Impacts and Measures of COVID-19 on Forest Development

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Abstract. The COVID-19 epidemic has disrupted human life in many ways. The governments have put in place measures to restrict human activities in order to control the development of the epidemic, which has had a number of effects. This paper briefly discusses the impacts of COVID-19 on forest development in terms of forest fires, forest management, forestry, and forest tourism. This paper illustrates the impacts by giving examples from countries in North America, Latin America, Western Europe, Eastern Europe, Asia and Africa. Among these regions, most governments delayed fire prevention due to the need to control the epidemic. For forest management, due to the restriction on human activities, some forest management work have been postponed or canceled. For the forestry, demand for forest products and in import and export markets have changed. For forest tourism, because of restrictions on people's activities, significant reduction has happened in ecotourism. In addition, this paper presents the mitigation measures developed by different governments in the face of the impacts of the epidemic on forestry. most governments have undertaken targeted investment and financing measures to mitigate the impacts of the epidemic, promote forest-related businesses and trade, and provide support and assistance to local residents. Some countries are trying to use this opportunity to shift their focus to a green economy. This essay expects that governments will pay attention to the impacts of the COVID-19 epidemic on forest development and respond to mitigate the damage caused by the epidemic.

Keywords: COVID-19, Forest Development, Forest Management, Forestry, Mitigation Measures

1. Introduction

COVID-19 is a brand-new illness brought on by a coronavirus that has never before been observed in humans [1]. COVID-19 (or SARS-CoV-2) is a global pandemic that infected over 75 million people and killed more than 1.6 million people by December 22nd, 2020 [1]. The COVID-19 pandemic has huge impacts on human lives, livelihoods and economic systems around the world. It has resulted in a severe public health crisis, a temporary economic downturn, the loss of livelihoods, extreme poverty, income disparity, and food insecurity, particularly in some of society's most vulnerable groups. Coughing and sneezing, intimate physical contact, touching an infected object or surface, and in rare cases, fecal contamination are all ways that viruses can travel through the air [1]. Therefore, in the absence of a reliable vaccination, social isolation, mask use, and a reduction in human interaction are the only prophylactic strategies. These actions, taken to diverse degrees by various governments, have affected the development of the forest.

Forests cover about one third of the world's land surface, and are vital to human life. The several ecosystem services and functions of forests directly or indirectly support the livelihood of billions of people worldwide. Forests are recognized as an essential component in providing variety products and services such as green space, watershed, livelihood, biodiversity, clean air, food, and cultural connection. According to FAO, approximately 90% of the 1.2 billion people living in extreme poverty worldwide rely on forest resources for at least part of their livelihood [2]. Forests not only produce products and raw materials such as fresh water, food, medicine, wood, and wild meat, but they also serve other important functions for human and environmental well-being. Forests play an important role in forming soil, nutrient cycling, controlling and preventing flood, carbon sequestration, preventing soil erosion, purifying water and air, and protecting coast. Forests provide cultural space, identity, and connections in addition to direct economic and ecological functions.

COVID-19 has impacted forests and those who rely on forests around the world in many ways. Because forests constitute a major life-supporting global ecosystem, it is important to understand how

forest use and management has changed under the epidemic. Looking ahead, it is necessary to consider how efforts can be made to reduce damage to forest ecosystems. Balancing deforestation and forest degradation will be part of both short- and long- term restoration plans, which will be particularly important for future risk prevention strategies. This is because biodiversity destruction is a major cause of zoonotic disease outbreaks, and some zoonotic diseases can be traced back to forests.

This essay examines the impact of the COVID-19 epidemic on forest fires, forest management, forestry and forest tourism based on reports from North America, Latin America, Eastern Europe, Western Europe, Africa and Asia, and explores measures to mitigate these impacts. Countries in North America, Latin America, Western Europe, Eastern Europe, Asia and Africa were taken as examples to demonstrate the impacts.

2. Impacts of COVID-19 on forest development

2.1. Forest fire

The COVID-19 epidemic has had an impact on the actions of forest fire prevention, which has led to an increase in the number of forest fires in some countries and regions. On the other hand, however, the restrictions on activities have reduced the probability of occurrence of some activities that could cause fires. In the USA, the greatest impact of the COVID-19 on forest health has been a reduction in the prevention and suppression of forest fires. Risky activities were reduced as a result of social distancing policies, such as planned burning and trimming vegetation near power lines [3]. Data from September 2020 indicate that the 2020 fire season in Canada was below the 10-year average for both the number of fires and the area burned (as shown in Fig. 1) [4].

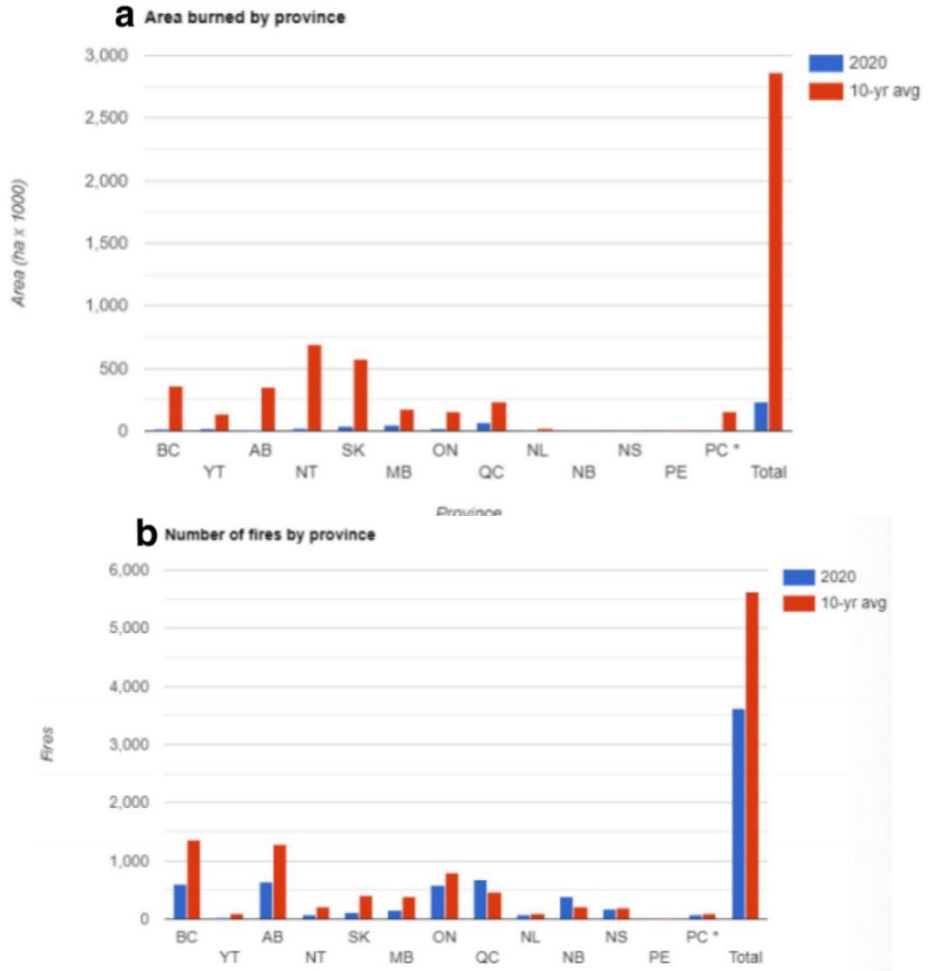

Figure 1. Area burned during fire season in Canada by province (a), number of fires during fire season in Canada by province (b) [4]

According to a study on forest fires in Nepal, the COVID-19 case resulted in a 4.54% decrease in the number of forest fire events (a proxy for the incidence), a 1.94 Kelvin (K) decrease in the brightness of forest fires (a proxy for the severity), and an 11.36% decrease in the radiated power of fires (a proxy for the intensity). In Thailand, due to restrictions on assembly, people were not be able to gather to carry out prescribed burning (a mechanism to control fire) [5]. Compared to 2019, data of eight provinces in forest fire burnt areas increased in 2020 (Fig. 2) [6]. The fire prevention preparations in Portugal and Spain was delayed, which were also likely to be similarly affected in France, Greece and Italy, which all have Mediterranean climate in these areas [7].

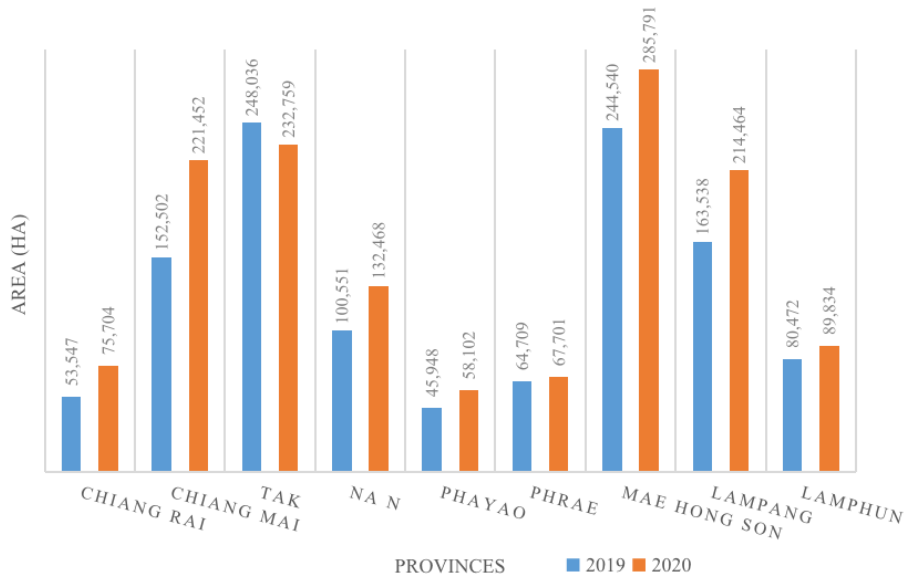

Figure 2. Comparison of Forest Fire-Burnt Areas of Nine Provinces in Northern Thailand [6]

2.2. Forest management

Because of the epidemic, countries have made certain changes in their forest management policies. The reduction of forest monitoring has led to an increase in the number of incidents of illegal logging or wildlife poaching in some Asian and African countries.

In Canada, forest management operations were delayed early in the pandemic in order to mitigate the potential spread of the virus. Some agencies developed measures in areas where workers and pest management operations are located, maintaining a level of operations in 2020. In the worst-affected provinces, some agencies had to cut back in the spring and summer of 2020 [3]. For example, the Ontario Ministry of Natural Resources and Forestry cancelled an aerial program for spraying jack pine budworm. The capacity of several provinces' programs has been reduced. Although it was difficult to operate under safety constraints, the impact was minimal because individuals and small teams did majority of the work outside.

Due to the pandemic, management activities in the USA, like as monitoring forest health, controlled burns, scientific surveys, and inspecting harvest, had to be delayed or stopped [3]. Meanwhile, the immigration policies limiting guest workers led to worker shortages, which could potentially delay even further reforestation.

In the UK, planting in Scotland was slightly affected. While in Sweden, pre-commercial thinning was delayed to prioritise planting [5]. In Portugal, replanting by small owners and small and medium-sized enterprises was delayed significantly [7]. Thinning operations were also delayed in many countries. In Australia, the problem of clearing fire-damaged plantations and natural forest areas was severely exacerbated by the fact that COVID-19 restrictions were imposed almost immediately after the summer fires that destroyed much of the forest [7]. In Iceland, the decline in tourism has led to a reduction in demand for fuelwood and therefore reduced thinning.

The most frequent reactions in Eastern Europe involve postponing and generally carrying out less of the intended sustainable forest management activities [8]. Restrictions had a negative effect in North Macedonia, Romania, and Slovakia since operations related to forest management were often postponed or cancelled. However, reforestation and afforestation activities were conducted in Belarus in 2020 on a surface area of more than 40.000 hectares [9]. In Poland and Bosnia and Herzegovina, the planned forest protection and maintenance activities, as well as reforestation and renewal treatments, were systematically carried out.

Following the outbreak, several instances of illicit logging and wildlife poaching took place throughout Asia. In Nepal, the lockdown and subsequent movement restrictions made monitoring and management practices of forests reduced or halted [5]. In community-managed forests, forest patrols stopped completely, which has led to illegal logging. In Thailand, because of the lack of mobility, the operation of forest activities has changed. For example, as reported by forest officers and foresters, some activities such as forest patrols in natural forest areas were delayed.

In North Africa, illegal harvesting of timber and non-timber forest products (NTFPs) increased due to reduction in monitoring by the public sector forest agencies [10]. The East Africa study shows that numerous forest management efforts related to reforestation, afforestation, and other silvicultural operations like thinning and pruning have been postponed or completely cancelled as a result of constraints. West Africa's circumstance is comparable. Government restrictions, for instance, had a considerable negative influence on nursery operations and reforestation in Ghana. In Southern Africa, COVID-19 led to the reduction in ground monitoring and control. However, the majority (70–90%) of sustainable forest management (SFM) activities—including afforestation and reforestation, fire management, aided and natural regeneration—persisted [10]. Additionally, due to a lack of oversight, criminal activities, such as illegal logging and the destruction of valuable wood tree species, expanded throughout Eastern Africa in countries like Uganda, Kenya, and Tanzania [10].

2.3. Forest industry

The forestry industry was affected mainly due to the shutdown or reduction of production in a large number of factories as the result of reduced market demand and the need to prevent and control the epidemic, as well as the impact on the import and export markets.

In the United States, the immediate economic disruption to the forestry industry caused by the COVID-19 was due to economic losses from the closure of non-essential industries and the inability of workers to carry out their activities remotely. Hordes of sanitary products led to a surge in demand for pulpwood, while economic uncertainty reduced the demand for wood. The rise in demand for sanitary supplies like toilet paper was brought about in part by customers' panic buying and work-from-home workers' workaholic tendencies. Comparing to the same period in 2019, sales of toilet paper in the U.S. reached 734% on March 12, 2020, and the shortage continued during the summer [3]. And between January and July 2020, U.S. sawmill production and consumption of wood raw materials fell by 6.7% compared to the same period in 2019, resulting in a $1.83 billion (13%) decline in the value of delivered lumber. The owners of forests, loggers, and transporters are just a few of the people that are impacted by this value decline in the entire supply chain for timber. The western United States is more affected than the southern United States by these cuts to the timber markets. Since most of Canadian forest products are exported to the U.S., price instability there has an impact on the Canadian forest business.

In response to COVID-19, many mills in Canada have closed or reduced production. Lower demand in newsprint and specialty papers, sawmill downtime, and a reduction in workforce due to safety precautions are among the reasons [3]. In western Canada, three lumber mills and five pulp and paper mills shut down or reduced their capacity in August 2020. Because of lower demand and/or COVID-19 restrictions, six sawmills, two pulp/paper mills and one newsprint mill in eastern Canada have reduced their capacity. Other segments of the industry, however, have increased production, such as medical grade pulp adapted to masks and gowns, which has doubled production [3]. Because the Canada’s forest products are reliant on exports, the pandemic has an impact on export regulations

in addition to the economic impact. The Government of British Columbia, for instance, has delayed the imposition of regulations on inshore log exports.

In Western Europe, since the COVID-19 pandemic started, export markets in France, Italy and Spain were interrupted and demand in Austrian and German markets decreased [7]. In Finland and Portugal, imports and exports declined and passenger and cargo traffic plummeted due to a combination of factors, particularly the rise in unemployment among migrant workers and the decline in demand for printing paper during the epidemic. The epidemic changed the structure of demand for forest industry products, resulting in a 22% decline in trade in roundwood from private forests in Finland from January to August in 2020, however, this decline was offset by increased demand for packaging and hygiene paper [7]. Portugal's sawmill, wood panel and wood furniture supply chain experienced a 40% decline [7]. The same situation was observed in the UK. While reduced construction activity led to lower demand for sawn timber in the building sector, increased demand for DIY materials, which somewhat offset the economic losses [7]. In Sweden, although the export market was affected, it was less affected by the epidemic due to a surge in demand for home furnishing and packaging materials [7]. In Turkey, according to statistics, the value of exports of forest products grew while imports fell sharply [7]. Many countries noted reduced demand for construction timber but increased demand for use as fencing and landscaping material. This has affected forest operations, with reduced need for felling larger trees, and the processing that product lines have had to be adapted.

The perception among and within countries in Eastern Europe varies greatly depending on the stakeholder perspective. According to a study conducted with 95 forest sector companies from 15 oblasts (administrative divisions) in Ukraine, the lockdown and imposed restrictions, combined with reduced purchasing power, have had a significant impact on the forestry sector. The majority of businesses suspended or reduced production, and nearly half reduced their sales of goods and services by 50% [10]. However, because of its lower reliance on exports and lower degree of internationalization, the Polish economy has suffered less from the pandemic's consequences than other European countries. During the pandemic, Belarus' forest sector reported improved performance. Enterprises in the forest industry harvested 14 million m3 of commercial timber, exceeding the target by 12% [10]. Revenues from forestry and hunting enterprises totaled 315 million (the planned figure was 264 million), an increase of 108% over the same period in 2019 [10].

The epidemic's effects on the forest industry in Asia are felt throughout the supply chain. The market demand for furniture increased in the case of the timber industries. However, limited transportation in Nepal resulted in a low supply of raw materials, reducing production volume, sales, and income. Demand for timber and wood products in Thailand has declined. Meanwhile, a reduction in orders made the production of teak wood products shrank, for it took a much longer time to export during the epidemic. In Vietnam, it is expected that wood product exports reduced by 80%, and timber companies has lost around US$1.06 million during the first quarter of 2020 [6]. Because the government administration offices in Malaysia had closed, legal permits to harvest timber and export logs were not available. The wood exports in India shrank by 35%, which was the largest decline in at least two decades [5].

In Africa, COVID-19 had a huge impact on tropical timber trade. According to the report presented at the 56th Session of the International Tropical Timber Council, log exports were down 28%, sawnwood exports were down 16%, and tropical plywood exports were down 8% [10]. For example, in Kenya, raw materials (logs) were not collected, and the saw log stockpile could not be processed due to travel restrictions. Malawi, in Southern Africa, reduced forest product exports to international markets and sub-regional countries.[10]. The export volumes in Cameroon dropped by 5% in the first half of 2020 [10]. Congo has a decreased demand for export, especially sales to China. The same thing occurred in West Africa. In summary, COVID-19 has lowered the prices of forest products in both domestic and international markets.

2.4. Forest tourism

Forest tourism was similarly affected to some extent. The epidemic has restricted the movement of people, leading to the closure of tourist sites and a major setback for ecotourism.

In Canada, aboriginal tourism has outperformed overall tourism activity, but it has nearly come to a halt due to travel restrictions and social distancing requirements, both of which have a negative impact on tourism and outdoor recreation [3]. As a result of travel restrictions, National Parks and National Forests in the United States have less visitors, particularly international visitors, which significantly affected visitor spending as well as sales and tourism taxes in those states. As a result, those small seasonal recreational companies offering outdoor equipment and services are in danger of going bankrupt.

In Western Europe, businesses that operate for forest recreation suffered the most impact. Restrictions on movement vary between, and sometimes within, countries. This led to changes in vacation patterns but no firm evidence shows its impacts on economic. In Portugal and Spain, the use of rural and protected areas as holiday destinations has increased [7]. In Switzerland, higher number of people from urban area visiting forests resulted in increased employment of forest rangers [7]. International travel is severely restricted in Iceland. While the use of hotels and other facilities geared toward foreigners has decreased as the number of tourists has decreased, the use of forest campsites by local residents has increased [7]. However, widespread restrictions on the hospitality industry have had a significant impact, despite the existence of government support programs. Those hospitality businesses that rely on forest recreation as their customer base can be quite severely affected, and some may not survive.

In Latin America, ecotourism was severely affected in Brazil. Every year, millions of national and international visitors flock to the Iguazu Falls National Park. The park was closed for more than six months, severely affecting the economy of the surrounding regions, which included hotels, restaurants, transportation, and other tourist-supporting services [10]. Guatemala is one of the most visited areas in the region each year, yet the closure of national reserves and other areas during the epidemic has dealt a major blow to the local ecotourism industry [10].

In Eastern and Southern Africa, due to the pandemic and movement restrictions, ecotourism has come to a halt. Consequently, the number of tourists visiting African forest ecotourism sites has declined. For example, visitor numbers in Senegal's Bandia Wildlife Reserve fell by 60-79%, resulting in a loss of tourism revenue [10]. Zimbabwe, in southern Africa, depends on a stable flow of tourist income. However, the ecotourism industry has been significantly hampered and thus leads to reduction in conservation funding and associated expenses such as staff wages.

3. Mitigation measures

The government is providing financial assistance to businesses and organizations in order to help them survive the COVID-19 pandemic. In the United States, Alabama has awarded the Coronavirus Relief Fund $10 million for a program applies in the state to assist timber owners in Alabama affected by the pandemic [3]. The Government of Canada released an economic statement on 30 November 2020 that included funding for the forest sector. Furthermore, the United States and Canada intend to transit their economy to a Green or Low-Carbon Economy, which could not only result in significant emission reductions but also in the creation of more jobs. In Western Europe, public investment to stimulate national economies will undoubtedly occur in all countries of the region. Some countries are attempting to use this opportunity to shift their focus to a greener economy, from which trees and forests will benefit [7]. In Eastern Europe, some countries have included forestry in the state program, which offers the financial support for better implementation of close to nature forestry measures [9]. In Asia, the governments provide incentives for the local for reforestation and monitoring [5]. Making full use of forest resources and underutilized lands is also an important way to generate income and employment. Meanwhile, approaches to disaster and shock mitigation must be integrated into forest planning, policies, and practice. It is critical for the sector's revival to mobilize existing and potential

bilateral and multilateral forestry financing to develop national forest financing strategies. In Latin America and Africa, in addition to the above measures, the governments also take actions on providing support to indigenous people and local communities.

4. Conclusions

As the world faces the COVID-19 epidemic, governments are trying to control the spread of the epidemic by imposing restrictions on people's movements, however, these restrictions are having an impact on forest development. Reports from North America, Latin America, Western Europe, Eastern Europe, Asia, and Africa shows that forest fires, forest management, forestry, and forest tourism have all been affected in 2020. The epidemic has had an impact on the prevention and suppression of forest fires, and most governments have delayed fire prevention due to the need to control the epidemic. The same is true for forest management. Most governments have restricted human activities, resulting in the postponement or cancellation of some forest management work. Also, the lack of monitoring has increased the incidence of illegal logging. For the forestry, changes happened in demand for forest products and in import and export markets during the COVID-19 pandemic have caused huge impacts. With the decreasing demand for wood and wood products, the demand for packaging materials, pallets and paper for toilet paper and masks remained stable or even increased. Import and export markets are affected to varying degrees due to differences in national policies on disease prevention. For forest tourism, most countries have made restrictions on people's movement, so ecotourism has been hit hard. As a result, governments implemented some targeted investment to promote forest-related enterprises and trade in order to mitigate the epidemic's impacts on forest development.

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