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COVID-19 lockdown and the forestry sector: Insight from Gandaki province of Nepal

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ABSTRACT

Almost all countries have imposed large-scale mobility restrictions (or lockdown) to stop the spreading of the novel coronavirus (COVID-19). The mobility restriction has disrupted all types of business; causing a devastating impact on countries’ economies; and pushing millions of people into extreme poverty. Scientists have been assessing the impact of COVID-19 lockdown on various fronts but there is limited scholarship in the forestry sector. We navigated the impact of COVID-19 lockdown on the forestry sector by taking Gandaki Province (21,974 km²) of Nepal as a case. Employing semi-structured interviews (n = 62) with all ten stakeholder groups, literature review and media analysis, our study revealed that the COVID-19 lockdown suspended all types of forestry and ecotourism businesses; obstructed research and monitoring activities; halted capacity development and extension services; impacted forest development work; and increased incidences of illegal logging and poaching and trafficking of wildlife. Because of the complete shutdown of businesses, the forestry sector of Gandaki province lost 9.6 million USD and 3.2 million man-days of employment during the lockdown period. The economic cost of the lockdown was 1.73 million USD for NTFPs traders, 1.26 million USD for ecotourism entrepreneurs, 0.55 million USD for the community forest user groups and 0.24 million USD for the smallholder or private forest owner. We suggested four post-COVID recovery pathways, including sustainable forest management, nature-based tourism, improvement of forest products value chain and community-based natural resource management to bounce back from the loss. As the current pandemic is most likely to derail the Sustainable Development Pathways of several countries, including Nepal and necessitates the need for an immediate response, the finding and recommendation of our study may inform decision-makers to reimage post-pandemic recovery and leverage sustainable development.

1. Introduction

The novel coronavirus disease (COVID-19) is the most crucial global health calamity of the century and the greatest challenge that human-kind faced since World War II (Chakraborty and Maity, 2020). Its very first emergence was reported in Wuhan, Hubei province, China in late December 2019 and most initial cases were related to source infection from a wet market (Huang et al., 2020). Because of its unique characteristics having numerous potential hosts, its prevention and treatment worldwide are challenging (Vellingiri et al., 2020). Globally the World Health Organization reported more than 3.95 million deaths and 182 million coronaviruses confirmed cases as of June 2021. Almost all the nations are struggling to slow down the transmission of the disease by testing & treating patients, quarantining suspected persons through contact tracing, restricting large gatherings, maintaining complete or partial lockdown (Chakraborty and Maity, 2020). As the transmission of novel coronavirus increases rapidly, governments are adopting curfew/lockdown with restrictions on human mobility (Arora et al., 2020; Lindsey et al., 2020). During the lockdown, all types of industries, vehicle movement, and people’s activity suddenly halted, perhaps for the first time in modern history (Yunus et al., 2020).

Because of the rapid transmission of COVID-19 and the associated mobility restriction, the entire world is experiencing social and economic deadlock and facing an irreparable crisis (Lindsey et al., 2020). It
has threatened human civilization both by causing an impact in every aspect of human life and also by the sudden stop of all types of social, economic, industrial and urbanization activities (Arora et al., 2020). In other words, every sector has been impacted by COVID-19 and the associated lockdown, including but not limited to, tourism (Carr, 2020; Gossling et al., 2020); biodiversity (Manenti et al., 2020; Rondeau et al., 2020); environment (Shrestha et al., 2020; Venter et al., 2020; Zambrano-Monserrat et al., 2020); industry (Belhadi et al., 2021; Rapaccini et al., 2020); agriculture and food security (Baudron and Liègeois, 2020; Dixon et al., 2021; Kumar et al., 2020; Nichols et al., 2020); education (Ahmed et al., 2020; Daniel, 2020); migration (Chakraborty and Maity, 2020; Smith and Wesselbaum, 2020); and forest conservation (Brancalion et al., 2020; Golar et al., 2020). Because of the COVID-19 pandemic, the global economy shrank by 4.4% in 2020 (IMF, 2020), the worst since the Great Depression of the 1930s. However, there are very limited studies on the economic impact of COVID-19 in the forestry sector and this study intends to bridge this knowledge gap by taking the case of Gandaki Province of Nepal.

Previous studies that were undertaken in various countries, for example in Nepal (Basnyat et al., 2020), across the tropics (Brancalion et al., 2020) and 21 high biodiversity countries representing Latin America, Africa, Asia and the Pacific (Rondeau et al., 2020), and Asia and the Pacific states, including Nepal and Thailand (Giri, 2021) have respectively assessed COVID-19 impact on timber production, deforestation, wildlife and biodiversity, and forests and forest-dependent people. These studies, however, have failed to thoroughly navigate the impact (including scale and extent) of COVID-19 mobility restriction to various fronts of the forestry sector, including forest development, forest administration and utilization, revenue and employment generation, the livelihood of forest-dependent people, eco-tourism, research and development and did not suggest how the economy of the country could recover from the loss caused by the pandemic. Besides, there are limited empirical studies on the implications of the COVID-19 lockdown to (sub) national economy and the country’s ongoing efforts in achieving sustainable development goals. As forests provide vital ecosystem services that are crucial to human well-being and critical for achieving sustainable development goals (Aryal et al., 2020), in-depth information and improved understanding of the impact of pandemic-led lockdown on various aspect of the forestry sector is deemed important for development planners and policymakers to reimagine recovery pathway and take swift decisive action to revive the national economy from the aftermath of COVID-19 pandemic (Sen, 2020).

Nepal is one of the leading countries for embracing community forestry (Nuberg et al., 2019) and allowing multi-stakeholder engagement in forestry-related decision-making (Laudari et al., 2020b). The forestry sector, particularly the community forestry of the country has a significant contribution to poverty reduction and rural development (Chhetri, 2009), forest cover enhancement and regrowth (Tripathi et al., 2020) and contributing 80 targets of the sustainable development goals (Aryal et al., 2020). While at the same time, the forestry sector (and related industries) of Nepal has the potential to generate millions of full-time jobs and goods and services worth billions (Subedi et al., 2014). But the recent waves of COVID-19 and associated lockdown have severely affected the forestry sector of Nepal and ceased economic, as well as conservation activities on the ground. In this connection, we intend to assess how the first wave of COVID-19 lockdown has impacted the forestry sector and learn how the recovery pathway the country needs to embrace by taking Gandaki Province of Nepal as a case. We are guided mainly by three analytical questions to navigate the details of impact. It includes a) what are the forestry-related sectors that are hard-hit by COVID-19 lockdown; b) what is the extent and magnitude of the impact to each front of forestry sector; and c) what implications it would bring to the country’s socio-economic front and development pathway. Based on the extent and magnitude of the impact and implications, we propose future pathways that the country should embrace to recover from the loss caused by COVID-19 lockdown. As forestry sector plays a key role in national economies in global, regional and national levels (Lebedys and Li, 2014), this assessment will provide a basis for the policymakers and development planners of Nepal and other countries to formulate appropriate policies and measures to bounce back from COVID-19 economic loss.

2. Methodology

2.1. Study area

Gandaki province is located in the central part of Nepal and lies between 27°26′15″ N to 29°19′50″ N latitude and 82°52′45″ E to 85°12′05″ E longitude (Fig. 1). The Province covers 14.67% (21,974 km²) of the total area of the country which is bordered by Bagmati province in the east; Lumbini and Karnali province in the west; China in the north; and India in the south (PPPCC, 2020). The altitude of the province ranges from 93 m to 8167 m above sea level. Administratively, the province consists of 11 districts including Nawalpur in Terai; Tanahun, Lamjung, Kaski, Syangja, Parbat and Baglung in Mid hills; and Gorkha, Manang, Mustang and Myagdi in the mountain region. In addition, it consists of 85 local levels including one metropolitan, 26 municipalities and 58 rural municipalities. The total population of the province is around 2.4 million. About 15% of the total population of the province lives below absolute poverty.

The Gandaki province is rich in forests and biodiversity because of its wide variation in physiography, topography, climate and ecology. The convergence of the Eastern floristic region and the Western floristic region have made the province rich in biodiversity. Forest covers 37.2% of the total area of the province and almost all districts of the province have more than 50% forest coverage except Mustang and Manang districts (MOITTE, 2020a) and providing A total of 3952 community forests, 1119 leasehold forests, 34 religious forests and one collaborative forest are being managed by the local communities. There are also 308 active community homestays in the province to serve eco-tourists in rural areas. The province has also one block forest, one (Panchase) forest conservation area, one world peace biodiversity garden and 421 registered private forests. Similarly, protected areas including parts of Dhorpatan Hunting Reserve and Chiwan National Park; and the entire territory of Annapurna Conservation Area (ACA) and Manaslu Conservation Area (MCA) fall in the province.

There are many reasons for selecting Gandaki province for the study. Because, 1) it is renowned for its invaluable nature-based tourism including paragliding, bungee jumping, white-water rafting, hunting, trekking and mountaineering (MoITTE, 2019a); 2) ecotourism is one of the key drivers for achieving prosperity in the province (PPPCC, 2020); and 3) forestry sector of the province has a significant contribution to the national and provincial economy by providing nearly 1 million cubic feet timber and 8000 regular jobs annually (MoITTE, 2019b). But the recent COVID-19 pandemic and the associated lockdown have hard hit several economic sectors, including tourism and hospitality, agriculture, remittance, and industry, and the forestry sector of the province is not an exception. Although the provincial government has made a COVID-19 recovery plan, it is limited only to the tourism and industrial sector. No intervention has been made in other areas of the forestry sector including community forestry, smallholder forestry, homestay, timber utilization, NTFP processing and biodiversity conservation so as to recover from the loss caused by COVID-19 lockdown. In this perspective, we aim to assess how the first wave (March-September 2020) of COVID-19 has impacted the forestry sector of the province so that it could inform decision-makers in advance and help in charting the post-COVID development trajectory.

2.2. Data collection and analysis

We employed both qualitative and quantitative research methods for...
undertaking the study. For data collection, we conducted the semi-structured interview (SSI) through the telephone with all ten stakeholders’ groups that are directly or indirectly related to forestry (sub) sectors in the province. It includes forestry officials representing provincial forest ministry, directorate, and forest research and training centre (n = 5), officials from division forest offices (n = 11), executive members of provincial Federation of Community Forestry User Network (n = 5), members of conservation area management committee (n = 4), entrepreneurs from forest-based industries (n = 10), NTFPs traders and collectors (n = 5), proprietor of community-based homestay (n = 10), officials from Dhorpatan Hunting Reserve, Manaslu and Annapurna Conservation Area Project and Chitwan National Park (n = 4), and private forest owners (n = 8). The research participants were purposively selected assuming that they would provide in-depth information about the impact of COVID-19 lockdown on the business and enterprise they are engaged in (Palinkas et al., 2015).

Although the COVID-19 pandemic was started earlier in December 2019, Nepal went under complete nationwide lockdown from March 2020 until the end of September 2020 (Adhikari et al., 2021). Hence, we set March 2020 as a benchmark of our study and started collecting data thereon. The Semi Structure Interview was conducted from November to December 2020 after the relaxation of travel restrictions. Before conducting SSI, we identified the possible areas of the forestry sector that may have impacted by COVID-19 lockdown through an intensive review of (inter) national literature. Then we discussed the possible area of the forestry sector that could be impacted by the lockdown among divisional forest officers and officials of the provincial ministry and refined it before developing the questionnaire. In the meantime, we developed the roster of possible research participants of each stakeholder group by consulting officials of division forest offices, protected areas, and the Ministry of Industry, Tourism, Forests and Environment (MoITFE) of the province. We then developed a set of open-ended questionnaires targeting each stakeholder group. Before undertaking the interview, the questionnaire was pretested with ten research participants covering all sectors. Lastly, we detailed the impact of COVID-19 lockdown on various fronts of the forestry sector through SSI. The research questions that were asked to the representative of different stakeholders group has been presented in Table 1.

In addition to the SSI, we also reviewed the monthly and annual reports of division forest offices, Ministry of Industry, Tourism, Forests and Environment and protected area authorities (including MCA, ACA and Dhorpatan Hunting Reserve) to validate and triangulate the information provided by different stakeholder groups. At the same time, we also followed and tracked some leading national news portals to understand and get additional information about the effect of COVID-19 lockdown on various fronts of the forestry sector in the province and the entire country. The response of each participant was transcribed and reviewed, and then categorized into eight themes by adopting the inductive approach as suggested by (Thomas, 2006). It includes: 1) program implementation; 2) biodiversity conservation; 3) forest administration and development; 4) forest utilization; 5) revenue and employment generation; 6) ecotourism; 7) human resource development, and 8) research. We then adopted both qualitative and quantitative methods to analyze the data. While doing quantitative data analysis, the total loss incurred by the lockdown in each front of the forestry sector was calculated and described based on the official records provided by various government agencies such as Division Forest Offices, Ministry of Tourism, Industry, Forests and Environment and protected area authority. For qualitative analysis, we described and analyzed the contents of each category applying the qualitative content analysis approach (Elo et al., 2014); discussed its implications; and suggested a post-pandemic recovery pathway based on it.

3. Results

Our study shows that COVID-19 mobility restriction impacted
| Research participants | Sample questions |
|-----------------------|-----------------|
| 1. Forestry officials of forest ministry/officials of division forest offices | • What were the sub-sectors most affected by the lockdown? Could you please elaborate on it?  
• What was the magnitude and extent of the impact in each sector? Could you please elaborate on it?  
• Can you say the estimated amount of loss of revenue and employment opportunities from each forestry (sub) sectors due to the COVID-19 pandemic and lockdown?  
• Had COVID-19 lockdown obstructed biodiversity conservation and other forest management related works in the districts of the province? If yes, pls elaborate on it.  
• What was the rate of forest crime during the lockdown? What illegal activities were there in forests and protected area during the lockdown period? Could you please elaborate on it?  
• Did you manage to control the illegal activities inside the forest during the COVID-19 lockdown? If not, why?  
• What were the other activities affected by the COVID-19 lockdown? What are your suggestions for reimagine post-pandemic recovery to recover from the loss?  
• Has the COVID-19 lockdown impacted forest development activities of the users’ group?  
• If yes, what forest development activities were impacted by covid-19? Please elaborate on it.  
• During the lockdown, did you get a chance to organize capacity development entrepreneurship development and other routinely work? If not, why?  
• Were there forest crimes in community forestry during a lockdown? How did the community control it?  
• How many days of employment opportunities were missed from the community forests of the province during the lockdown?  
• What are your suggestions for reimaging post-pandemic recovery?  
• Did the COVID-19 lockdown impact your business? If yes, would you please categorize it?  
• If yes, what was the month-long lockdown impact on NTFPs collection and trade categorically? Did you able to collect and trade the NTFPs during the lockdown period?  
• How much income did you lose while collecting and trading NTFPs during the lockdown?  
• Had it impacted your livelihood? If yes, how? What would be your suggestions for post-pandemic recovery?  
• Did the COVID-19 lockdown impact your business? If yes, would you please categorize it? If yes, what was the magnitude and extent of the impact on your business, including the loss of income and employment? What was the financial loss of your business during the lockdown? |
| 2. Executive committee members of provincial-level FECOFUN |  |
| 3. Entrepreneurs of forest-based industries |  |
| 4. NTFPs collectors and traders |  |
| 5. Entrepreneurs of ecotourism business/community-based homestay |  |
| 6. Private forest growers (smallholders) |  |
| 7. Officials of Annapurna Conservation Area/Manaslu Conservation Area/Conservation Area Management Committee | • What were the other activities obstructed by the COVID-19 lockdown?  
• Had it impacted your livelihood? If yes, then how? What are your suggestions for post-pandemic recovery?  
• Did the COVID-19 lockdown impact the activities of the protected area? If yes, would you please categorize it? If yes, what was the magnitude and extent of the impact on the activities of the protected area? Were there incidences of illegal activities inside the protected area? How did you deal with it? Was there a loss in the revenue from the protected area during the lockdown period?  
• What were the other activities obstructed by COVID-19 lockdown in the protected area? What are your suggestions for post-pandemic recovery |

Table 1 continues...
3.2. Biodiversity conservation

The COVID-19 lockdown also caused severe impacts on biodiversity conservation, including reporting and investigation of wildlife crime and control and management of problematic animals. Four one-horn rhinoceros Rhinoceros unicornis, an endangered species was illegally hunted in the Nawalpur district inside the Chitwan National Park during the lockdown period (Rimal, 2021). The poacher took advantage of the mobility restriction caused by the lockdown and hunted them. Similarly, the lockdown halted the rescue of 97 injured wild animals. In some districts, local people are found to engage in illegal hunting of wild boar, deer, pheasants and fish species.

Moreover, COVID-19 induced lockdown affected forest protection and law enforcement in all districts of the province. Because of poor law enforcement, incidents of encroachment, illegal felling, logging, collection, transportation and trade of timber, fuelwood and NTFPs dramatically increased in the majority of the districts. One case of forest encroachment; four cases of illegal transportation of timber; and four cases about illegal hunting and transportation of the trophy of the wild animals were registered in the district courts. Nearly 20 ha of forest land was encroached for building house and road construction. 13 people were penalized for illegally entering the grasslands for collecting caterpillar fungus in MCA and ACA. 10 people were penalized for illegally entering the protected area, particularly from Annapurna Conservation Area and Manaslu Conservation Area. One case of forest enforcement, incidents of encroachment, illegal felling, logging, collection, transportation and trade of timber, fuelwood and NTFPs were reported.

3.3. Forest administration and development

Forest development is one of the core activities of the division forest offices, watershed management offices and offices of protected areas. The extended lockdown halted various forest development activities and evaluation program of different supervising offices was also stopped during the lockdown period.

Table 2 Impacts of COVID-19 lockdown in the forestry sector of the Gandaki province.

| Forestry sectors | Impacts |
|------------------|---------|
| Program implementation | • Obstructed implementation of forestry-related annual programs, including, preparation of forest management plan, coordination meetings and training, monitoring and evaluation, and establishment of NTFP processing plant. |
| | • Limited fiscal progress to 68%. |
| | • Nearly 9817 general assemblies, 25,860 CFGUs meetings and 50 conservation area management committee’s meeting were obstructed. |
| Biodiversity conservation | • Halted reporting and investigation of forest and wildlife crime. |
| | • One case of forest encroachment; four cases of illegal transportation of timber; and four cases about illegal hunting and transportation of the trophy of the wild animals were registered in the district courts. |
| | • Nearly 20 ha of forest land was encroached for building house and road construction |
| | • 13 people were penalized for illegally entering the grasslands for collecting caterpillar fungus in MCA and ACA. |
| Forest administration and development | • Obstructed forest administration and development activities in the entire 11 districts, including nursery development and transportation and distribution of seedlings, plantation activities, tending and silvicultural operation and other construction-related work (fencing, fire line construction and cleaning). |
| | • Disrupted collection and sale of 0.5 million cubic feet (cft) of timber |
| | • Obstructed implementation of scientific forest management program in 119 community forest. |
| | • Dropped the collection and sale of timber from private lands by 48%. |
| | • Disrupted distribution of 5000 cft. timber and 10,000 cft fuelwood to disaster victims and 7000 cft timber to the general public. |
| | • Completely shut down the furniture, sawmill and veneer industries. |
| | • Affected the collection and processing of NTFPs, including seabuckthorn, Angel marmelos, Choerospondias axillaris, Girardiana diversifolia, Daphne bholua, and Cinnamomum tamala |
| | • Restricted the collection of caterpillar fungus (Vordagamba) in the entire mountain districts. |
| | • Missed an opportunity of collecting revenue, worth 1.8 million USD from the sale of forest products. |
| | • Lost the revenue, worth 4 million USD from the protected area, particularly from Annapurna Conservation Area and Manaslu Conservation Area |
| | • Forest users group lost the income equivalent to 0.548 million USD from the sale of timber and fuelwood |
| | • Private forest owner missed an income worth 0.225 million USD from the sale of timber grown in their private land. |
| | • Employment opportunities equivalent to 1.1 million man-days were missed from the timber extraction and processing |
| | • Missed employment opportunities of 0.30 million man-days from NTFPs collection |
| | • Entrepreneurs engaged in NTFPs collection and trading lost the income of 1.73 million USD |
| | • Employment opportunities equivalent to 94,880 man-days were lost from forestry-related program implementation |
| | • Completely halted ecotourism related activities (eg. white water rafting, bungee jumping, trekking, paragliding and mountaineering) |
| | • Interruption of eight eco-friendly infrastructure development, 113 homestay promotion programs and building and renovating of 141 tourism structures |

Table 2 (continued) Impacts of COVID-19 lockdown in the forestry sector of the Gandaki province.

| Forestry sectors | Impacts |
|------------------|---------|
| | • The homestay owners lost income of 1.26 million USD |
| | • Lost of 54,720 man-days employment from the operation of homestay programs |
| | • Lost the tourism-related daily business worth 1.2 million USD |
| Human resource development | • Delayed recruitment and promotion of 235 regular staffs (49,350 man-days) and 4470 seasonal employees (1,609,240 man-days) of forest and protected area authority |
| | • Halted 145 training and other capacity development programs targeted for government staffs, forest users’ group and other stakeholders. |
| | • Disrupted (inter)national learning and exchange programs targeted for government staffs |
| | • Disrupted 9 action research and study; postponed camera trapping (leopard and snow leopard) and Rhino count and halted research and establishment of a breeding centre of musk deer in the Gandaki province. |
| | • Disruption in easy availability of equipment and lab facilities for academic researches and periodic ecological monitoring of charismatic animals. |

6 SSI with provincial FECOFUN and Conservation Area Management Committee
7 SSI with official of Chitwan National Park
8 SSI with officials of Annapurna and Manaslu Conservation Area
9 SSI with official of Division Forest Offices
10 SSI with official of Division Forest Office and MoITFE
11 SSI with official of Conservation Area Management Committee of MCA
that need to be completed within the fiscal year 2019/2020. More specifically, the severely impacted forest development activities due to the lockdown were nursery establishment; nursery maintenance; seeding production and regular monitoring. Because of the lockdown-induced mobility restriction, seeding production of various divisional forest offices was sharply reduced. For example, the annual seeding and cutting production target was reduced to 45,020 in Myagdi, Manang and Lamjung districts and 10,000 in ACA in the fiscal year (2019/2020) respectively.

In addition to seeding production, the lockdown disrupted several other field-level forest development activities, including plantation (site preparation, pitting or seeding and manure transportation), tending operation (cleaning and weeding), construction-related work (fencing, and fireline and pond construction) and silvicultural operations (mother tree selection, marking and numbering of trees, marking verification, regeneration felling and enrichment plantation). Because of the first wave of COVID-19 and associated lockdown, almost all divisional forest offices stopped undertaking forest development works.

3.4. Forest utilization

In the Gandaki Province, the collection, transportation, processing and trade of forest products was sharply reduced during the seven-month-long lockdown. Altogether, the lockdown halted the collection and sale of a total of 0.5 million cubic feet of timber from 11 districts of the province. In addition, the lockdown impacted forest management activities of 119 community forests that have implemented scientific forest management program, a new concept of productive forest management both in government and community-managed forests of Nepal focusing mainly on the production of timber and fuelwood, covering an area of 23,173 ha in eight districts. Last year, this program was conducted in 106 community forests covering an area of 20,389 ha. Despite the increase in number and area of scientific forest management this fiscal year, the collection and sale of timber from the compartments and sub-compartments were dropped by 27% (0.7 million cubic feet in 2019 and 0.5 million cubic feet in 2020) due to COVID led obstruction in timber harvesting, logging and yarding.

The COVID-19 lockdown also affected smallholder forestry (or private forest). The collection and sale of timber from smallholder forestry were dropped by 48% (0.58 million cubic feet in 2019 and 0.30 million cubic feet in 2020) while the collection of fuelwood was decreased by 7.5% (0.33 million cubic feet in 2019 and 0.30 million cubic feet in 2020) in the same period. Furthermore, the lockdown disrupted the distribution of 5000 cubic feet of timber and 10,000 cubic feet of fuelwood to the victims of disasters and halted the supply of 7000 cubic feet of timber to the general public at a reasonable price from the district forest product supply committee. There was a complete shutdown of furniture, sawmill and peeling industries in the whole province because of the COVID-19 lockdown.

The non-timber forest products (NTFPs) is one of the key sectors that have a greater contribution to the national economy and poverty reduction. Income from caterpillar fungus Ophiocordyceps sinensis alone accounts for up to 65% of the total household cash income in the mountain regions of the country (Shrestha et al., 2019). However, the lockdown affected the collection, processing and utilization of various types of NTFPs in the province. For example, there was a dramatic reduction in the collection of NTFPs, including but not limited to, bamboo shoots, fiddlehead fern, mushroom and Nepalese allium. Similarly, the collection of caterpillar fungus was completely restricted throughout the mountain districts of the province. In addition to the collection, the lockdown affected the processing of NTFPs such as Sea buckthorn, Angel marmelos, Cheroepsopis axillaris, Girardiana diversifolia, Daphne bholua, Cinnamomum tamala, Persea odoratissima and other medicinal and NFTPs species because of lockdown induced mobility restriction and shortages of raw materials in the market. Entrepreneurs engaged in NTFPs collection and trading lost income, worth 1.73 million USD during this period.

3.5. Revenue and employment

The mobility restriction during the COVID-19 pandemic also halted revenue collection. The province missed an opportunity of collecting revenue, worth 1.8 million USD from the sale of forest products from government-managed, community-managed and private forests during the lockdown period. The lockdown also enormously impacted the activities of protected areas of the province. During the lockdown, no revenue and entry fee was collected in protected areas of the province because of the complete closure of check posts and information centres. The Dhorpatan Hunting Reserve, the only hunting reserve of Nepal which is located in the north-western part of the province received no tourists for hunting Himalayan tahr and Blue sheep in the year 2020 and missed collecting 10,000 USD as revenue. Likewise, a total of the entree fee, 0.168 million and 3.8 million USD were respectively lost from the MCA and ACA of the province. Apart from revenue and entry fees, forest user groups also lost their income equivalent to 0.548 million USD from the sale of timber and fuelwood. Owners of smallholder forestry also missed income, worth 0.235 million USD that would come from the sale of timber during the pandemic.

Moreover, the COVID-19 lockdown disrupted seasonal employment opportunities from forestry sectors, including collection, processing and sales of forest products. Employment opportunities equivalent to 1.1 million man-days were missed from the timber extraction and its processing in furniture, sawmills, and veneers industries. Similarly, 0.15 million man-days of employment from the collection of Caterpillar fungus (which is around 1.5 month) and 0.15 million man-days of employment from other NTFP collection was lost due to the pandemic-led mobility restriction. Total employment of 54,720 man-days was lost from the shutdown of homestay business during the pandemic and associated mobility restriction. Similarly, employment of 94,880 man-days was lost from forestry-related program implementation during the lockdown period.

3.6. Ecotourism

Ecotourism is one of the major sectors that is severely ruined by the COVID-19 pandemic and the associated lockdown in the Gandaki Province (Prasain, 2021). During the pandemic, almost all homestays of the province were completely shut down. In addition, nearly 95% of the

13 SSI with officials of Division Forest Office
14 SSI with officials of MoITFE
15 SSI with officials of Division Forest Offices
16 SSI with officials of MoITFE and Division Forest Offices
17 SSI with official of Division Forest Office
18 SSI with Private Forest grower
19 SSI with forest-based industries

19 SSI with official of ACA and MCA
20 SSI with NTFP traders and officials of MoITFE
21 SSI with officials of MoITFE
22 SSI with officials of forest ministry, Gandaki Province
23 SSI with official of Dhorpatan Hunting Reserve
24 SSI with officials of Annapurna and Manaslu Conservation Area
25 SSI with officials of Division Forest Offices and Provincial FECOFUN
26 SSI with private forest owners
27 SSI with the entrepreneur of saw mills, furniture and other forest-based industries
28 SSI with NTFPs trader and collector
29 SSI with home stay entrepreneur
30 SSI with officials of division forest offices and forest ministry of Gandaki Province
hotels that were set up in various parts of the province (except a few in Pokhara city) were also forced to close their business. Several other tourist enterprises including hiking, paragliding, white-water rafting, kayaking, mountaineering and wildlife hunting were completely closed (RSS, 2020). On the other hand, the construction of eight eco-friendly infrastructure development within the forests and 133 homestay promotion programs were suspended by MoITFE during the lockdown period. Similarly, all the tourism development programs of ACA and MCA, including building and renovating 141 tourism structures were disturbed. 33 The lockdown also reduced a significant number of international tourists (nearly 98%) and domestic tourists (nearly about 92%) in the province (Prasain, 2021). The lockdown also created difficulty in rescuing stranded tourists in various mountain regions of the province (Upreti and Gurung, 2021). As a result of persistent lockdown, the daily business worth 1.2 million USD was lost from the tourism sector (excluding homestay) of the province (MoITFE, 2020b). The impact of lockdown was more pronounced to homestay business too. For instance, the homestay owners lost an income of 1.26 million USD during the lockdown period. 32

3.7. Human resource development

In the Gandaki province, the continued lockdown disrupted the capacity development program that was targeted for CFUG, government officials and other stakeholders. For example, three provincial-level training designed for the government staff (mid-level and low-level technicians) and 22 district-level meetings for forest-related stakeholders were cancelled because of the pandemic. Similarly, 120 field level training, workshops and meetings targeted to forest users and conservation area management committees regarding leadership development, record keeping and forest fire management were completely halted. 33 In addition to capacity development, the lockdown obstructed recruitment of 235 new staff (49,350 man-days) such as forest guard, game scout, forester, senior game scout, ranger and officer and their periodic promotion. Similarly, the recruitment of 4470 seasonal employees (1.6 million man-days) to carry out fieldwork and other activities in divisional forest offices, soil conservation offices and protected areas was also halted due to the pandemic. 34 The regional and global knowledge-sharing events (including workshops, seminars, conferences, meetings, short courses and studies) targeted for the decision-makers and practitioners to enhance their skills and expertise on forestry-related issues were also postponed during this period. 35

3.8. Research

Our study also shows that the COVID-19 pandemic has affected all the conservation communities including researchers and practitioners. For example, the pandemic and the associated lockdown completely suspended nine action research and studies that were scheduled by Divisional Forest Offices, Provincial Research Training Center and Protected areas of the province in 2020. 36 Camera trapping of snow leopard in ACA area and common leopard in Tanahun were also completely put on hold fearing the transmission of the COVID-19 virus. 37 In addition, the lockdown also halted research and the establishment of a breeding centre for musk deer in the Gandaki province. Similarly, the already scheduled Rhino count Chitwan National Park, of which a small portion of its area falls in the province, was also postponed for an indefinite period because of the COVID-19 pandemic. 38 Apart from these, other activities that are deemed important for action researches, including data collection resource inventory and lab work were also cancelled. 39

4. Discussion (implications and future pathways)

4.1. Impact and implication of COVID-19 lockdown

Our study shows that COVID-19 mobility restriction impacted various fronts of the forestry sector. It not only halted regular forestry works, including forest management, biodiversity conservation, research and development but it also sharply reduced the income of entrepreneurs engaged in NTFP collection, timber collection, processing and trade, smallholder forestry and ecotourism enterprises (Table 2). Along with forest-based industries, smallholder forestry and biodiversity conservation (including research and development), the tourism sector is another highly impacted sector by the pandemic. The NTFPs and homestay entrepreneurs respectively lost 1.73 and 1.26 million USD while the CFUG and owners of smallholder forestry respectively lost 0.548 million and 0.255 million USD because of the shut down of businesses caused by the lockdown. A similar observation was documented from various regions of the world where the tourism industry faced adverse shock from the COVID-19 pandemic and the associated lockdown (Foo et al., 2020; Gößling et al., 2020; Jaipuria et al., 2020; Skare et al., 2021; Ugar and Akbıyık, 2020). Every segment of the tourism sector is hard hit by the pandemic-led lockdown, including travel and booking enterprise and hospitality and small- and medium-scale tourism business (Dube et al., 2020; Shafi et al., 2020; Sheller, 2020) due to sudden mobility restriction and closure of global transportation networks (Chang et al., 2020; Ioannides and Gyimóthy, 2020; Jessop, 2020) that quickly led to the emptying of hotels, closing of tourism sites, and huge downturn in (future) bookings.

Although the loss from the pandemic is very high, some entrepreneurs, including national and provincial level timber traders and hoteliers (star-rated) could recover from the loss when the pandemic is contained. But entrepreneurs who run small-scale businesses, including homestay entrepreneurs, seasonal workers (trekker and porters), proprietors of (non-star) restaurants and hotels, smallholder (or private forest owner), and labourers working in the tourism and forest-based industries may colloquially bear the cost of the pandemic. Our finding corroborates with the results of previous studies and agrees with the notion that the COVID-19 lockdown has made millions of people jobless and poor (Gupta et al., 2021; Narula, 2020; Nicola et al., 2020; Shafi et al., 2020) and is making wage labours more sufferers (Gentle et al., 2020). As the country is receiving thousands of jobless returnees from gulf countries and big cities of neighboring countries, the indirect impact of the pandemic would be high and will further aggravate the existing vulnerabilities. However, some scholar argues that returnees could engage in the expansion of agriculture production and increase resilience towards food security (Adhikari et al., 2021; Ceballos et al., 2020), but their long-term engagement is highly uncertain because the government currently do not have long-term plans and policies for retaining jobless people and returnees in the country.

Our study further reveals that the lockdown stopped the collection, transportation and sale of timber and fuelwood. In addition, the forest-based enterprises remained closed during the pandemic because of raw material and labour shortages. The continued stopover of logs in the forest on the one hand and extension of mobility restriction on the other could raise the price of timber in the market. And eventually, it may result in illegal logging and harvesting of timber products. The lockdown-induced mobility restriction is likely to bring negative
implications to other fronts as well: a) green employment opportunities that the country would gain from sustainable management of the country’s forest will be seriously missed out; b) revenue collection from the sale of forest products will be significantly reduced; c) the poor people who work in a daily wage in forest-based industries will become poorer. Similar evidence was documented from all across the globe that transportation restriction and border closure due to COVID-19 affected the lives of forest-dependent people; stopped the business of forest-based industries causing reduced revenue for private, public and community-based enterprises; increased unemployment; and lost income from formal and informal forest sectors (UNDESA, 2020). For example, the COVID-19 lockdown caused a dramatic decline in revenues in Canada and the US (Stanturf, 2021) and Bangladesh (Rahman et al., 2021); rose the price of timber products to historically high levels in the US (Riddle, 2020) and China (Tao et al., 2021); decreased forestry sector employment in Thailand (Giri, 2021); and created a labour shortage in wood-based industries and declined in the timber trade in Vietnam (Tatarski, 2020). The loss of income and employment from the forestry sector could induce urban to rural migration and push jobless people to poverty, which may eventually increase immense pressure on common-pool resources, including forests.

It is also evident from our study that the COVID-19 outbreak and subsequent lockdown increased threats and put substantial pressures on forests and biodiversity and halted many conservation and research-related activities (Table 2). Increased cases of illegal logging and collection of forest products (Adhikari, 2020; Bhandari and Baral, 2020; Ghimire, 2020); hunting of wild animals, including wild boar and critically endangered elephant, gharial, musk deer, and one-horned rhino (WWF, 2020); and filing and registering cases against illegal hunting and logging (Mandal, 2020; WWF, 2020) has already been observed in the country during the lockdown. Our finding corroborates with the conclusion of recent studies in various parts of the world that COVID-19 and the associated lockdown elevated threats to biodiversity and forest ecosystems (Brancalion et al., 2020; Cooke et al., 2021; Lindsay et al., 2020); increased deforestation (Daly, 2020; Fair, 2020; Schwartz et al., 2020); reduced research and development activities related to biodiversity conservation (Corlett et al., 2020; Ramvillas et al., 2021); interrupted and hampered conservation activities (Bang and Khadakkar, 2020; Daly, 2020; Manenti et al., 2020); reduced conservation funding (Lindsay et al., 2020); and increased illegal trade of threatened species (Aditya et al., 2021).

The upsurge of illegal logging and hunting during the pandemic could be linked to weak enforcement of the law fearing COVID transmission; social distancing; mandatory entry pass; and lack of coordination between local levels and police; shortages of PCR tests; and low conservation priorities amid pandemic. Scholars argue that weak law enforcement during and after the pandemic could bring short-run effects with possible serious long-run implications both to natural resource management and (sub) national economy (López-Feldman et al., 2020; Manenti et al., 2020). If the mobility restriction and weak law enforcement persist for a longer period and alternative solution to the local’s livelihood isn’t provided, the country’s biodiversity is likely to bear insurmountable pressure from forest-dependent people inhabiting near the forests and protected areas and could even challenge Nepal’s decade-long conservation success.

Some researchers argue that local as well as returnees might have further amplified the risk to biodiversity (Mukhra et al., 2020) but our study couldn’t confirm whether returnees were engaged in illegal logging and hunting. Some even have confirmed positive effects of lockdown on biodiversity, including an increase in species richness, breeding success of an aerial insectivorous bird, and reduction of road-killing of both amphibians and reptiles (Manenti et al., 2020) and reduction in the number of human-induced forest fire (Paudel, 2021). The lockdown may have brought some positive changes in the country’s biodiversity but our study miss to document these elements too.

We also found that the pandemic completely suspended all the research and monitoring activities, including but not limited to, camera trapping of snow leopard and common leopard and Rhino count (Table 2). In addition, various capacity development programs targeted to field level (forestry and protected area) staff and forest users, as well as recruitment of permanent staff and seasonal workers were also obstructed during the lockdown. The research and capacity development activities and recruitment of workforce can be done in the next year but the conservation sector could immediately bear the cost of a limited workforce during the pandemic. For example, we could miss an opportunity of filling the data gap on (existing) biodiversity, including flora and fauna and inform decision-makers and practitioners about the scale and extent of damage/loss; and choose appropriate measures for biodiversity conservation during and after the pandemic. As the revenue of forestry sectors (including protected areas) is likely to reduce in the coming years because of the ongoing COVID-19 pandemic, more funds will be released for addressing immediate societal and economic needs and concerns and conservation-related research and development activities may get less priority. Reduced patrolling and surveillance due to budget (and human resource) constraints and COVID-19 led mobility restriction could result in increased instances of illegal logging and hunting in the forest and protected areas.

The increasing instances of illegal harvesting and transportation of endangered flora and fauna and reduced income of entrepreneurs engaged in tourism, (smallholder) forestry, NTFP and timber business signal that the pandemic-led crisis may bring multiplier effects in the national economy and impede our efforts in achieving the ambitious sustainable development goals (SDGs) and the Paris Agreement. Since sudden and dramatic fall of the income of middle and lower-class people could increase both rural and urban poverty and our efforts to achieve goal 1 (no poverty), goal 2 (zero hunger), goal 4 (quality education), goal 8 (decent work and economic growth) and goal 10 (reduced inequality) will not come to fruition. As subsequent waves of coronavirus are not unlikely to cease (Case et al., 2021), the incidence of illegal harvesting of wood and non-wood products and wild animals is unlikely to stop at least for few years. The poverty-led dependency on forest and natural resources and mobility restriction-led weak enforcement of the law could accelerate unsustainable and illegal logging and harvesting, which may eventually compromise the achievement of various other SDGs, including goal 9 (industry, innovation and infrastructure), goal 12 (responsibility consumption and production), goal 13 (climate action), goal 15 (life on land) and goal 16 (peace and strong institution).

This scholarship has also some limitations. The local communities, forest users group and entrepreneurs engaged in tourism and forest-based industries might have adopted several strategies to cope with COVID-19 lockdown. A recent study, to some extent, has tried to explore these fronts but they have limited their investigation on communities’ immediate response to the pandemic, including rescue and quarantine arrangements (Gentile et al., 2020). An in-depth understanding of how locals are meeting their daily need for forest products and how forest users group and homestay owners, smallholders and NTFPs entrepreneurs are managing their livelihood amid the pandemic remains unexplored. We suggest undertaking further research on this front in the future to enhance our understanding of the preparedness and coping strategies adopted by locals and other entrepreneurs amid the pandemic. As our study has missed documenting the relationship between COVID-19 led reverse migration and illegal logging and hunting, we couldn’t confirm whether increasing incidence of illegal logging and hunting in the province was attributed to reverse migration led by the COVID-19 pandemic. We, therefore, recommend doing further assessment in this field as well to explain and understand the causal relationship between COVID-19 led reverse migration and deforestation. Similarly, our study assessed the potential impacts of COVID-19 on the forestry sector by using a case study. As anecdotal observations of the impact of COVID-19 are still emerging (Cooke et al., 2021), we suggest conducting more empirical as well as data-driven studies so as to document and visualize multiple impacts of the pandemic and associated lockdown on the
Our assessment and analysis show that ecotourism, biodiversity conservation (including research and development), and forest-based enterprise (smallholder forestry, NTFPs and timber trade) were the major sectors that are hard hit by COVID-19 in the province. In addition, the forestry sector in Gandaki Province lost 9.6 million USD and 3.2 million man-days of employment due to the COVID-19 lockdown (Table 2). The homestay and NTFPs enterprises share the highest loss followed by community forest user groups and entrepreneurs engaged in smallholder forestry. The pandemic-led socio-economic loss as such is testing our preparedness level (Schwartz et al., 2020) and highlighting inadequacies of the government’s response to cope with pandemic-induced risks and challenges (Phillips et al., 2020). As the shock of the COVID-19 pandemic and the associated lockdown has made our economies more vulnerable and is likely to derail the Sustainable Development Pathways, governments around the world including Nepal should look for recovery options that generate green jobs and employment. In this perspective also, it is urgent to develop recovery packages so as to revive economies and livelihoods back to the normal stage, make society resilient to similar kinds of shock, and achieve global (development and climate) goals. As Nepal is rich in forest resources and landscape beauty, its post-COVID recovery pathways should be built mostly on the green sectors. The first recovery pathway that the country needs to embrace is sustainable forest management. Since Nepal’s forests, if managed sustainably, can provide millions of jobs and billions of revenue annually (World Bank, 2019); mitigate and adapt to the negative impact of climate change (Pandey et al., 2016); and help to achieve various global goals (Aryal et al., 2020; Laudari et al., 2020a). In addition, sustainable forest management discourages timber import from pacific rim countries; helps to lower increasing timber prices; and reduces (in)direct pressure on forest resources. However, the collective forest tenure reforms dictate the success of sustainable forest management (Aggarwal et al., 2021). The federal and provincial governments, particularly the Ministry of Forests and Environment and the Ministry of Industry, Tourism, Forests and Environment can take a lead by simplifying its process and procedure; improving its governance; and develop tenure arrangements. Similarly, Division Forest Offices (and their sub-units) could facilitate its implementation process by enhancing the capacities of forest users groups and other stakeholders.

As Nepal has cultural and environmental diversity and is a prime destination for ecotourism (Aryal et al., 2019), nature-based tourism could be the second recovery option for the country to achieve dual goals: a) biodiversity conservation; and b) rebuilding the national economy after COVID-19. However, the uncertainty in international tourism could impact it because of the ongoing second and third waves of the pandemic. The promotion of domestic tourism would be a good option both to bounce back from the lost economies of tourism sectors and accommodate the recreational need of diverse public (Derks et al., 2020). To revitalize nature-based tourism, the government of Nepal (federal tourism ministry in particular) should focus on developing strategic and decisive measures, including but not limited to, public-private partnership, health security and safety measures while the provincial ministries (including forest ministry, agriculture ministry, social development ministry and physical development ministry) can design (fiscal) policies and plan that leverage rebuilding of tourism goods and services focusing medium- and small-scale tourism enterprises, including organic farming, handicrafts making, trekking trail/route development/improvement, and enhance skills and expertise of tourism entrepreneurs. The private sector and local communities can also engage and complement the initiative by maintaining quality tourism and health-related safety protocols.

The third approach that the country needs to take for post-pandemic recovery is to improve the value chain of forest products. Since forest-based industries, CFUGs, and entrepreneurs of smallholder forestry and NTFPs are hard hit by the pandemic and have little chance to recover from the incurred loss. In addition, smallholder forestry (or private forest) and NTFPs have a high prospect of providing thousands of green jobs and millions of revenues to the country. Despite the high economic potential of these sectors, the middleman is taking the largest profit compared to farmers and collectors. It is, therefore, urgent to provide fiscal incentives and make investment in the production and processing chain not only for increasing the income of these entrepreneurs but also for reducing the trade deficit of the country. Enhancing entrepreneurship of all actors across the forest products value chain (including production and processing chain of NTFPs and smallholder forestry) would discourage unsustainable consumption and harvesting of forest resources; promote industrial innovation and responsible consumption and production; contribute to climate action; and make peace and strong institution. To improve the forest products value chain, both domestic and global value chain specific measures, including but not limited to, sustainable harvesting, commercial cultivation, value addition through processing and product development, and diversification of markets need to be employed. The provincial forest ministry, divisional forest offices and protected area authorities (including Dhorpatan Hunting Reserve, Annapurna Conservation Area Project and Manasalu Conservation Area Project) can design and implement stimulus programs for improving the forest product value chain, including community forestry, smallholder forestry and NTFPs. The federal ministries, including the Ministry of Forests and environment, and the Ministry of Industry and their respective departments can develop policies and strategies envisioning technical support and fiscal incentive.

The fourth recovery pathway that the country needs to adopt is a community-based approach for forests and biodiversity conservation. As the COVID-19 pandemic has become a new and indirect driver of deforestation and forest degradation, as well as illegal hunting, the importance and scope of a community-based and multi-stakeholder approach for forest and biodiversity conservation programs have been increasingly acknowledged and expanded in recent years. Since the implementation of community-led conservation not only helps to tackle the problem of illegal logging and hunting and poverty (Oldekop et al., 2019) but also makes our conservation efforts effective and long-lasting (Bajracharya et al., 2006). Side by side, local’s engagement in forest and biodiversity provides employment opportunities to poor people even in the difficult time of the pandemic that hinders recruitment of permanent and temporary workforce. But how we can make local communities more equipped and competent so that they could remain active in forest and biodiversity conservation during and after the pandemic has become a greater challenge. As the voluntary contribution of local people to forest and biodiversity conservation is becoming an obsolete business, the (sub) national level forestry and protected area authority should provide fiscal incentives and enhance the capacities of local communities and indigenous people on legal, procedural and safety protocols while undertaking patrolling and monitoring amid pandemics. The provincial and local governments can contribute a lot to this undertaking by mobilizing financial and human resources. Strengthening the capacities of civil society organizations, the private sector and other stakeholders is equally important.

5. Conclusion

This paper has assessed the impact of COVID-19 lockdown on various fronts of the forestry sector by using Gandaki Province of Nepal as a case. Our analysis shows that the impact of the lockdown was more extensive in (eco)tourism and forest-based enterprises, forestry development work and research and monitoring activities. Because of the weak law enforcement caused by COVID-19 mobility restriction, incidences of illegal logging and hunting increased dramatically both inside and outside the protected area. Our study further reveals that the forestry sector lost 9.6 million USD and 3.2 million man-days of employment.
during the lockdown period. Among others, the homestay and NTFPs enterprises owners incurred the highest loss followed by community forest user groups and smallholders.

Based on the analysis of the impact of COVID-19 lockdown on Nepal’s forestry sector, we draw some policy implications that may inform decision-makers of Nepal and other countries to bounce back from post-COVID crisis. First, the COVID-19 lockdown could dramatically reduce the income of middle- and lower-class people and may increase both rural and urban poverty. Second, the continued stopover of logs in the forest because of extended mobility restriction caused by second and third waves of COVID could increase the price of timber in the market. Third, the weak law enforcement during and after COVID-19 could bring short-run effects with possible serious long-run implications in forest and biodiversity conservation. The loss of income and employment from the forestry sector together with weak law enforcement and the increased price of timber could further increase pressure on common-pool resources, including forests and biodiversity. Fourth, conservation-related research and development activities may get less priority because of the loss of revenue from forestry sectors and shifting priorities of the government for addressing immediate societal and economic needs. The reduced number of patrolling and surveillance due to budget (and human resource) constraints could again accelerate illegal activities in the forests and protected areas. Lastly, the pandemic-induced crisis may bring multiplier effects in the national economy and impede the nation’s efforts in achieving the ambitious sustainable development goals (SDGs) and the Paris Agreement.

The shock of the COVID-19 pandemic and the associated lockdown has already made countries’ economies and environments more vulnerable. In this perspective, governments around the world including Nepal should look for recovery options that generate new jobs; revive the lost economy; safeguard forests and biodiversity; and make people resilient to future shock. Recovery options that integrate forests and balance the environment and economy can offer a cross-cutting solution to multifaceted problems created by the COVID crisis. Sustainable forest management, nature-based tourism, improvement of forest products value chain and community-based natural resource management are some of the post-COVID recovery pathways that the countries can embrace so as to address multiple problems induced by COVID-19 lockdown, including but not limited to, unemployment, illicit logging and hunting of wild animals, and poverty. Adoption of these recovery options may also provide an opportunity to build back countries’ post-pandemic economies and help achieve global (sustainable development and climate) goals.

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