111].

Many people have responded to the COVID 19 pandemic by increasing their on-line shopping. Although e-Commerce accounted for less than 20% of overall US retail spending in 2019, on-line purchases increased 100%-200% after restrictions on travel and congregating were imposed. In spite of the overall decline in economic activity caused by closures and layoffs, e-Commerce supports containerboard demand for shipping packages[113]. One estimate is that e-commerce uses seven times more corrugated material per $US spent than sales at bricks-and-mortar stores. The question that arises is whether the trends toward more teleworking and e-commerce will hold up as economies recover, and what lasting effect will this have on demand for forest products? The preliminary answer to this question is these changes are probably here to stay [114]. Will brick-and-mortar stores and restaurants re-open at pre-pandemic levels? Relatedly, will there be a decrease in commercial office space demands and repurposing of retail spaces, and what lingering effects will this have?

[111] Interviews with Daowei Zhang, 15 October 2020 and Jeff Prestemon, 14 October 2020.
[112] Fastmarkets RISI. 2020. The COVID-19 pandemic-the coronavirus's impact on forest products markets. https://insights.risiinfo.com/covid-19-pandemic-coronavirus-impact-on-global-forest-products-markets/index.html#Impact-Wood-products-daxgYGdK35
[113] McKinsey. July, 2020. Beyond COVID-19: The next normal for packaging design. https://www.mckinsey.com/industries/paper-forest-products-and-packaging/our-insights/beyond-covid-19-the-next-normal-for-packaging-design
[114] McKinsey, 16 December 2020, reports that consumer attitudes in US are concerned with food safety. https://www.mckinsey.com/industries/paper-forest-products-and-packaging/our-insights/sustainability-in-packaging-inside-the-minds-of-global-consumers. Major companies in the US and other countries have announced plans to continue remote working arrangements well into 2021 or even permanently for some employees. (https://www.wsj.com/articles/for-many-remote-work-is-becoming-permanent-in-wake-of-coronavirus-11590100453 ; https://www.forbes.com/sites/jasonwingard/2020/05/22/remote-working-how-to-succeed-over-the-long-term/?sh=771034745469 ; https://www.flexjobs.com/blog/post/companies-switching-remote work-long-term/

For example, if office workers continue to work remotely one day a week, that translates into a potential 20% reduction in demand for commercial space[115].

The effects of COVID 19 on forests have been immediate and with potential long-term effects. The feelings of isolation caused by social distancing requirements have elicited a move to suburbs and rural areas, especially for those able to continue working remotely[116]. Likewise, the relatively safer conditions of outdoors and desire for a release from inaction have driven an increase in demand for outdoor recreation experiences. The immediate impact of more visitors to public forests, along with decreased numbers of employees and volunteers to provide necessary operations and maintenance duties, including fee collection, has been an increase in vandalism, littering, and over-taxing of infrastructure. Longer-term effects of reduced public sector budgets will add to the backlog in maintenance funding for public outdoor recreation facilities.

More permanent occupation of forested areas, that is increased building and occupation of wildland areas, could lead to increased problems with wildlife human conflicts, fire management (e.g., increased ignitions, difficulty in fire suppression, opposition to prescribed burning), and changing attitudes toward active forest management. Off-setting these negative factors are the increased demand for wood traditional uses as well emerging markets for mass timber construction, bioenergy, nanomaterials, and innovations in packaging that all support a move to a more robust bioeconomy.

Along with market forces, any lingering or continuing effects of COVID 19 on forests and the forest sector will be determined by the nature and scale of government actions. Government spending is a larger factor than any other economic sector. Immediately the question is whether emergency economic interventions will continue to provide economic stability. Although government interventions and regulations tend to both distort and perfect markets, they undeniably influence both the forest sector and forest management. Future government budgets will undoubtedly be subject to contentious debates about the deficits incurred in recent years and likely there will be less discretionary funding available for forest management and forestry research and development (CRS 2020). While the emergency spending in response to COVID 19 is not the only factor in the deficit, it has certainly played a role, along with the economic impact of business closures and other public health measures undertaken to reduce the impact of the pandemic.

9 Emerging Opportunities

The changes in consumer behavior that affect consumption of forest products were discussed above. Increased levels of on-line shopping and remote working and learning were largely accelerated by the social distancing restrictions imposed to counter the pandemic, rather than emerging as novel drivers of change. While the question remains of whether these changes will be sustained, the immediate positive effect on the packaging industry and negative effect on graphic paper has been significant [117]. Remote working, increased demand for outdoor experiences, and out-migration from cities and older suburbs, if sustained, will affect housing construction and ripple throughout the supply chain[118]. These trends have been supported by fiscal

[115] Interview with Daowei Zhang, October 15, 2020.

[116] Washington Post, 15 October 2020, https://www.washingtonpost.com/realestate/choosing-the-suburbs-over-city-life-during-the-pandemic/2020/10/15/01c94c5e-e716-11ea-97e0-94d2e46e759b_story.html.

[117] Accenture 2020. Reinventing the forest products industry-- https://www.accenture.com/us-en/insights/natural-resources/reinventing-forest-products-industry ; RISI Aug 25, 2020 Uncertainty in the forest products markets, https://insights.risiinfo.com/ufpm-report-2020/index.html; McKinsey. Aug 2020. How the packaging industry can navigate the coronavirus pandemic. https://www.foodengineeringmag.com/articles/99158-water-bottles-from-wood-materials-poland-spring-explores-alternatives https://www.foodengineeringmag.com/articles/98999-paper-bottles-for-drinks-diageo-pepsico-pursue-plastic-free-package.

[118] Interviews with Jeffrey Prestemon, US Forest Service; Daowei Zhang, Auburn University; and Derek Nighbor, Forest Products Association of Canada. October 2020.

policy, including immediate stimulus, historically low interest rates, and potentially longer-term support for infrastructure construction[119].

Off-setting these trends are significant barriers arising from the pandemic and control efforts. The debt load from the stimulus spending and ballooning deficits will be a political issue whichever political party is in power. In both the USA and Canada, anemic recovery from the current economic recession caused by the disruption in economic activity due to the pandemic will affect the forest sector, along with lingering effects of the 2008 recession. High unemployment and permanent losses of jobs due to business closures and cutbacks will depress consumer spending and housing starts with effects throughout the forestry supply chain. Declining public sector budgets will pressure discretionary funding, affecting research and international aid.

On a brighter note, the COVID 19 pandemic presents a once in-a-lifetime opportunity to shift the global development paradigm towards greater sustainability and a greener, more inclusive economy. Canada has taken the lead in planning for this transition (CCFM, 2017) and has shown the political will to go down this path (CFPAC, 2020); the current USA national government administration (i.e., Trump administration) has moved in the opposite direction, supporting fossil fuels and relaxing environmental protections. This trend is likely to be reversed by the incoming Biden administration[120]. In both countries the notion of directing stimulus spending to target infrastructure has momentum. Three themes are in play and are interrelated: Build Back Better, Green/Low-Carbon Economy, and Forest Restoration.

9.1 Build Back Better

Directing stimulus and recovery spending toward infrastructure that supports a more progressive future than a return to business as usual could follow the guidelines set out in Stark (Stark, 2020) to invest in COVID 19 recovery with a view toward climate change adaptation; this is the approach of the Canadian government[121]. Additionally, fiscal policies could transition to zero carbon rather than supporting carbon intensive industries in the transport, energy, land use sectors. Investing in a sustainable recovery could be funded by pricing reforms including taxing carbon and removing fossil fuel subsidies[122]. The experiences of lockdown and social distancing show how possible are societal changes (Stark, 2020). The Forest Products Association of Canada has proposed $CN 1.5 billion in “shovel ready” projects for the recovery budget that focus on environmental improvements[123] in the forest products sector (CFPAC, 2020).

9.2 Green/Low-Carbon Economy

A transition to a Green or Low-Carbon Economy is already taking place to an extent in both countries. A low-carbon recovery could initiate significant emission reductions and also create more jobs than would be created by a high-carbon recovery program[124]. Many estimates of the mitigation effect of low-carbon programs that focus on the energy sector ignore bioenergy, although combining forest biomass conversion with carbon capture and storage technology has great potential (Hanssen *et al.*, 2020). Further potential for carbon sequestration in the forest sector is being realized with the emergence of innovations such as mass

[119] Hancock NRG Aug 2020
[120] See for example the Climate 21 Project Transition Memo for the Department of Agriculture, https://climate21.org/usda/
[121] Interview with Maureen Whelan, Natural Resources Canada (UNFF Point of Contact), October 30, 2020.
[122] World Economic Forum. Here's how to deliver a green recovery for the G20 economies. July 14, 2020. https://www.weforum.org/agenda/2020/07/rebuilding-green-g20-economies-after-covid-19/
[123] Interview with Derek Nighbor, Forest Products Association of Canada, October 28, 2020.
[124] McKinsey. How a post-pandemic stimulus can both create jobs and help the climate. May 27, 2020. https://www.mckinsey.com/business-functions/sustainability/our-insights/how-a-post-pandemic-stimulus-can-both-create-jobs-and-help-the-climate.

timber construction and cross laminated timber[125]. Other innovations in packaging and containers, paper-based face masks, and utensils as discussed above are contributing to this transition. Advanced products can be manufactured from cellulose nanocrystals or filaments extracted from woody biomass (CCFM, 2017; Nasseri *et al.*, 2020)[126]. The forest products industry has great potential to lead the movement to Build Back Better in a Circular Economy. Wood is a renewable resource, and can be harvested sustainably and processed into materials with low embedded energy and high carbon content, substituting for other energy-intensive materials. The existing infrastructure can be upgraded to biorefineries producing high-value biomaterials and biochemicals. Policy initiatives to make this transformation already exist; what is needed is the will to implement innovative solutions[127].

9.3 Forest Restoration

Restoring degraded forests in the USA and Canada could potentially contribute to the Green Economy, reduce carbon emissions, sequester carbon, adapt to climate change and create jobs (Mansuy; Stanturf *et al.*, 2015; Mansuy *et al.*, 2020). Currently the Green/Restoration economy in the USA is estimated to directly employ about 126,000 jobs and indirectly an additional 95,000 jobs with $US 24.5 billion in total economic activity (BenDor *et al.*, 2015). Both countries have proposed to scale up tree planting, on the order of billions of trees (Mansuy *et al.*, 2020)[128]. An estimated $US4-4.5 billion annual investment over 20 years, planting 60 billion trees, mostly on private lands, could create 150,000 jobs per year ($US 1 million invested in reforestation creates 40 jobs (Edwards *et al.*, 2013)[129]. The US Forest Service is contemplating how to respond to an Executive Order on the Trillion Trees Initiative[130]. Two bottlenecks will need to be overcome: producing climate adapted seedlings of native plants (Stanturf *et al.*, In Press) and the labor force needed for planting. Planting is one of the forestry practices with the most potential for automation[131] using drones. While the Executive Order establishing the One Trillion Trees Interagency Council[129] was issued by the Trump administration, there is reason to think that the Council, or at least the idea of expanding tree planting will survive into the Biden administration[132].

9.4 Further thoughts

Deforestation has for decades dominated international conservation discussion (Rudel and Horowitz, 1996; Hughes, 2011; Kissinger *et al.*, 2012; Bhagwat *et al.*, 2014). Various analyses of proximate and ultimate drivers have been published and measures to counter them proposed. The COVID 19 pandemic has brought to the forefront of international dialogue another factor, the loss of natural habitat and the rise of zoonoses (Everard

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[125] Smart Cities, 4 November 2020, https://www.smartcitiesdive.com/news/mass-timber-reaches-for-new-heights-to-unlock-zero-carbon-cities/588354/

[126] Biomass. February 12, 2020. Resolute Forest Products to produce cellulose filaments in Quebec. http://biomassmagazine.com/articles/16806/resolute-forest-products-to-produce-cellulose-filaments-in-quebec#:~:text=Cellulose%20filaments%20are%20derived%20from,in%20a%20low%20carbon%20footprint.&text=that%20is%20dedicated%20to%20the%20development%20of%20nontraditional%20applications%20for%20cellulose%20filaments .

[127] For example, the Forest-Climate Working Group Policy Platform for the 117th Congress, http://forestclimateworkinggroup.org/resource/forest-climate-working-group-policy-platform-for-116th-congress/ .

[128] White House. Executive Order on Establishing the One Trillion Trees Interagency Council. October 13, 2020. https://www.whitehouse.gov/presidential-actions/executive-order-establishing-one-trillion-trees-interagency-council/#:~:text=On. Fast Company. These are the companies leading the trillion trees effort in the U.S. https://www.fastcompany.com/90544563/these-are-the-companies-leading-the-trillion-trees-effort-in-the-u-s?partner=rss&utm_source=rss&utm_mediu%E2%80%A6 .

[129] WRI. Want to Help the US Economy? Rethink the Trillion Trees Act. August 26, 2020. https://www.wri.org/print/66273

[130] R. Kasten Dumroese interview, 2 November 2020; https://www.whitehouse.gov/presidential-actions/executive-order-establishing-one-trillion-trees-interagency-council/ .

[131] One estimate is that 57% of the jobs in agriculture/forestry/fisheries/hunting have potential for automation. Brookings. March 24, 2020. The robots are ready as the COVID-19 recession spreads. https://www.brookings.edu/blog/the-avenue/2020/03/24/the-robots-are-ready-as-the-covid-19-recession-spreads/

[132] Climate 21 Project Transition Memo for the Department of Agriculture, https://climate21.org/usda/

et al., 2020; Tollefson, 2020), the deforestation link[133]. Studies have pointed out that it is less expensive to prevent viral pandemics than fix them (Dobson *et al.*, 2020; Tollefson, 2020). Because the greatest threat of zoonoses is habitat loss in the tropics, one measure suggested is to swap the debt of developing countries, where debt is reduced so that capital can be redirected toward climate and biodiversity programs (Steele and Patel, 2020).

The COVID 19 pandemic will have long-term social consequences. Just as the pandemic has exposed racial injustice in society, COVID 19 has highlighted environmental justice issues[134]. Rural communities will be impacted by outmigration from cities into rural areas. Business closures in tourism-dependent communities likely will be significant, especially the long-term consequences of outdoor recreation businesses that do not survive[135]. A re-awakened appreciation of nature and outdoor pursuits will influence urban design and the social benefit of urban trees[136].

10 Annex 1. Questionnaire

Survey questions

1. *Forest Health and the Environment*—What effects, both positive and negative, have the Covid-19 restrictions had on the environment or on the scope and timing of the forest health and conservation measures? For example, on the following:

a. Fire suppression
b. Smoke management
c. Pest management
d. Wildlife and fisheries

2. *Sustainable Forest Management*—What effects, both positive and negative, have the Covid-19 restrictions had on the scope and timing of forest management activities? For example, on the following:

a. Regeneration (e.g., visas for planting crews)
b. Thinning, competition control
c. Prescribed burning
d. Harvesting
e. Recreation
f. Research

3. *Forest industry*

a. What changes that were a consequence of the Covid-19 restrictions have affected the forest industry? For example, on the following:
b. Product supply chains
c. Wood supply
d. Demand for forest products (if possible, segment by sector)
e. Exports / imports

[133] Interview with Maureen Whelan, Natural Resources Canada. October 30, 2020.
[134] Connecting the dots between environmental justice and the coronavirus, 7 May 2020, https://e360.yale.edu/features/connecting-the-dots-between-environmental-injustice-and-the-coronavirus
[135] Interview with Dr. Susan Charnley, US Forest Service Social Scientist, 2 September 2020.
[136] Interview with Margot Downey, Natural Resources Canada, based on COVID-related survey for the Montreal Process Working Group, 20 November 2020.

4. *Forest sector institutions*--Are there observed changes in the forest sector's institutional capacity as a consequence of the Covid-19 restrictions? For example, on the following:

a. Organizational administration effectiveness (public or private sector)
b. Functioning of key forest sector institutions
c. The need to revise strategic level plans and risk assessments
d. Data and information gathering and application
e. Ability of personnel on the ground to ensure operating standards are maintained and minimize illegal activities
f. Personnel able to develop and refine their expertise and experience
g. Gaps made apparent in legislation and regulations

5. *Livelihoods and Communities*-- How have the Covid-19 restrictions changed the lifestyle and livelihood pattern of those people dependent, directly or indirectly, on forests? For example, on the following:

a. Labor market and employment
b. Worker health and safety
c. Lifestyle and livelihood changes that affect the forest (specifically for women and youth)
d. Forest Dependent Communities
e. Native Americans/First Nations
f. Gateway Communities and Recreation providers

6. Access to forest financing and investment, as well as public spending on forests

a. Have the Covid-19 response measures resulted in changes in accessibility of forest financing and investment in your country?
b. Do you expect that public spending for national and international forest programmes will change in the aftermath of the Covid-19 response measures?

7. International and regional cooperation on forests and forestry issues

a. How have the Covid-19 response measures affected international and regional cooperation?
b. How have social distancing and travel restrictions affected communication methods (e.g., meeting effectiveness, duration and timeliness of procedures and processes, changes to the number and range of participants)

8. Assessment of opportunities and threats

a. In your view, what are the major opportunities and threats for SFM in your country that will result from the Covid-19 situation?
b. Have policies and strategies been implemented (or are they being planned) that are intended to help alleviate negative consequences of the Covid-19 measures for the forest sector?

9. Do you have any other comments or points you would like to raise?

Annex 2. Contacts							
Last name	First name	Title	Affiliation	Address	Email	Date of interview	Notes
Blinn	Charlie	Professor, Extension Specialist	University of Minnesota	330B Green Hall 1530 Cleveland Ave North Saint Paul, MN 55108 USA	cblinn@umn.edu	21 October	Results of a survey of forest operations companies regarding migrant worker visa program
Charnley	Susan	Research Social Scientist	US Forest Service, Pacific Northwest Research Station	620 SW Main, Suite 502 Portland Oregon 97205-3028 USA	Susan.charnley@usda.gov	2 September	Notes of Social Dimensions Research staff meeting
Downey	Margot	Science Information Policy Analyst, Canadian Forest Service	Natural Resources Canada		margot.downey@canada.ca	20 November	Notes from COVID Survey; people who responded to survey included Graham Stinson, Michael Hoepting, Bryan Bogdanski David Paré, Kara Webster, Bruce Macnab, Jean-Sébastien Chevrier, Amélie Roberge
Dumroese	R. Kasten	Senior Scientist (Research Plant Physiologist / National Nursery Specialist)	US Forest Service, Rocky Mountain Research Station	1221 South Main Street Moscow Idaho 83843 USA	kas.dumroese@usda.gov	2 November	
Lindsay	Kate	Senior Vice President	Forest Products Association of Canada	Suite 410–99 Bank Street Ottawa, Ontario K1P 6B9 Canada	klindsey@fpac.ca	27 October	

Lowe	Matthew	Senior Investment Forester	Timberland Investment Resources		lowe@tirllc.com	26 October	
Mansuy	Nicolas	Researcher	Natural Resources Canada	Northern Forestry Centre 5320-122nd Street Edmonton, AB T6H 3S5 Canada	nicolas.mansuy@canada.ca	4 September	
Miller	Darren	Vice President – Forestry Programs	NCASI	Tallahassee, FL	dmiller@ncasi.org	4 November	
Nighbor	Derek	President and CEO	Forest Products Association of Canada	Suite 410–99 Bank Street Ottawa, Ontario K1P 6B9 Canada	dnighbor@fpac.ca	27 October	
O'Hara	Tim	Vice-President of Government Affairs, & Manager, Lake States Region	Forest Resources Association	310 Jackson Avenue Cloquet, MN 55720 USA	TOhara@forestresources.com	21 October	Results of a survey of forest operations companies regarding migrant worker visa program
Prestemon	Jeffrey	Research Forest Economist and Project Leader	US Forest Service, Southern Research Station	P.O. Box 12254 Research Triangle Park, NC 27709-2254 USA	Jeff.prestemon@usda.gov	14 October	
Vice	Kirsten	Vice President – Sustainable Manufacturing & Canadian Operations	NCASI	Montreal, Quebec, Canada	kvice@ncasi.org	4 November	
Whelan	Maureen	Manager, International Affairs, Canadian Forest Service	Natural Resources Canada	580 Booth Street, Ottawa, ON K1A 0E4 Canada	maureen.whelan@canada.ca	30 October	
Zhang	Daowei	Alumni and George Peake Jr. Professor, Forest Economics and Policy	Auburn University	School of Forestry & Wildlife Sciences 602 Duncan Drive Auburn, Alabama, 36849-5418 USA	ZHANGD1@auburn.edu	15 October	

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