Review Article

EFFECTS OF COVID-19 ON ALNUS NEPALENSIS TIMBER VALUE CHAIN IN DHANKUTA, NEPAL: AN ECONOMIC PERSPECTIVE

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ABSTRACT

This article examines the COVID-19 impact on the Alnus nepalensis timber value chain in Dhankuta district, Nepal. It explores the vital role of Nepal's forests, particularly private ones, in meeting timber demand and supporting rural livelihoods. Utilizing primary and secondary data sources from surveys, interviews, and five fiscal years (2017/18 to 2021/22), the study assesses the pandemic's effects on the timber market. The research reveals that the COVID-19 pandemic and associated lockdowns disrupted the entire timber value chain in Dhankuta district. Timber trade, employment opportunities, and revenue generation suffered losses, affecting various stakeholders. The financial toll in Dhankuta district alone surpassed half a million USD, signifying a substantial loss. The forest-dependent livelihoods experienced considerable disruption due to the mobility restrictions imposed due to the COVID-19 pandemic. The study highlights the urgency of proactive measures, including designating the forestry sector as essential, documenting its economic contribution, and promoting private forest entrepreneurs. It emphasizes the need for policy adjustments to secure the sector's role in Nepal's economic recovery and underscores the importance of private forestry in sustaining timber production, advocating for policies to safeguard this critical industry. The research also calls for the development of strategies to mitigate adverse impacts during future crises.

Keywords: nepalensis, COVID-19, timber, trade, private forestry, lockdown.

INTRODUCTION

Nepal's forests cover 43.56% of the country's land area (FRTC, 2022) and offer a variety of essential commodities to humans, both directly and indirectly. In addition to the indirect benefits that include: performing essential ecological functions such as biodiversity conservation, water regulation, erosion control, provision of clean air, wilderness, carbon sequestration, and spiritual respite (FAO, 2009); the direct benefits are of timber and non-timber origin. In Nepal, timber is derived from three principal sources: (a) government-managed forests, (b) community forests, and (c) private land, which includes trees on farms and private woods (MoF, 2020). The majority (86.6%) of the wood volume produced in the country is from private property, followed by community forests (5.5%) and government-managed forests (7.7%). According to the Economic Survey of Nepal for the fiscal year 2019/2020, forests were found to generate 10.2 million cubic feet of timber and a government royalty of NRs. 279.9 million. Additionally, wood, which accounts for more than half of all forest income, is the main source of income for individuals living in rural areas (Meilby *et al.,* 2014). Rural communities are diversifying their rural livelihoods by investing their revenues in community development and forest management (Lund *et al.,* 2014; Baral *et al.,* 2020). Nepalese forests are divided into two general categories: national forests and private forests, with the distinction being based on who owns the property. National forests are those where the government owns the land; private forests are those where a private entity holds the tenure rights (Forest Act, 2019). Both of these forest types—more specifically, community forests in the case of national forests—have been essential to Nepal's ability to produce timber and revenue.

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Table 1: Timber sale and revenue generation from forest types in fiscal year 2016/17

Forest type	Timber (cum.)	Revenue (USD)
Community Forest	11,975	263,956
Private Forest	179,554	547,834

(Source: DoF, 2018)

Table 1 indicates that despite the unclear chain age of private forests, they are found to significantly contribute to meeting market and consumer demands. Although the potential role of the forestry sector in economic contribution has been discussed by policymakers, scholars, academicians, practitioners, and professionals of the forestry sector as a central theme for more than two decades, it is intriguing that there has been a profound lack in identifying the exact economical potential and forest resource contribution (Rai *et al.,* 2014).

Private forests are not only meeting industrial and commercial demands, but they are also making a sizable contribution to the national economy by creating jobs and raising taxes. Timbers sourced primarily from private forests have been used by sawmills, plywood factories, and other forest-related businesses. They also make a sizable contribution to the national economy in terms of Value Added Tax (VAT). The primary cause of the rising trend in timber supply from private forests is improved access to rural regions via roads, which has decreased transportation costs and increased market demand (Amatya and Lamsal, 2017). Over 150,000 people in Nepal are employed by wood-based businesses in furniture, ply, veneer, kattha (catechu), sawmills, and other industrial sectors (Bhatta, 2011). An estimated 4,500 wood-based businesses in Nepal have made approximately NRs. 12 billion in investments in these sectors (Banjade, 2012). The collaboration between the private

forestry sector and the government has been instrumental in overseeing forest resources, aiming to attain favorable livelihood outcomes. These include human resource development, the sustainable flow of forest products, enhancements in social capital, physical and infrastructure development, and the creation of financial opportunities (G.C. *et al.,* 2016).
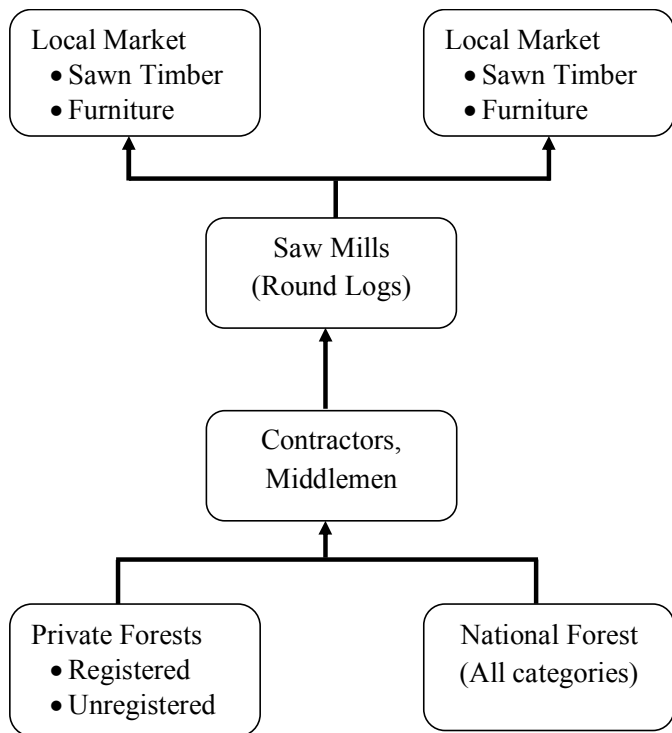

Figure 1: Timber Supply Mechanism Amatya *et al.,* 2015 cited in Amatya & Lamsal (2017)

Himalayan Alder (*Alnus nepalensis)* is a deciduous or semi-deciduous tree that may grow up to 30 meters in height and have a trunk diameter of 60 cm (rarely up to 2 meters). It is a pioneer species that thrives in both full sunlight and shade. It grows in wet areas at lower altitudes, such as those near rivers, but it will also colonize rocky areas that have been exposed by landslides or that have been left after cultivation. It frequently grows in streambeds, close to streams, in ravines, and in dry woods (Jøker, 2000). Despite not being the most preferred building material, *Alnus nepalensis*is frequently utilized in hilly locations for home construction, partly because it is readily available whereas preferred species are scarce. *Alnus nepalensis*, as such, is not considered a raw material for furniture manufacture; however, it has witnessed a continuous increase in demand in the timber trade sector. Its use as a raw material in Nepal's veneer and plywood industries has increased as a result of its acceptance in the furniture industry. The present demand for *Alnus nepalensis* in the veneer industry has recognized its economic potential, establishing its industrial trade (Chapagain *et al.,* 2014). It is a prevalent indigenous species extensively employed in forestry and agro forestry across the eastern Himalayas. It naturally rejuvenates in areas recently affected by landslides, as well as in degraded and disturbed sites. As an actinorrhizal plant with root nodules capable of fixing atmospheric nitrogen, it exhibits remarkable adaptability to wet soil conditions and boasts high water use efficiency (Nautiyal and Purohit, 1987). Typically coexisting with Cardamom, this symbiotic relationship yields ecological and economic benefits. The resulting agro forestry system demonstrates exceptional soil nutrient availability, substantial water-holding capacity, minimal soil loss, the highest N_2 fixation capacity, and elevated annual economic returns when compared to alternative

forest and agro forestry practices (Sharma *et al.,* 2016). In addition to its nitrogen-fixing properties, the litter, when incorporated into the soil, contributes phosphorus, potassium, calcium, and other nutrients through biomass addition (Sharma and Prasad, 1994). The economic returns derived from the Alnus-Cardamom agro forestry system are noted to be 11 times greater than those of forest-based systems and 3.2 times higher than farm-based systems (Sharma *et al.,* 2016).
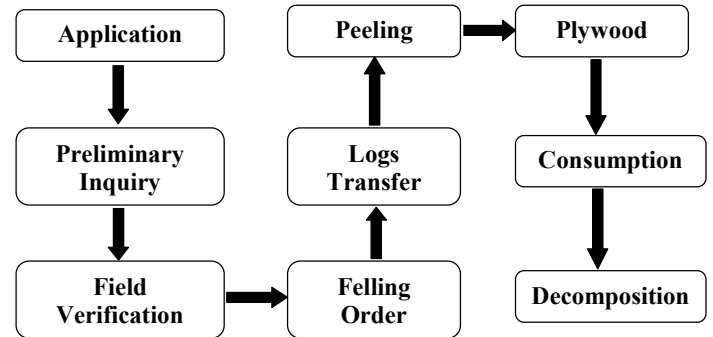

Figure 2: The flow chart of *Alnus nepalensis* value chain

The novel coronavirus disease (COVID-19) is the biggest threat to humans since World War II and the most important global health disaster of the century (Chakraborty and Maity, 2020). Its prevention and treatment are difficult around the world because of its distinctive traits and the large number of possible hosts (Vellingiri *et al.,* 2020). As of December 13th, 2022, the World Health Organization stated that there have been over 6.6 million fatalities and 645.6 million coronavirus-verified cases worldwide. Governments implemented curfew/lockdown measures with limits on human mobility as the spread of new coronaviruses accelerated (Arora *et al.,* 2020; Lindsey *et al.,* 2020). For the first time possibly in modern history, all forms of industry, vehicle movement, and human activity abruptly came to a stop during the lockdown (Yunus *et al.,* 2020). The COVID-19 pandemic hit all sectors of the economy, where the most immense impact was expected to be in agriculture, industry, tourism, and remittance. Restrictions on physical activities impacted forestry activities, especially on timber production and supply chain, which had put livelihoods and forest-based industries at risk (FAO, 2020), the strict lockdown period (March-June) too, coincided with the peak timber harvesting season of the country (between February to July). The forestry sector's contribution to the national economy is very nominal compared to its contribution to livelihood support, which ranges between 3.0-11.3% of total household income (Meilby *et al.,* 2014), however, this fact seemed to be ignored during the imposition of mobility restrictions (Basnyat *et al.,* 2020).

In response to the COVID-19 outbreak, several country-wide lockdowns were also implemented in Nepal: the most significant ones were the COVID-19 mobility restrictions of March-July, 2020 (Sharma *et al.,* 2021) and April-August, 2021 (Pokharel and Niroula, 2021). These restrictions, supplemented by local-level specific restrictions adversely affected the timber market. The effect of the mobility restriction on timber trade in terms of domestic and national economy has not been studied in detail. Previous research in Nepal investigated the impact of COVID-19 on deforestation, biodiversity, forests, and forest-dependent communities (Laudari *et al.,* 2021). However, these studies have not adequately explored the impact (including magnitude and scope) of COVID-19 mobility restrictions on economic consequences in terms of national income and local livelihood. Therefore, it is deemed crucial for development planners and policymakers to have in-depth knowledge and improved understanding of the impact of pandemic-led lockdown on crucial

aspects of the forestry sector in order to construct recovery pathways and take prompt, decisive action to revitalize the forest economy in the lead-up of the COVID-19 pandemic (Sen, 2020).

COVID-19 has affected not only human health and caused a lot of casualties but also created a challenging situation in the economic sector. Many countries are still facing difficulty in overcoming the blockades created in the economic sector due to this outbreak. The forest sector faced serious situations as the forest owners and contractors were restricted from performing harvesting and transport operations. The unavailability of local laborers and blockades made the situation worse as the trees faced and converted to merchantable logs were not allowed to be transported to the sawmills and veneer/plywood industries. This caused a huge dip in the income of the rural households and the local laborers causing a decline in the employment opportunities for the locals. Moreover, reduced timber extraction led to a huge decline in government royalties: local, provincial, and central. This study tries to assess the effect COVID-19 had on the timber market of the Dhankuta district, specifically focusing on rural livelihood and revenues within the *Alnus nepalensis* timber value chain.

MATERIALS AND METHODS

Study Area
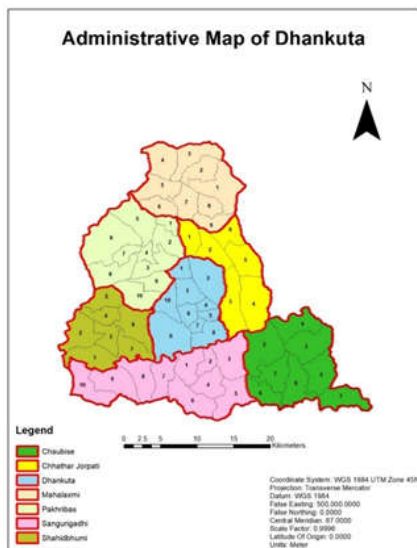
Dhankuta, the second smallest district in Koshi Province, is an eastern hilly district with latitudes ranging from 26°53' N to 27°19' N and longitudes ranging from 87°08' E to 87°33' E (DFO Dhankuta, 2023). It covers an area of 89,525.5 hectares and has an altitude ranging from 120 to 2,702 meters above mean sea level (FRA Nepal, 2015). The district comprises of seven municipalities, three of which are urban and four rural. Forests occupy 41% of the district's land area (FRA Nepal, 2015) and forestry is one of the primary activities of the residents (DFO Dhankuta, 2023).

The study used primary data and information sourced through questionnaire surveys, key informant interviews (KIIs), and focus group discussions (FGDs) with related farmers, contractors, business entrepreneurs, private sector and government stakeholders in case study approach. Secondary data and information were collected from published and unpublished records of private and government institutions. For primary data collection, five private landowners and five timber contractors from each municipality of Dhankuta were selected at random. Data regarding private landowners and timber contractors were obtained from Division Forest Office, Dhankuta. Questionnaire survey was used for collecting information from

farmers and contractors. As such, representation from each of the seven municipalities within the district was ensured. 13 FGDs were carried out in total; 1 each from 6 subdivision forest offices and 1 each from 7 municipalities. Division Forest Office Dhankuta staff, District forest products entrepreneur's association, District private forest users' network members, and office bearers were identified as key informants. Timber trade data of five fiscal years (2017/18 to 2021/22) of *Alnus nepalensis* was collected from Division Forest Office Dhankuta office records. Data related to the number of trees, log volumes, and associated VAT deposited were collected by this secondary means. The collected data have been tabulated and analyzed by means of MS-Excel and presented in graphical and tabular forms.

RESULTS

Timber trade scenario of Alnus nepalensis

Since fiscal year 2019/20, the yearly quantity of *Alnus nepalensis* trees cut and traded has grown. Before the COVID-19 epidemic hit Nepal in fiscal 2020/21;45,121 trees were harvested per year, providing 46,605 cum.[1](16,45,169 cft.[2]) of wood. The timber trade increased at the onset of the festive season (September) tend to fare almost uniformly during the initial winter months (October and November). The trade then is then found to rise till January after which it is found to dip to its lowest point in the month of May. The trade seemed to decline a bit after the end of winter season and was found to be lowest during the drier months (April to June). The value-added tax (VAT) contribution of timber trade to the national economy has been observed to rise uniformly throughout the duration of the study period, and the monthly contribution of VAT followed the trend of monthly volume. Based on the official records of DFO Dhankuta, the average annual VAT contribution of *Alnus nepalensis* from Dhankuta district prior to the outbreak of COVID-19 pandemic was 1,93,900USD[3].
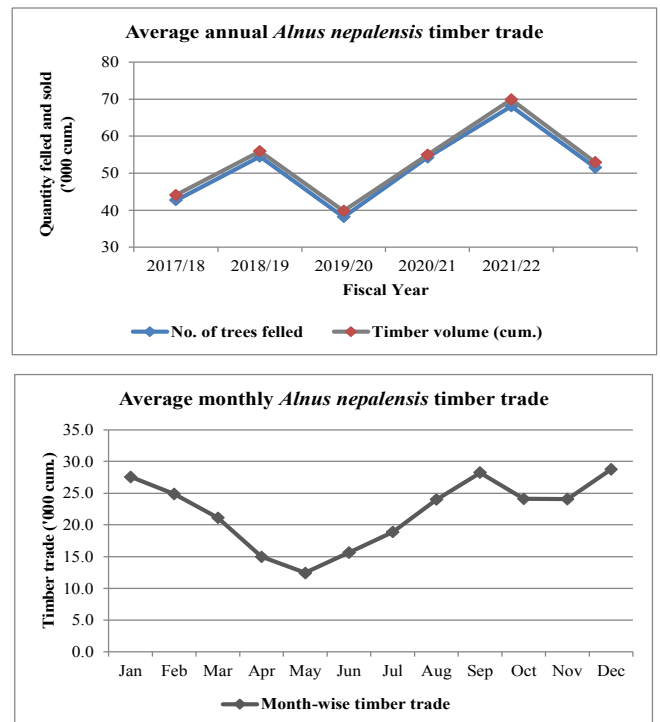

Figure 3 (a): Average annual and monthly timber trade between the fiscal years 2017/18 and 2021/22.

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[1]cum. = cubic meters
[2]cft. = cubic feet
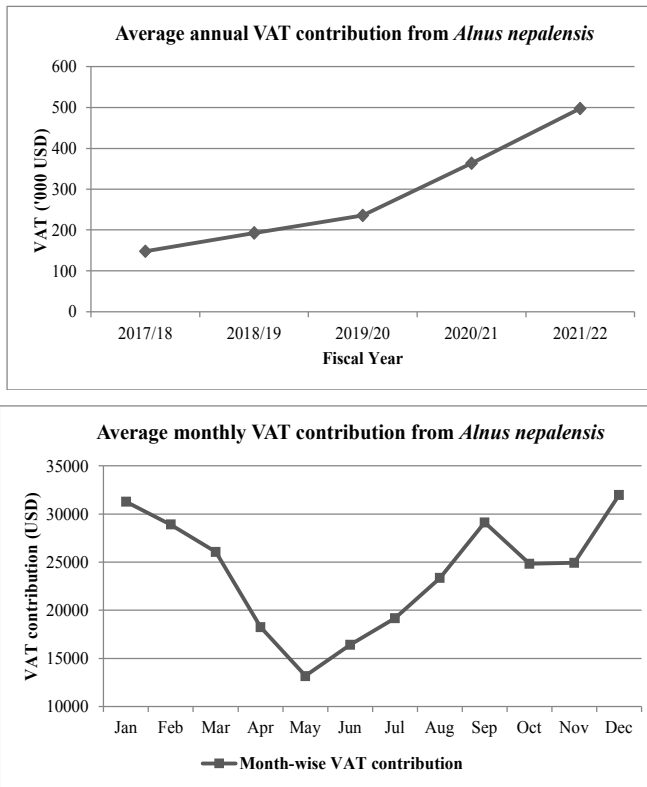[3]1 USD = 133.23 NRs. (July 19, 2023)

Figure 4 (b): Average annual and monthly VAT contribution between the FYs 2017/18 and 2021/22

The first COVID-19 limitations in Nepal predominantly occurred between March and July of 2020. The following figures compare the trade status of Alnus nepalensis prior to the COVID-19 outbreak and during the first official lockdown.
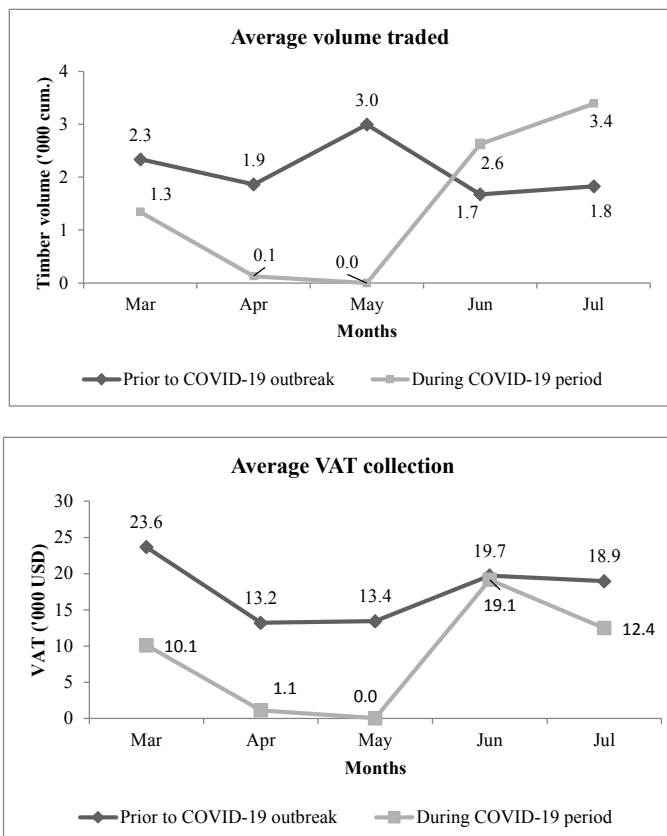

Figure 5: Alnus nepalensis timber trade status prior to COVID-19 and during COVID-19 months

Table 2: COVID-19 effect on quantity traded and VAT generated from Alnus nepalensis

Year (March-July)	Volume (cum.)	Value Added Tax generation (USD)
Before 2020	10,700	88,873
2020	7,500	42,794
Difference	**3,200**	**46,079**

As seen in Figure 5, trade of *Alnus nepalensis* timber for the first three months of the first official lockdown decreased continuously and reached the point of no trade in May. However, some trade started to take place after May which allowed some of the already cut timbers to be transported during the months of June and July. According to Table 2, during the period of five lockdown months, mobility restriction halted the trade of 3,200 cum. (113,024 cft.) timber. Simultaneously, VAT generation was also substantially affected as during the first official lockdown 46,079 USD was lost due to restrictions in vehicular movement. Apart from the losses to the national economy, seasonal and periodic employment opportunities to the local people were significantly affected. This caused immense effect on local livelihood for the *Alnus nepalensis* timber trade dependent communities in Dhankuta. This caused a negative effect on local livelihood for the *Alnus nepalensis* timber trade community.

Costs and benefits from timber trade of Alnus nepalensis at different level engagement

a) Producer level

Farmers are at the beginning of the value chain for Alnus nepalensis wood. When an Alnus nepalensis tree reaches 8-15 years of age and has developed secondary growth, it is deemed harvestable. First, the farmer decides to sell his trees, or the wood contractor investigates the region and contacts the farmer. The fee is normally agreed between the farmer and the contractor on a per-tree basis. In the presence of the ward chairman, written approval is obtained. The price per tree was shown to range between 11 USD and 34 USD. Trees located upward from the access road received a higher price than those located downhill. Similarly, the closer the access road, the higher the price of the tree. The contractor completes the legal requirements necessary to begin harvesting, which include getting the plot farm's land clearing receipt, land ownership certificate, and cadastral map. The division forest office (DFO) then communicates with the Land Revenue Office and the Survey Office to verify the area and ownership and then directs the concerned subdivision forest office (SDFO) to conduct on-site observations to determine the species number and tree dimensions according to the plot. Following complete legal compliance, the DFO issues a tree felling order. The mean monthly amount of Alnus nepalensis timber felled and marketed in Dhankuta was 4,410 cum. (347truckloads).

Based on the average price per tree (23 USD), number of trees felled annually (51,535), and annual wood volume (1,868,759 cft., i.e. 52,917 cum.), the average timber volume generated per tree was found to be1.02 cum. As the sale is performed on the basis of the number of trees, the total income from the sale of Alnus nepalensis trees from Dhankuta sum up to 11,58,882USD each year. This accounts for 21.9 USD per cum. of tree.

b) Local workers (category: harvesting/loader/unloader/ saw mill labour)

Conversion of trees to lumber occurs only after the DFO issues a felling order. After receiving the felling permission, the contractors engage locally available conversion laborers. In general, this is a team of four people (skilled and unskilled) who do tree felling,

conversion, and stack piling. The conversion crew costs between 150 and 263 USD for every truck load (1 truck carried 12.7 cum. Alnus nepalensis logs). This pricing accounted for 16.2 USD per cubic meter of converted log, for a total annual revenue of 8,57,255 USD.

Based on discussions with contractors, 10-15 Man days (MD) are required to finish the conversion procedure and load logs into a truck. So, on an annual basis, Alnus nepalensis timber conversion generated 51,910 MD of local employment, providing full-time work for 173 locals.

c) Municipalities/Ward

The contractor must get a clearance report on the legal status of the land from the District Land Revenue Office. A legal document from the District Survey Office confirming the area and plot number must also be obtained. Following the completion of these processes, the DFO notifies the relevant Sub Division Forest Office to undertake on-site observations and determine the species, quantity, and size of trees plot by plot. This must be done in the presence of at least five local adults, the owners of surrounding plots, a representative from the survey office, a representative from the land revenue office, and a representative from the ward office (CIAA Directive of Jan. 8, 2012). A letter of reference from another major stakeholder: the concerned ward office, is required. This ward recommendation should state its specific position on permitting tree harvesting (Forest Act, 2019). Dhankuta ward offices have been reported to impose an office levies fee of NRs. 20-55 per tree (average: 0.3 USD per tree). The tariff for the same type of tree varies depending on the local municipality or even ward, as well as the remoteness of the site. The ward offices in Dhankutagather 21,167 USD from the harvest of Alnus nepalensis, which yields a rough figure of 0.4 USD per cum. of log.

d) Central Government

Contractors were required to deposit 13% of Alnus nepalensis government royalty rate (Previously NRs. 100, i.e. 0.75 USD as specified in the Forest Regulations of 1995) as a value added tax (VAT) to the federal government. In some cases, the conversion cost (NRs. 100-150) also are additionally included in the agreement made with the landowner, as such the rate of VAT increases. The average yearly VAT generated from the trade of Alnus nepalensis timber was 2,89,882USD, totaling a value of 5.5 USD/cum. of logs.

e) Truck owners

After depositing the VAT in the designated bank, the DFO permits a forest officer/Ranger to check the logs and stamp each log with a transfer stamp if the evaluation is satisfactory. Following that, log transfer permission is given. Local laborers manually load the converted logs into trucks under the supervision of SDFO personnel, who subsequently seal the vehicle and prepare the seal certificate. The trucks carry the log transfer permit and deliver the logs to the veneer/plywood industries listed on the transfer permit. The DFO at the destination opens the truck and authorizes the proponent to unload it. During this haulage, the trucks charge 210 USD to 300 USD (average 255 USD per truck, i.e. 20 USD per cum. log) depending on the distance traveled. The annual turnover for truck owners is1,121,840 USD based on the annual average number of trucks hauling Alnus nepalensis logs.

f) Contractors

The logs are unloaded and measured when the trucks arrive at their destination. Logs are classified into four categories at the veneer/plywood industry: A, B, C, and D. The grades attained at this stage determine the purchase price of logs. Dhankuta logs have been

found to be mostly transported to three Terai districts in eastern Nepal: Sunsari, Morang and occasionally to Jhapa. Not only did purchase rates differ by grade level, but also by district. The following table displays the rates fixed in the destination districts based on different grades:

Table 3: Rate of Alnus nepalensis logs at sink

Destination District	Purchase price (USD/cum. log)			
	Grade A (Girth >36 inches)	Grade B (Girth 30-35 inches)	Grade C (Girth 24-29 inches)	Grade D (Girth <24 inches)
Jhapa	134.2	127.2	113.0	74.2
Morang	120.1	113.0	106.0	81.2
Sunsari	120.1	113.0	106.0	77.7

Source: Basnet (2022)

According to Table 3, one cum. *Alnus nepalensis* log fetches an average of 105.25 USD to the contractors. The yearly gross income of *Alnus nepalensis* contractors in Dhankuta district was calculated to be 5,569,705USD. The net annual income of contractors, after deducting expenses, was found to be 2,120,679USD.
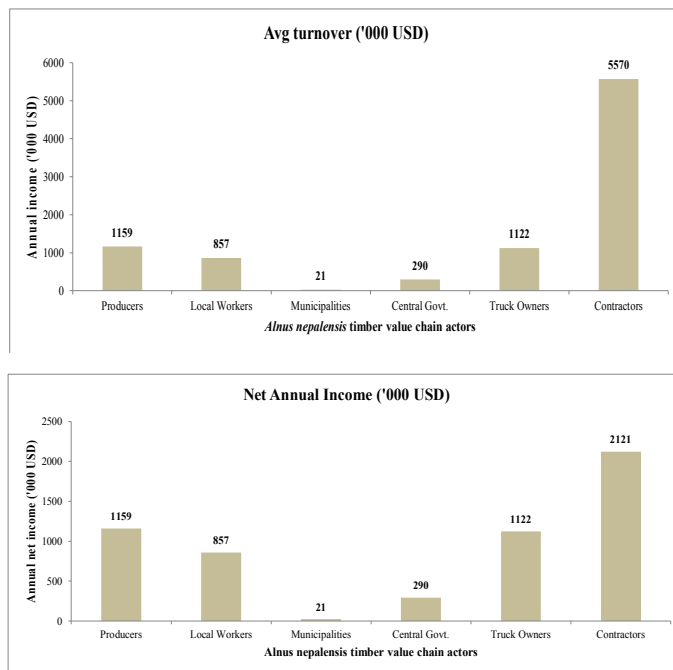
Figure 6: Income generated from Alnus nepalensis

Effect of COVID-19 on Alnus nepalensis timber value chain

The timber trade in Dhankuta and across the country faced disruptions due to mobility restrictions imposed amid the COVID-19 pandemic. All participants in the timber trade's value chain experienced significant losses. Specifically in Dhankuta (refer to Table 4), 3,200 cubic meters of *Alnus nepalensis* timber were unable to enter the value chain, resulting in losses for all involved actors.

Table 4: Income lost by Alnus nepalensis VC actors

S.N.	Value chain actors	Income per cum.(USD)	Income Lost (USD)
1	Tree producers	21.9	70,080
2	Local workers	16.2	51,840

3	Municipalities	0.4	1,280
4	Central government	5.50	17,600
5	Truck Owners	20	64,000
6	Contractors	105.25	3,36,800
Total			**5,41,600**

The disruption caused by the COVID-19 pandemic led to a total loss of 541,600 USD in the timber trade. In terms of monetary impact, timber contractors bore the most significant losses, although all participants in the *Alnus nepalensis* timber value chain experienced substantial setbacks commensurate with their roles. The timber value chain in Dhankuta serves as a crucial means of livelihood for the local population, and the pandemic disrupted this vital support system. Based on the aforementioned data, employment opportunities for 3,150 local workers were lost, equivalent to the elimination of 11 full-time jobs. This substantial loss occurred within a relatively brief span of five months, underscoring the significance, especially given the limited job market in Nepal.

DISCUSSION

In Nepal, the private sector accounts for 86.6% of timber production, with government-managed forests accounting for 7.7% and community forests accounting for 5.5% (Meilby *et al.,* 2014). This demonstrates the significance of private forests or trees outside forests in sustaining Nepal's wood production and supply. Timber products account for more than 90% of the forestry sector's revenue (Banjade, 2012). Dhankuta district alone experienced a trade loss of 3,200 cum. of *Alnus nepalensis* timber in just one year, resulting in a total loss of more than half million USD combining all value chain players. Considering that this figure only comes from a single district, for a single species, and for a single year, this value is highly noteworthy. According to research done in Gandaki province, the first lockdown reduced timber collection and sale by 48% and fuelwood collection and sale by 7.5% owing to the entire suspension of the province's furniture, sawmill, and peeling enterprises (Laudari *et al.,* 2021). The findings are comparable with the economic survey report of Nepal, which indicated a significant decline in timber production and income generation as a result of COVID-19 (MoF, 2020). During the COVID-19 epidemic, movement restrictions were a significant impediment to income creation. T he consecutive lockdowns hit every actor in the *Alnus nepalensis* value chain, with timber contractors bearing the brunt of the damage. However, each actor in the value chain experienced a significant setback in terms of generating income when taking into account the average turnover of each actor. This also affected revenue collection at all three levels of the government.

The study further reveals that the lockdown ceased the collection, transportation and sale of timber. Additionally, due to the lack of raw materials and personnel, the forest-based businesses (particularly the veneer and ply sectors) were closed during the epidemic. The price of veneer, sheets, and plywood may increase as a result of further lockdown and stoppage of logs. The potential adverse outcomes of this phenomenon may manifest in several ways, including illicit timber extraction and logging, reduced income generated from forest product sales, lost opportunities for green employment through sustainable forest management, and heightened poverty due to the reduced employment prospects for underprivileged locals. The forestry sector encompasses various subsectors and significantly involves local communities, contributing to both the national and local economies (Paudel and Paudel, 2021). In a conservative estimate, the forestry sector in Nepal has the potential to generate up to 420,000 jobs (Subedi *et al.,* 2014). These employment opportunities play a crucial role in attracting and retaining youth within the country, discouraging

them from seeking employment abroad. Consequently, it becomes imperative to develop strategies that foster the uninterrupted growth of this sector, considering potential adverse scenarios thoughtfully. The COVID-19 pandemic exacerbated the situation by causing job losses for many, including in the forestry sector. This not only disrupted the livelihood options for local residents but also compelled them to explore opportunities for foreign employment.

There has been consistent evidence from around the world that COVID-19's travel restrictions and border closures had an impact on the lives of those who depended on the forest; decreased revenue for private, governmental, and community-based enterprises by stopping the operation of forest-based industries; reduced revenues from the formal and unofficial forest sectors and increasing unemployment (UNDESA, 2020). For example, there was a significant drop in generation of revenues as a result of the COVID-19 led lockdown in Canada and the United States (Stanturf, 2021), as well as Bangladesh (Rahman *et al.,* 2021); the price of timber products increased to an all-time high in the United States (Riddle, 2020) and China (Tao *et al.,* 2021); decreased Vietnam's timber trade and caused manpower crisis in Vietnam's wood-based industries (Tatarski, 2020); and reduced employment in Thailand's forestry sector (Giri, 2020). Nepal, in this regard, hasn't been any exception as illegal logging and forest product extraction have already transpired as a consequence of the COVID-19 outbreak and subsequent lockdowns (Adhikari, 2020). The loss of revenue and employment in the forestry sector may cause urban-rural migration and force jobless people into poverty, putting enormous strain on common property resources such as forests.

Illegal logging may have increased during and after the pandemic due to lax law enforcement in response to COVID transmission, low conservation priority during the epidemic, and COVID-19 health protocols. It has been proposed that poor law enforcement during and after the epidemic might have short-run consequences with major long-run repercussions for both natural resource management and the national/domestic economy (López Feldman *et al.,* 2020). If the COVID-19 pandemic spreads further or a new disaster occurs, and is accompanied by weak law enforcement, the country's forest resources are likely to face insurmountable pressure from forest-dependent people living near the forests, potentially jeopardizing Nepal's decade-long conservation success (Laudari *et al.,* 2021).

Dhankuta district's wood industry, specifically the private sector, has employed a considerable number of people and has the capacity to keep doing so in the future. But in situations like the current COVID-19 outbreak, this industry is severely impacted. Youths of the country, who are in dire need of income generating opportunities, may follow the migrating trend to gulf countries. Thus, it is extremely necessary to prioritize this sector and make concrete decisions to promote the same. Some aspects in such case can be i) enlisting the forestry sector in the essential service sector (Basnyat *et al.,* 2020), as the employment opportunity to a large number of people is seriously affected when the trade chain is disturbed, ii)documentation of livelihood and employment generation opportunities created by forestry sector in the national database, iii) easing the timber utilization aspects under government-managed and community-managed forests, which could also contribute to meeting national timber demand (MoF, 2020), iv) promoting private forest entrepreneurs, v) preparing short-term and long-term strategies for tackling against adverse scenarios like the COVID-19 pandemic.

CONCLUSION

Private sector plays a predominant role in Nepal's timber production, comprising a substantial share in Nepal's timber market. The significance of private forests in sustaining wood production is underscored by the fact that timber products constitute over 90% of the forestry sector's revenue.

The adverse impact of the COVID-19 pandemic on the forestry sector in Nepal is evident, with tangible losses observed in Dhankuta district. The COVID-19 led country-wise lockdowns resulted in a halt in timber collection, transportation, and sale, affecting all actors in the *Alnus nepalensis* value chain and leading to a substantial setback in income generation. Forest-based businesses, particularly veneer and ply sectors, were forced to close due to the lack of raw materials and personnel. The consequences include potential increases in the prices of veneer, sheets, and plywood, illicit timber extraction, reduced income from forest product sales, lost opportunities for green employment, and heightened poverty among underprivileged locals.

The global context further supports these findings, as similar repercussions were observed in various countries due to COVID-19 restrictions, including decreased revenue, increased timber prices, manpower crises, and unemployment. In Nepal, illegal logging and forest product extraction have already emerged as consequences of the pandemic, posing a threat to the nation's conservation success.
The potential escalation of illegal logging, coupled with weak law enforcement during and after the pandemic, raises concerns about the long-term impact on natural resource management, local livelihood and national economy.

6. Recommendations

Private forestry has been producing significant amounts of timber in Dhankuta district, generating considerable earnings and profits across its value chain. Additionally, given the nation's current economic situation; the job prospects that such commerce offers are quite substantial. However, global pandemics, like the COVID-19-led mobility limitations, pose a major threat both at the local and the national scale. Thus, preparing the forestry sector against various potential adversaries is extremely crucial. This has to be done not only at the level of implementation, but also at the policy level.

Urgent measures are required to mitigate the above mentioned challenges. Prioritizing the forestry sector, enlisting it as an essential service, documenting its contributions to livelihoods in the national database, and promoting private forest entrepreneurs are crucial steps. Additionally, easing timber utilization under government and community-managed forests, along with the formulation of short-term and long-term strategies to address adversities like the COVID-19 pandemic, are essential for sustaining this vital sector and preventing adverse impacts on both the environment and the economy.

Devising appropriate polices and amending hindering clauses within the legal and institutional framework in order to motivate not only the private sector in terms of forestry but also the government-managed and community-managed forestry regimes could provide huge benefits at all levels. This could increase the national timber production; decrease the gap between timber's national demand and supply; assure job opportunities to skilled as well as unskilled citizens; create and motivate forestry entrepreneurs; and discourage youths from migrating out of the country.

Declaration of Competing Interest
None

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