

## Impacts of COVID-19 pandemic on the livelihoods of rural households in the community forestry landscape in the Middle Hills of Nepal

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### ABSTRACT

The novel coronavirus disease (COVID-19) has severely affected all sectors of the economy, and the impacts are expected to last-long. One major impact is that migrants return to their original households in rural communities due to loss of jobs. Since rural communities are highly dependent on forest and agriculture for livelihoods, an influx of return migrants likely increases the consumption of forest products and intensifies the agriculture practices, increasing the pressure on forest resources. Based on in-person interview of 215 in 2018 before the pandemic and a phone interview of the same 215 rural households in 2021 at the peak of the pandemic in Kavrepalanchowk district in Nepal, this study addresses the following research questions: (1) Does COVID-19 exert differential impacts among the socio-economic groups? (2) How do return migrants affect the rural land use? (3) Do return migrants put additional pressure on forests resources? The rare before-and-after dataset provide a precious opportunity to assess the COVID-19 impacts on the livelihoods of rural households in the community forestry landscape in the Middle Hills of Nepal. We found that the impacts of COVID-19 were severe on the households with larger family size, those belonging to the marginalized caste groups, having lower number of livestock, low wellbeing index, those who rely on daily wage-based occupation, with low level of education, and the households with return migrants. A significant number of migrants were found to return to their village of origin. As a result, there was a decrease in abandoned land and an increase in the livestock number and forest product use. These findings provide timely insights for the post-pandemic recovery efforts in better targeting needy household with limited resource in the community forestry landscape in the Middle Hills of Nepal.

### 1. Introduction

The novel coronavirus disease (COVID-19), the largest global health crisis in more than a century, has severely impacted all sectors of the economy worldwide (Gupta et al., 2021; World Bank, 2020; Wunder et al., 2021), and the ensuing socio-economic impacts are expected to be long-lasting (FAO, 2021). Complete and partial lockdowns and restrictions to contain the spread of the virus have forced many businesses and other forms of economic sectors to close. Since the confirmation of the first COVID-19 case in late January 2020, Nepal has undergone a series of complete and partial lockdowns as a measure to control the spread of the pandemic. Besides human casualties and challenges in the public health sector, the pandemic has led to insurmountable

socioeconomic and cultural setbacks. Multiple sectors such as tourism, health, education, remittance, transportation, including agriculture and forestry have been hit hard by the COVID-19 pandemic (hereafter 'the pandemic') in Nepal (Laudari et al., 2021). The UNDP estimates that three in every five employees in both formal and informal micro, small, and medium enterprises in Nepal have lost their jobs due to the pandemic (UNDP, 2020), and three out of 10 households have reported a reduction in income (WFP, 2021). National economy has recorded negative economic growth in the fiscal year 2020–2021, for the first time in four decades in Nepal due to the pandemic (Sharma, 2021). While some early assessments have been carried out to examine the impacts of COVID-19 at the macro level, such as economic growth, Gross Domestic Product (GDP), budget, and employment (IOM, 2020; Karn,

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2021; Pandey et al., 2020), very limited information is available at the household level (Kansiime et al., 2021).

COVID-19 has impacted the community disproportionately (Fischer, 2020; Kansiime et al., 2021; Saxena and Fischer, 2021), so it is crucial to gauge the impacts of the pandemic at the household level. Though pandemic has impacted all categories of people in the community, its level of impact could vary based on the socio-economic status and livelihood strategies (Kansiime et al., 2021; Mahmud and Riley, 2021; Pathak et al., 2020; Rahman et al., 2021a). The resilience capacity of individual households is determined by financial, social, physical, natural, and human capital (Wang et al., 2020). Understanding the socio-economic factors that explain the severity of the pandemic is crucial for post-pandemic recovery efforts and policy supports in the rural community (Rahman et al. 2021b).

In Nepal, more than 6 million people were in the international labor market before the start of the pandemic (Adhikari et al., 2021). Though there is no exact data on the number of unemployed individuals, a report has estimated that more than 20% of the Nepalese living abroad lose their jobs due to the pandemic (Baniya et al., 2020). The foreign employment board of Nepal has estimated that about 1.3 million from India were expected to return and an additional more than 407,000 migrants to return from 37 other countries (Baniya et al., 2020). In addition to migrants returning from overseas, larger numbers of reverse migrations took place within the country from urban centers to rural areas (FAO, 2021). More than 54% of the international migrants are in the Gulf Cooperation Council countries and Malaysia, working in the constructions and hospitality sectors (HELVETAS, 2020). Studies suggest that it will take these countries several years to regain their economy back to normal (FAO, 2021; Saxena and Fischer, 2021) and many years for the international migrants who were furloughed to return back.

Remittance contributes about 35% of the total household income and 30% of the GDP in Nepal (Adhikari et al., 2021; Bhattacharai and Conway, 2021; Poudel 2021). It plays a significant role in the rural economy of Nepal, as more than 85% of the labor migrants in Nepal originate from rural areas (Bossavie and Denisova, 2018). Early analysis shows that the rural communities in Nepal faced disruptions from the pandemic in two ways: (a) loss of income of the people working in informal sectors and (b) reduction of remittance from migrants, both internal and international (Babu et al., 2021; Bhattacharai and Conway, 2021). The higher number of return migrants due to the pandemic likely reduced the remittance and impacted the rural economy (Attah, 2021; FAO, 2021). Rural communities are highly dependent on forest- and agriculture-based livelihoods (Bista, 2022). The influx of return migrants is thus assumed to increase the consumption of forest products and the intensity of agriculture practices (Fox et al., 2020; IOM, 2020; Rahman et al., 2021a). Study on the impacts of COVID-19 on sustainable forest management in African countries found that returned migrants were more likely to contribute to deforestation through illegal timber harvests, charcoal production, tenure conflicts, and land grabbing for economic gains (Attah, 2021). Return migrants could be associated with potential changes in agriculture land use patterns. Some earlier studies state that the return migrants in rural areas will engage more in agriculture work, which will likely reduce the cropland abandonment to some extent (Adhikari et al., 2021; Chapagain et al., 2020; DailyDhamaka, 2021). However, COVID-19 also led to disruptions in supplies, including fertilizers, agriculture extension facilities which could negatively impact agriculture practices (Adhikari et al., 2021; Babu et al., 2021; Kumar et al., 2021; Singh et al., 2021; Thapa Magar et al., 2021). These disruptions could further cause cropland abandonment. Most of these studies, while useful for scenario analysis, were however based on assumptions, rather than actual data collected on the ground. As such, these remain limited to fully understand the linkages of COVID-19 on return migrants and its potential effects on agriculture and forestry land use systems in rural Nepal.

The impacts of COVID-19 have been perceived to be remarkable in the forestry sector, including community forestry. Forestry operations

such as plantations and reforestation have slowed down as a result of the pandemic (Giri, 2021; Laudari et al., 2021). Following the pandemic and subsequent lockdown, forestry sector experienced a significant reduction in timber revenue (Laudari et al., 2021). Forestry sector budget declined by 9.1%, and the capital expenditure fell by 23.3% (Basnyat et al., 2020). It is well anticipated that the reduced budget and investments of government and bilateral aid agencies in forestry and conservation sectors will impact forestry practices in the long term (Wunder et al., 2021). Likewise, loss in revenue and income of community forestry user groups (CFUGs) will limit conservation and forest management activities, which might create additional pressure on community forests in the coming years.

This study primarily aims to examine the factors describing the impacts of COVID-19 on rural livelihoods and analyze the land use change and forest product use dynamics among the forest-dependent communities amidst the influx of return migrants due to the pandemic. In order to evaluate the pandemic impacts on rural livelihood, we aimed to explore the following research questions: (1) Do people experience different levels of impacts from the COVID-19 pandemic? If so, which socio-economic class group is experiencing the severity of the pandemic? (2) How do return migrants affect the rural land use dynamics? (3) Do return migrants lead to a heightened pressure on community forests (CF)? Moreover, we hypothesized that within a specific geographic area, the impact level of COVID-19 at the household level significantly differs across a range of socio-economic settings, and return migrants forced home by the COVID-19 are likely to affect agriculture land use and forest product use consumption.

The following section provides conceptual framework- theorizing how migrant returnees and forest use are interrelated; followed by the methodology (Section 3); and results and discussion (Section 4). We provide additional discussion on the role of community forestry in mitigating livelihood impacts of COVID-19 before we present the study conclusion (Section 5).

## 2. Return migrants - forest use pathways: a conceptual framework

Out migration and agricultural land use practices are closely interrelated. Studies on migration and agricultural land use have revealed that out-migration increases cropland abandonment (Bista et al., 2021; Zhang et al., 2018), decreases household livestock units (LSU) and the dependency on forest products (Bhawana and Race, 2020; Oldekop et al., 2018). However, reverse migration could also follow similar pathways in a reverse order (Fox et al., 2020). While rural out-migration minimizes the forest dependency (Angelsen et al., 2020), return migrants could add that pressure on the forests (Fox et al., 2020; Golar et al., 2020). Migrants that return to villages from cities or abroad are likely to increase pressure on the forests (FAO, 2021; Saxena and Fischer, 2021; Wunder et al., 2021), especially when they lose their jobs and source of income due to COVID-19. An influx of returnees could, thereby, trigger an increase in forest resource extraction and consumption, mediated by the increasing number of livestock and re-utilization of abandoned land. Lack of adequate surveillance and monitoring by the forestry agencies due to lockdown can exacerbate these trends. A study on other countries also revealed that return migrants were more likely to be involved in agriculture farming (Angelsen et al., 2020), which could lead to decrease cropland abandonment.

Several countries have experienced an increase in forest area due to rural out-migration, also known as migration-led forest transition (de Jong et al., 2017; Song et al., 2008). In Nepal studies suggested that rural out-migration is one of the major contributing factors of the recent increase in forest area (Fox et al., 2020; Oldekop et al., 2018). The return migrants could halt the rate of forest recovery through increased consumption, if not an increase in deforestation. In an early assessment, Fox et al. (2020) stated the issue of possible deforestation by return migrants in rural Nepal as a potential cost of COVID-19. Another assessment has

also asserted that the loss of income due to COVID-19 could trigger depletion of land based resources and likely upset local governance of common property resources (Boillat and Zahringer, 2020).

Return migrants can have multiple effects on land use, mediated by socio-economic conditions of the household (Kaur and Kaur, 2021; Nolte et al., 2022). We use the migration-forest use pathways framework (Fig. 1) to understand the relationship between return migrants and forests (Angelsen et al., 2020). The framework presented in Fig. 1 outlines potential causal linkages between return migrants and pressure on forests. In this model, return migrants have two principal impact pathways leading to pressure on forest resources. First, return migrants add additional individuals to the household agriculture labor pool, increasing agricultural acreage that can be farmed. In rural Nepal, more than 26% of cropland were abandoned, mostly because of the lack of labor (Bista et al., 2021). Second, return migrants affect forest resource use due to the decrease in remittance income and increase in household livelihood expenditure. In the absence of market access due to geographic isolation, return migrants are likely to be engaged in forest and subsistence agriculture-based livelihood, leading to more consumption of forest products. Though the market is crucial factor for land use decision (Geist and Lambin, 2002), subsistence agriculture in rural areas is comparatively less dependent on market and are less affected by the COVID-19, compared to the commercial agriculture (Adhikari et al., 2021; Nolte et al., 2022). These scenarios have complex land-use implications that can increase pressure on forest resources (FAO, 2021).

### 3. Data and methods

#### 3.1. Study area

The study was carried out in seven community forest user groups in the Bhumlu rural municipality of Kavrepalanchowk district in Nepal (Fig. 2). Kavrepalanchok lies about 35 km east of the capital of Nepal, Kathmandu, with an area of 1396 square kilometers, ranging in altitude from 1007 m to 3018 m above sea level. Government's data<sup>1</sup> shows that Kavrepalanchowk district was the top 12 district in terms of COVID-19 infections, out of the 77 districts in Nepal. The study area is dominated by hilly terrain. Agriculture integrated with forestry and animal husbandry is the dominant land-use system, while forestry and agriculture are two major land-use types. The study area represents rural areas with a high number of return migrants after the pandemic, higher proportion of cropland abandonment pre-pandemic, and a higher dependency on forest and agriculture-based livelihoods (Bista et al., 2021; Bista and Song, 2021), which makes this municipality an ideal place to carry out the study. There is diversity in the economic class of the people, ethnicity and caste groups. The study area has an increasing unemployment rate due to the pandemic. The Bhumlu rural municipality data for the Prime Minister Employment Program<sup>2</sup> shows that the number of unemployed individuals increased by 51% (from 462 to 943), and the number of households (HHs) with unemployment increased by 54% (from 151 to 328) after the lockdown started in April 2021.

#### 3.2. Data collection

This study is based on a questionnaire survey of 215 households before the pandemic in 2018 and a follow-up phone survey after the first round of lockdown in early 2021. For our pre-Pandemic survey, we adopted a multi-stage sampling method. In the first stage of sampling, we selected seven CFUGs based on their accessibility and years dedicated to CF practices. At the second stage, households within each CFUG

were selected with a simple random sampling method. We randomly selected at least 30 HHs from each CFUGs. Households were selected randomly from the list of CFUG members listed in the CFUG Operational Plan. In total, we collected data for 215 households from seven CFUGs. A follow-up survey was conducted with the same 215 households that were surveyed prior to the pandemic in 2018. This dataset provides a rare before-and-after data to assess the COVID-19 impacts on the livelihoods of migrant households in the community forestry landscape in the mid-hill region of Nepal. The details of the previous round of the survey and its administration were explained in Bista et al. (2021). The initial household survey (prior to COVID-19) was designed to understand three major aspects of community forestry: (a) role of community forestry in human-wildlife conflict, (b) cropland abandonment in community forestry landscape, and (c) rural out-migration and community forest governance. In addition, we collected socio-economic information of households, including demographic composition, socio-economic condition, household well-being index (WBI) (Song et al., 2018), agriculture parcel profile, livestock information, forest management, and forest product use, etc.

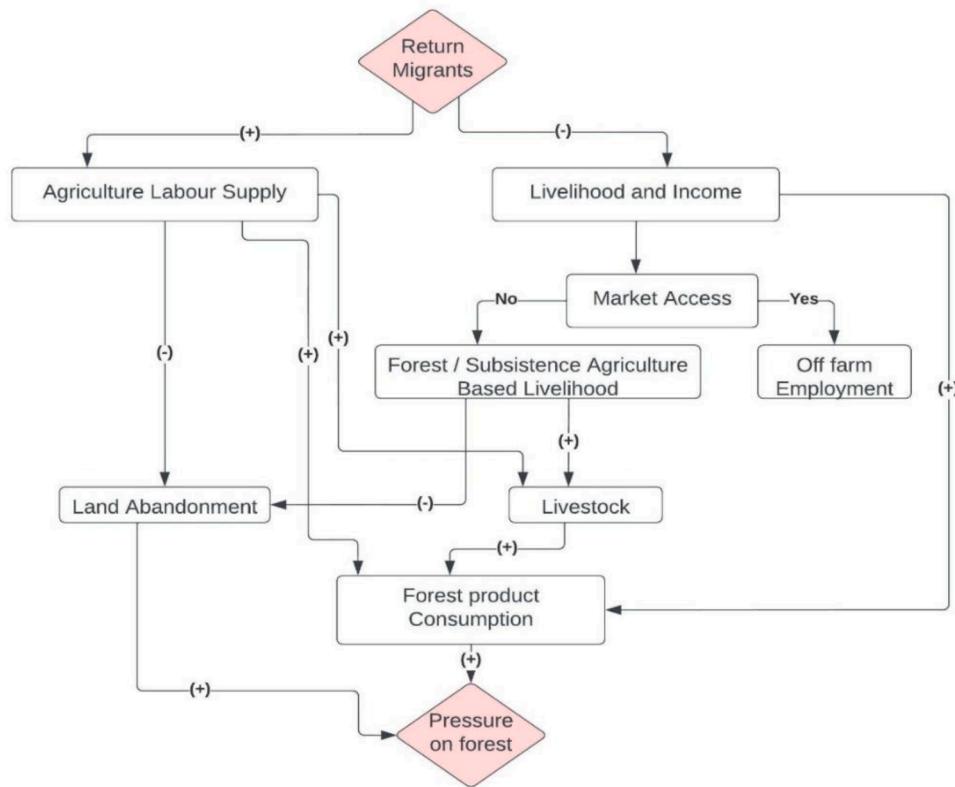
The initial household survey took an hour to complete on average, while the COVID-19 impacts related follow-up phone interview on average lasted for 8 to 10 min. With the help from local enumerators, study team led both the household survey in 2018 and the follow-up phone interview in early 2021. Since the respondents were familiar with the overall research objectives from our first visit, it was easier to administer the follow-up phone interview. During the pandemic, designing and implementing household survey using phone interview has been reliable and preferred mode of household data collection across low and middle-income countries after the pandemic (Zezza et al., 2021). Considering the possible time and resource constraints in a phone interview, we designed our questionnaire to collect nominal and ordinal data in five major aspects: (a) the severity of the COVID-19 impacts on livelihood (low, medium, and high), (b) the number of return migrants in each households, (c) Change in agriculture land use area at the household level since the pandemic started, (d) change in the forest product use compared to the pre-pandemic situation (same, decreased, increased), (e) change in the livestock number compared to the pre-pandemic situation (same, decreased, increased). Following Zezza et al. (2021), which suggested avoiding complex measurement questions in a phone interview, we attempted to simplify the survey instrument and phone interview procedure with easy-to-answer categorical questions.

#### 3.3. Statistical analysis

Descriptive statistics were used to summarize and present the data. We used chi-square and Kruskal Wallis tests to determine the degree of association between COVID-19 impact levels (dependent variable) and categorical and continuous explanatory variables. The severity of livelihood impacts (low, medium, and high) was the dependent variable for the model. The independent variables included various social, economic, and biophysical factors. Respondents were asked to rate the level of COVID-19 impacts on their livelihood on a three-point scale: low, medium, and high. We considered the impact as "High" if the HH had a hard time managing and organizing food and basic household supplies for their family members; "Medium" if the HH experienced economic hardship but managed using social networks, and relatives' support; and "Low" if the HH had no issue organizing for food and supplies. For the ordinal scale response on the severity of the impact of COVID-19 realized by surveyed households, we employed the ordered logistic regression model to investigate the effects of multiple social, economic, and biophysical variables on the level of realized COVID-19 impacts. We used the likelihood ratio Chi-square test to assess the goodness of fit by contrasting a model which had no independent variable with a model we that did. The Brant test was used to test the proportional odds assumption, the underlying assumption of the ordered logistic

<sup>1</sup> Health and population ministry COVID1-9 Dashboard <https://covid19.mohp.gov.np/>

<sup>2</sup> Prime-Minster Employment Program web-portal: <https://pmep.gov.np/es/statistics>



**Fig. 1.** Framework and path hypothesized to understand return migrants and forest relation under the realm of COVID-19 pandemic. The + and - signs in the figure represent the expected direction of the relationship between the variables. (Adopted and modified from [Angelsen et al. 2020](#))

regression approach. Data were entered in excel and analyzed using STATA 16, mostly using the quantitative method. The study also acknowledges that additional case studies and observation notes could have enriched this manuscript. The social network above refers to both formal and informal relationships developed among the community members through information and resource exchanges ([Wang et al., 2021](#)). Descriptions of the variables are presented in [Table 1](#).

#### 4. Results and discussion

##### 4.1. Socio-economic characteristics and pandemic impacts

[Table 1](#) presents the descriptive statistics of socioeconomic characteristics of the respondents, aggregated and broken down at three different levels of impacts. Out of 215 respondents, 20% of the households reported severe impacts of the pandemic, 37% experienced moderate impacts, and the remaining 43% of the households did not realize substantial direct impacts of COVID-19 on their livelihood. A national-level survey on COVID-19 impacts on household's income found that only 31% of the surveyed households had a reduction in income in Nepal ([WFP, 2020](#)), which is substantially lower than our results.

Among the studied population, individual households had an average size of 5.5, with an average agriculture land holding of 14.79 *ropani*<sup>3</sup>. Remittance from migrants was one of the major sources of household income, with an average of 1.1 people per HH migrated domestically, and 0.15 person per HH migrated internationally. On average, each HH received a remittance of Nrs. 6841<sup>4</sup> per year. Before the onset of the pandemic, each HH earned an average of Nrs. 1779 per

month from agriculture. Of the 215 households, 48% were Brahmin/Chettri (prevailing class caste group), 42% were Dalit (marginalized caste group), and 10% were Janajati (indigenous group). A typical household head with an average age of 50.2 ( $\pm 13$ ) had an average education of around 4 ( $\pm 3.8$ ) years in schools. Around 85% of the household heads were male, and 58% of the households relied on wage-based informal occupations for their livelihoods. Almost 95% of the households had at least one kind of livestock, and on average, an individual household had 2.6 ( $\pm 1.5$ ) livestock units (LSU). A standardized measure for converting number of livestock into LSU was described in [Bista and Song \(2021\)](#). Individual household used 10.36 *bharti*<sup>5</sup> of fuelwood and 27 *bhari* of fodder per month. The community forests supplied around 57% of fuelwood and 32% of fodder, respectively.

There was a significant difference in the levels of impacts from COVID-19 among households in terms of total agriculture land holding, number of migrant members, percentage of fuelwood obtained from CF, well-being index, agriculture income, and age and education of household head, whereas LSU, gender, occupation, fuelwood use did not vary significantly ([Table 1](#)). Household heads working in their own agriculture land, non-farm business, and in-office were less impacted compared to other occupations ([Fig. 3a](#)). Day-to-day wage laborers were most impacted by COVID-19. Similarly, low caste groups reported high impacts from the pandemic ([Fig. 3b](#)). Low caste groups in Nepal have limited land ownership, poor access to material and non-material resources, and are highly vulnerable to economic shock like the pandemic ([Singh et al., 2021](#)). Studies found that wage laborers, indigenous and marginalized people are more likely to suffer from COVID-19 because they have less access to coping resources ([Adhikari et al., 2021; Rahman et al., 2021a; RECOFTC, 2021; WFP, 2021](#)). Households having larger agriculture landholdings reported lower impacts compared to those

<sup>3</sup> 1 hectare = 19.66 *ropani*

<sup>4</sup> 1 USD = Nrs 110 (during the time of survey)

<sup>5</sup> 1 *bharti* = 30 kg

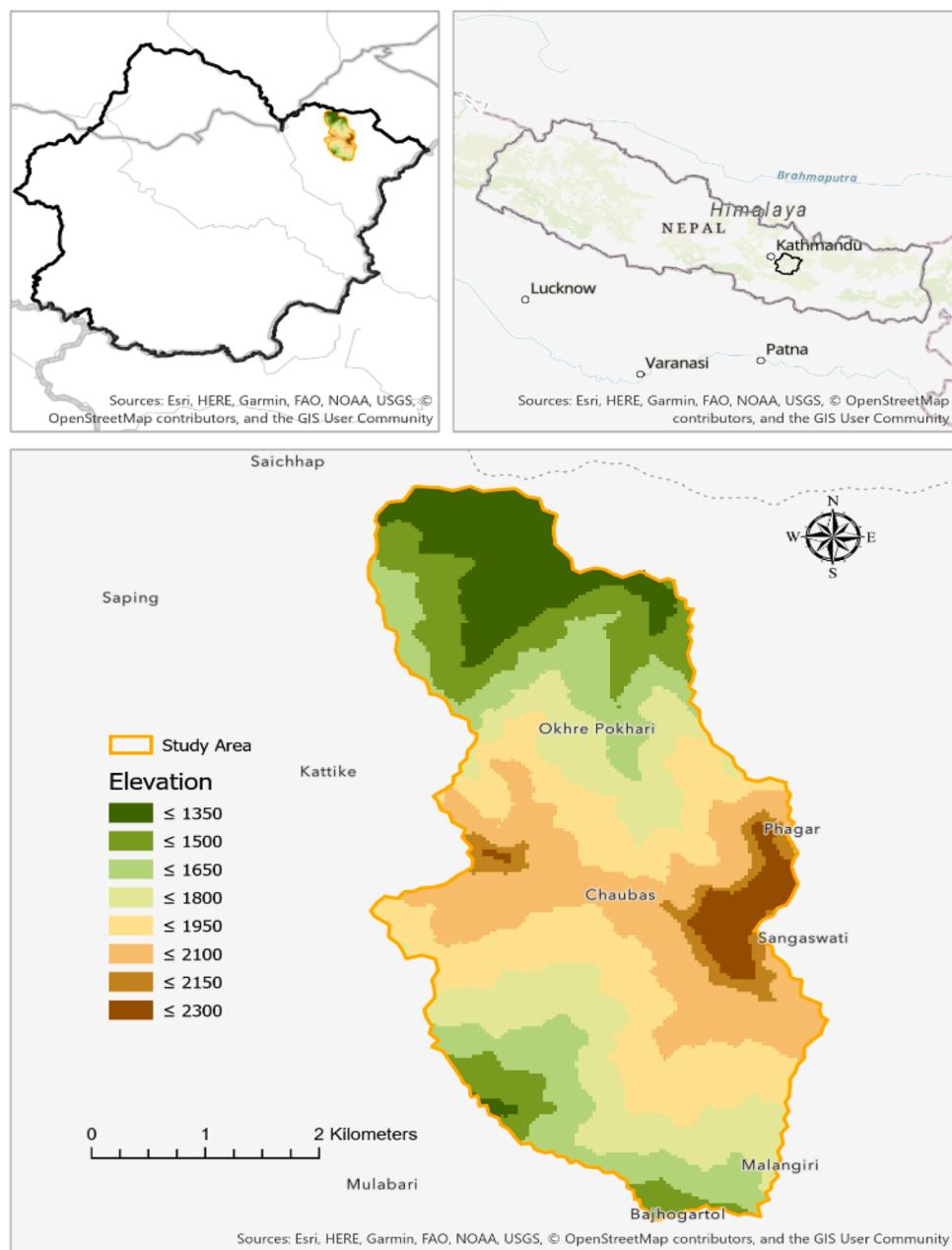


Fig. 2. Map of the study area showing the elevation range and settlement area.

having smaller agriculture landholdings. Though the subsistence rural agriculture practice that communities have been long practicing in Nepal fails to provide full livelihood security, it is highly resilient to crises such as the COVID-19 pandemic, compared to the commercial farming practices (Adhikari et al., 2021). Diverse farming system and low capital investment makes subsistence farming more adaptive. Families that depend more on agriculture and livestock income are comparatively resilient to COVID-19 impacts compared to other occupations. Households reporting low impact had a mean annual agriculture income of NRs 32,251, while those reporting medium and high impact had an average annual agriculture income of NRs.13,873 and NRs.12,823, respectively.

Households with higher impacts from the pandemic had higher fuelwood dependency on CF. We found that livelihoods with younger HH head and those with less education were highly impacted by COVID-19, which is in line to the findings of Daly et al. (2020). Higher impacts on livelihoods of younger HH heads can be attributed to the fact that the

younger population are more mobile and generally employed in informal, non-agricultural occupations, making them more vulnerable to COVID-19 impacts.

Households with higher WBI reported lower COVID-19 impacts. Such households are able to maintain social well-being and livelihood opportunities in the face of socio-economic, and environmental disturbances caused by the pandemic. Households with lower WBI have less capacity to facilitate anticipation and preparedness to respond to the threats caused by the pandemic (Rahman et al., 2021a). We also found that households with many members reported higher impacts compared to the households with fewer members. It is likely that a bigger HH size has a higher number of dependent members and as such their vulnerability has increased due to COVID-19. HHs receiving more remittance before the pandemic reported less impact from COVID-19. One possible explanation could be that such HHs might have some savings to absorb the shocks until their savings last (Shimizutani and Yamada, 2021).

**Table 1**

Summary statistics and the mean difference in the variables among COVID19 impact levels. Kruskal–Wallis tests for continuous variables and chi-sq test for categorical variables.

Variable	Description	Overall (n = 215)	Low (n = 93)	Medium (n = 80)	High (n = 42)	P-value
Area of parcel	Area of land parcel ( <i>ropani</i> )	14.74	18.66	11.91	10.86	0.0001
LSU	Livestock unit	2.67	2.76	2.71	2.40	0.67
Age	Age of HH head in year of survey (in years)	50.89	52.38	51.93	45.54	0.018
Education	Years of schooling of HH head	3.89	4.88	3.26	2.78	0.0003
HH number	Number of HH members	3.93	3.36	4.02	4.97	0.0001
Migrants number active	Number of migrants at HH with an age between 16 and 65	1.16	1.36	1.2	0.61	0.0008
Return migrant	HH with return migrants after COVID (0= Without returnee, 1= With returnee)	0.28	0.18	0.41	0.26	0.004
WBI	Wellbeing Index	8.66	9.46	8.3	7.5	0.0001
Ag income	Income from agriculture	21797	32251	13873	12823	0.0022
Remittance	Amount received by migrants HH in a year as remittance	6841.04	7925	5865	5653	0.31
Gender	Gender of HH head (0=Female, 1=Male)	0.84	0.8	0.87	0.88	0.36
Daily wage Occupation	Occupation of HH head (0 = non-wage-based, 1 = wage-based)	0.58	0.44	0.62	0.83	0.00
Fuelwood Use	Amount of fuelwood use (kg)	801	752.62	817	876.42	0.67
Fuelwood dependency on CF	Percentage of fuelwood obtained from CF	57.38	45	63.39	72.61	0.0001

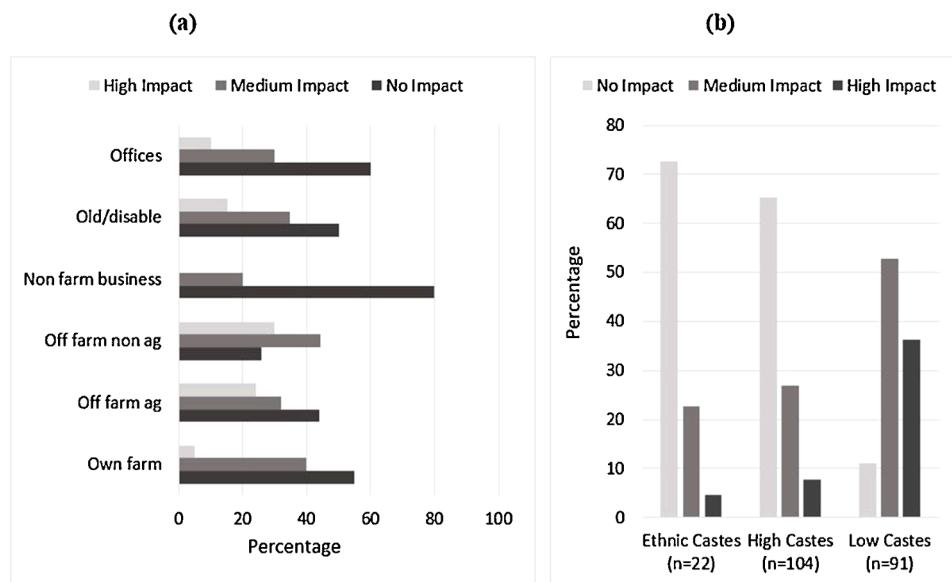


Fig. 3. COVID-19 impacts by occupation (3a) and caste group (3b).

#### 4.2. Predictors of COVID-19 impacts

We estimated an empirical model to examine factors potentially explaining the varied impacts of COVID-19 on household livelihoods in the study region. The likelihood ratio test showed that the model was significant with a chi-square value of 117.06 (*p*-value < 0.00) and had a pseudo *R*<sup>2</sup> of 0.27. The Brant test of the parallel regression assumption was statistically insignificant, substantiating the validity of the ordered logistic regression as an appropriate estimation method. Our results (Table 2) showed that seven out of 13 socio-economic variables were statistically significant at 10% level of significance. The statistically significant factors include LSU, total household population, return migrants in the HH, education of HH head, occupation, well-being index, and caste. Households with large family size ( $\beta = 0.42$ , *p*-value < 0.00), with return migrants ( $\beta = 0.70$ , *p*-value < 0.06), Dalit HH ( $\beta = 1.75$ , *p*-value < 0.00) daily wage labor household head ( $\beta = 0.65$ , *p*-value = 0.06) were more likely to be impacted by COVID-19. Similarly, households with larger LSU ( $\beta = -0.22$ , *p*-value = 0.05), higher WBI ( $\beta = -0.17$ , *p*-value = 0.07), and HH head with higher education ( $\beta = -0.00$ , *p*-value = 0.08) were less likely to be impacted by the pandemic. Other economic metrics (i.e., land holdings, remittance, access to financial

institutions/ proxy to market access), HH-head characters (e.g., gender and age), number of migrants, and social networking were found not to be statistically significant factors explaining the COVID19 impacts.

The marginal effects of independent variables on the probabilities of high, medium, or low outcomes of the dependent variables are presented in Table 2. Marginal effects for LSU denote that per unit increase in LSU increase the probability of HH being in the 'low' impact category by 5% and decrease the probability of the HH being in 'medium' and 'high' impact level by 3% and 21% respectively. Similarly, a unit increase in HHs size decreases the probability of HHs being in the "low" impact category by 9% and increases the probability of HHs being in the "medium" and "high" impact category by 5.8% and 4% respectively. In relation to migrants' number, marginal effects show that the unit increase in migrants' numbers decrease the probability HHs being in the 'low' impact category by 11% and increases the HHs being in the 'medium' and 'high' impact category by 6 and 4% respectively. Likewise, a unit increase in the education of HH head increases the probability of HH being in the 'low' impact category by 2%, decreases the probability of HH being in the 'medium' and 'high' impact categories by 1.2%, and 0.8% respectively. Table 2 also denotes that HH heads with wage-based occupations are 14% less likely to be in the 'low' impact category and

**Table 2**

Ordered logit estimation and its marginal effects of the socio-economic factors explaining the disproportionate impacts of COVID-19.

Independent variables	Odds ratio	Marginal Effects		
		Low	Medium	High
Livestock Unit	0.79 ** (0.09)	0.052** (0.02)	-0.03*** (0.01)	-0.21*** (0.01)
Agriculture landholding	0.99 (0.01)	0.0005 (0.004)	-0.0003 (0.002)	-0.0002 (0.001)
Total household population	1.53 *** (0.16)	-0.09*** (0.024)	0.058** (0.018)	0.04*** (0.01)
Total migrants' number	1.10 (0.13)	0.012 (0.03)	-0.007 (0.019)	-0.005 (0.013)
Return migrants	2.01* (0.76)	-0.11** (0.052)	0.06** (0.03)	0.04** (0.021)
Gender HH head	0.54 (0.28)	0.13 (0.11)	-0.08 (0.07)	-0.05 (0.04)
Education of HH head	0.91 ** (0.04)	0.021* (0.012)	-0.012 (0.007)	-0.008* (0.005)
Age of HH head	0.98 (0.01)	0.004 (0.003)	-0.002 (0.002)	-0.001 (0.001)
Remittance	0.99 (0.00)	0.00 (0.000)	-0.00 (0.000)	-0.00 (0.000)
Wage occupation	1.92 * (0.68)	-0.14* (0.08)	0.087* (0.05)	0.06* (0.03)
Well-Being Index	0.84 * (0.08)	0.04* (0.02)	-0.023* (0.014)	-0.016* (0.009)
Access to financial institute	0.94 (0.31)	0.01 (0.07)	-0.006 (0.04)	-0.004 (0.031)
Social networking	0.99 (0.00)	0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
Caste Dalit (ref: Brahmin/Chettri)	5.80 *** (2.2)	-0.37*** (0.07)	0.18*** (0.05)	0.19*** (0.04)
Caste Janajati (ref: Brahmin/Chettri)	0.76 (0.46)	0.057 (0.14)	-0.04 (0.12)	-0.01 (0.25)
Cut 1	-1.84 (1.3)			
Cut 2	0.89 (1.36)			

LR chi2 (p-value) = 117.06 (0.00); Pseudo R<sup>2</sup> = 0.27; Log likelihood = -155.58; Brant test (p>chi2) = 15.89 (0.320)

\*\*\* Significance at 1% level, \*\*5% level, \* 10% level

8% and 6% more likely to be in the 'medium' and 'high' impact category respectively. Per unit increase in WBI increase the HH being in 'low' impact category by 4% and decrease the HHs being in 'medium' and 'high' impact category by 2.3 and 1.6% respectively. With respect to Brahmin/Chettri, Dalit caste HHs are 37% less likely to be in the 'low' impact category and 18% and 19% more likely to be in the 'medium' and 'high' impact category. This indicates that Dalit HHs are more affected by the covid impacts compared to the higher caste group.

#### 4.3. COVID-19 and return migrants

Prior to the pandemic, a total of 252 individuals in the age group 16–65 migrated to other places. Around 62% of the households have at least one migrant member in their family. Out of the total migrated population, 88% were internal migrants, and the remaining 12% were international migrants. The majority of migrants are below 35 years old at the time of migration. About 57% of the migrants were between the age of 16 and 20 years, next 41% between 21 and 35 years, and the remaining 2% above 35 years. In terms of education, that most of the migrants had less than a secondary level of education at the time of migration. Very few individuals had attended college at the time of migration. Regarding pre-migration occupation, 21% worked on their own agricultural land, 4% were in off-farm agriculture, 5% in non-farm business, 7% in off-farm non-agriculture, and around 42% were students immediately preceding the time of migration. All these migrants' profiles indicated that the migrants were younger, less educated, lacking

technical skills making them most likely to be engaged in low-paying jobs that require low skill sets such as in construction, security, labor, and agriculture (HELVETAS, 2020).

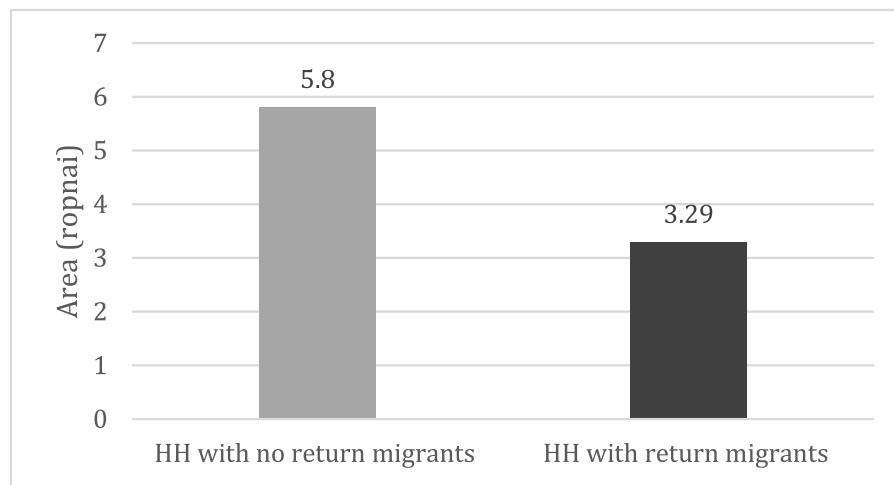
The post-pandemic survey found 45% of the households had one or more return migrants after the pandemic. Out of the total active migrant population ( $n = 252$ ), 34% of the migrants returned. Around 68% of the return migrants had no plan to re-migrate, 15% had plans to return back after the situation became normal, and the remaining 16% were not sure about their migration plan in the future. The ordered logistic regression results also suggest that respondents with return migrants had more likely to realize higher COVID-19 impacts (Table 2). HELVETAS (2020) study about the international return migrants also found that 41% wished to stay in Nepal, 33% had plans to return in foreign employment, and 26% were not certain about the situation. Multiple other studies indicated a higher likelihood for return migrants to stay at the place of origin (Aryal and Shrestha, 2020; FAO, 2021). All these survey are findings consistent with our study and showed that a large proportion of the returned migrants will remain in the area of origin and will either be seeking other livelihood alternatives or remain unemployed. This is primarily attributed to the loss of jobs that they were continuing or the social pressure they had from their friends and families to get back to their families.

Since non-agricultural opportunities are limited in rural areas, a large share of return migrants turns to agriculture. Lack of access to credit constraints return migrants to self-employment (FAO, 2021). The study by International Fund of Agricultural Development (IFAD) in Nepal showed that 60% of the return migrants not willing to re-migrate were likely to engage in subsistence agriculture and forest-based livelihoods (Aryal and Shrestha, 2020). Realizing the potential increase in unemployment rates due to COVID-19, Bagmati provincial government formulated a "Commercial Agriculture Program for Return Migrants" with the objective of providing employment to the return migrants, enhancing the agriculture production and motivating youths towards the agriculture profession (MoLMAC, 2021b). The provincial government also operated an "Agro-Transport call center" to support and promote agriculture as a strategy to address farmers' concerns during the pandemic (Ratopati, 2020). Similarly, the impact of returned migrants on rural economies is reflected in the increasing demand for work under the "Prime Minister Employment Program," which aimed to provide a minimum of 100 days of wage employment for jobless citizens of Nepal. Recent national data on 2021 shows that the number of candidates applying for temporary jobs increased by 45% (from 370,734 to 700,000) compared to the pre-pandemic situation (GoN, 2021).

#### 4.4. Return migrants and abandoned agricultural land

Out of the total of 3145 *ropani* of land owned by 215 HHs, 29% of cropland were abandoned before COVID-19. Households with cropland abandonment decreased from 104 HH (48%) before the pandemic to 97 HH (45%) after the COVID-19 lockdown. In terms of area, 104 households had a total of 925 *ropani* of land abandoned, which decreased to 792 *ropani* after COVID-19. This represents a decrease of 14% in the total abandoned cropland area. Our post lockdown survey showed that 78% of the HHs had no change in cropland abandonment status while 18% showed a decrease and 3% reported an increase in abandonment status. A decrease in cropland abandoned area after COVID-19 indicated increase in the engagement of households in agriculture and made use of agricultural lands for farming. This also could be due to more availability of agricultural labor with an increase in return migrants. Our findings are in line with Angelsen et al. (2020) which also reported that the return migrants increased the labor availability for agriculture and forestry related works, and the reduction in remittance made the household more dependent on agriculture incomes (Fig. 4).

On average, HHs with migrants had 5.7 *ropani* of land abandoned before the pandemic, which reduced to 3.2 *ropani* (41% decrease) among the HHs with return migrants during the pandemic. The t-test



**Fig. 4.** Area of abandoned cropland among the HH with and without return migrants after lockdown.

shows that the area of abandoned cropland is statistically significant ( $p$ -value = 0.07) among the HH with and without return migrants (Fig. 4). HHs reporting a low impact from pandemic had an average area of 5.24 ropani of abandoned cropland, and HH with medium and high impact from the pandemic had an average area of 2.68 and 2.13 ropani respectively of abandoned cropland (Table 1). This indicates that HHs impacted by the pandemic are more likely to use their cropland for farming and leave less land abandoned, in order to overcome the economic burden and livelihood impacts caused by the pandemic. Most of the lands have been utilized for vegetable and fruit farming, while some individuals have also started planting crops in under-utilized slopes.

Though some studies have predicted that COVID-19 will more likely increase the disruption of agriculture practices due to discontinuity with the market (Adhikari et al. 2021; Kumar et al. 2021), leading to less production and an increase in underutilized land, we found no such trend in our study sites. District agriculture production records show that the production of total cereal crops (paddy, maize, millet, buckwheat, wheat, barley) increased from 141,996 metric tons in 2019 to the 153,499 metric tons in 2021 (MoLMAC, 2019, 2021a). Though there is no study that can ascertain the increased production of agriculture crops due to the promotion of agriculture and forest activity by return migrants. Ofuoku et al. (2021) found that the inflow of migrants after COVID-19 increased farm yields. Rural community receiving migrants after the pandemic witnessed the entrance of farmers and farm laborer in agriculture activities and hence increased the agricultural productivity (Ofuoku et al., 2021). Most of the rural communities in Nepal practice subsistence agriculture, which is known to be more resilient compared to commercial farming (Adhikari et al. 2021), the impacts of COVID-19 seem to be less among farmers practicing subsistence agriculture. Rural subsistence agriculture is usually less integrated on the domestic supply chain and the national agriculture markets hence, it is less likely to have severe impacts of the pandemic (Nolte et al., 2022). Access to the market has modest negative effects on land use change in rural households (Nolte et al., 2022).

#### 4.5. Forest product use and livestock trend after the pandemic

Before the pandemic, each HH on average used 10.35 *bhari* of fuelwood in a month and 26.91 *bhari* of fodder per month for livestock. A total of 57% of the fuelwood and 31% of the fodder used were obtained from the CFs. Our 2021 household survey data found that there was no change in the amount of forest product use among 50.7% of the HH, while 17.7% reported a decrease and 31.63% reported an increase in forest product use, compared to the data before the pandemic. We found a higher proportion of HHs reporting an increase in firewood use among

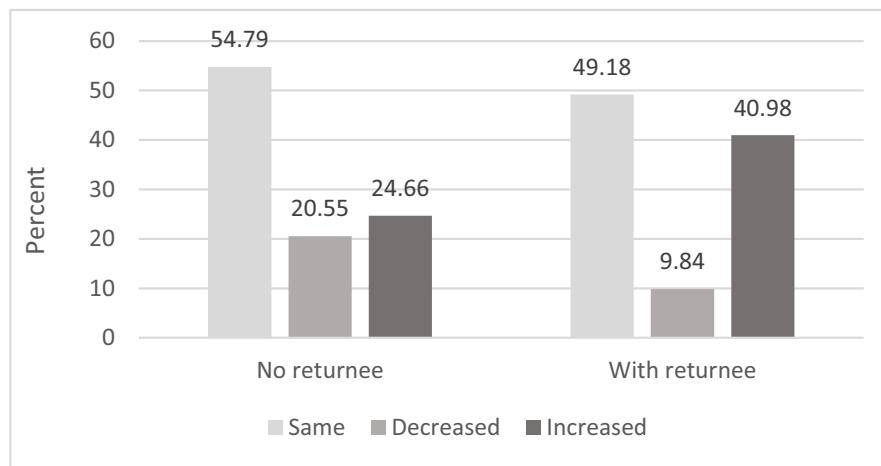
the HH with return migrants. The chi-sq test shows a significant difference [ $\chi^2(2) = 5.39$ ,  $p$ -value = 0.06] in the forest product (fuelwood) use among the HHs with and without return migrants (Fig. 5). Disruption in the supply of alternative energy sources such as LPG due to travel restrictions, accompanied by a decrease in HH income, have also increased the demand of fuelwood in rural households (Giri, 2021) Fig. 5.

Forest products consumption increased along with the increase in the number of family members due to the influx of return migrants and an increase in the livestock to offset the income loss from COVID-19. Firewood consumption had increased due to the adoption of alternative livelihood options such as alcohol production. Recent studies also reported an increased use of firewood for cooking during the lockdown period (Giri, 2021; RECOFTC, 2021). Another study in Indonesia also found increased forest product utilization and forest product demand, resulting in the additional pressure on forests after the COVID-19 pandemic (Golar et al., 2020).

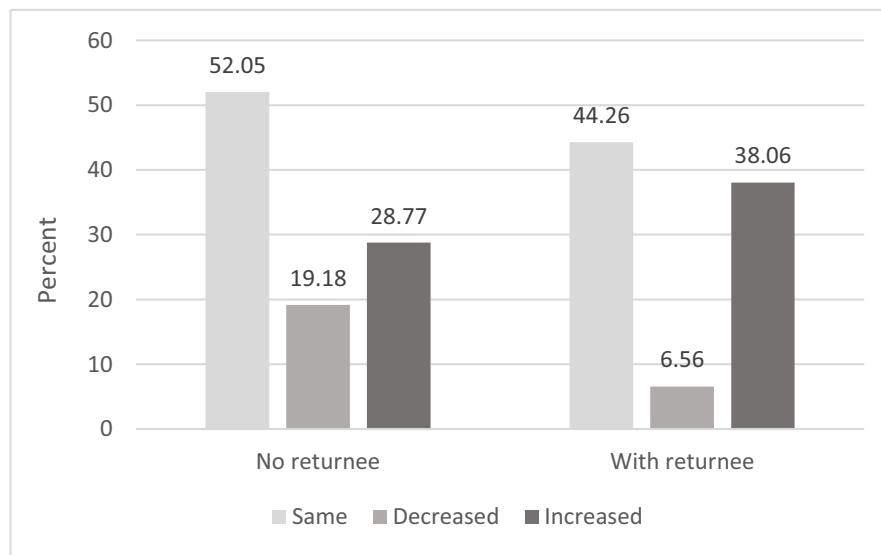
Our household survey data before the COVID-19 shows a household possessed 2.6 LSU ( $SD = 1.5$ ) on average. However, our post lockdown assessment found a significant difference [ $\chi^2(2) = 7.99$ ,  $p$ -value = 0.018] in the livestock keeping trend among the HHs with and without return migrants (Fig. 6). We found a higher proportion of HHs reporting an increase in livestock number among the HH with return migrants compared to HHs without return migrants. Around half of the respondents reported no changes in the livestock number. Surprisingly, more than 38% HHs reported an increasing trend of livestock. Such rapid increase within a short duration is not expected under normal situations. Mahmud and Riley (2021) also found that rural communities are increasing livestock numbers to overcome the economic stresses caused by the pandemic. We found that 38.06% of the surveyed HHs with return migrants had reported an increase in the number of livestock after the lockdown. In contrast, only 28.77% of the HHs with no return migrants had an increase in livestock number. This difference highlights the possible increase in demand on forest resources among the HHs with return migrants. Therefore, it is necessary for local community groups to devise forest management activities and forest products distribution measures that can meet the demand induced by return migrants for forest products. Such activities and measures should consider and benefit the poor and marginalized households, who are more affected by the pandemic Fig. 6.

#### 4.6. Role of community forestry in COVID-19

Our post-lockdown survey data shows that none of the respondents participated in any formal meetings and forest management activities



**Fig. 5.** Forest product (fuelwood) usage among the HHs with and without return migrants.



**Fig. 6.** Livestock trend among the HHs with and without return migrants.

related to the CFUGs since the pandemic began. Under the normal scenario, CFUGs are supposed to conduct an annual general assembly, which gives the mandate to CFUGs to conduct forest management and other activities within CFs, and other periodic meetings as per the requirement. Before the pandemic, 25% of the respondents participated in forest management activities, and 68% attended one or more CFUG-related meetings. Since the studied CFUGs did not have any substantial source of income, none of the HHs received any kind of cash or in-kind support from CFUGs during the pandemic lockdowns. Because there were no membership fees, CFUGs had a nominal fund from timber sales. Fuelwood and fodder were mostly free in all the studied CFUGs, and there was no restriction in forest product (fuelwood and fodder) collection during the lockdown for its members. In the interview with CF executive leaders, we found that there was an increasing demand for timber during the lockdown, mostly to repair and construct sheds and old houses that had been destroyed during the 2015 earthquake. The lockdown afforded the local people ample time for needed repairs and maintenance that they were not able to do before.

Though the direct contribution of CFUG to the COVID-19 responses was not significant in the studied CFUGs, the numbers and figures show a remarkable role of CFUGs in other parts of the country. During the lockdown period, hundreds of CFUGs mobilized their financial and

human resources to support the communities affected by the COVID-19. The data released by the Federation of Community Forest Users Nepal (FECOFUN) show that the CFUGs supported around \$168,770 in cash and in-kind supports through the government relief fund and purchased relief materials and food supplies for their members. More than 27,638 households were benefited from the supports extended by CFUGs (Gentle et al., 2020; Giri, 2021). CFUGs and FECOFUN offered 1411 community forestry buildings throughout the country as space for self-quarantine for return migrants while local and provincial governments were struggling to do so (Pathak et al., 2020). Community forestry buildings were also provided as shelters to those walking long distances back home. Thus, CFUGs have been serving as a safety net to the local communities during the time of natural hazards and crises such as COVID-19 through mobilizing social, natural, human, physical, and financial capitals (Gentle et al., 2020; RECOFTC, 2021).

Besides, the role played by the local government during the COVID 19 lockdown period is commendable. Multiple early assessments reported that local governments played a vital and effective role in addressing the COVID-19 crisis (Adhikari and Budhathoki, 2020; Mainali et al. 2021; Thapa 2022). During the peak of COVID, local governments were vigilant and responded promptly; allocated budgets and build facilities for quarantine; distributed health kits; facilitated

tracing and quarantining of the returnees; provided rations for very vulnerable families (Thapa, 2022). Like other municipalities around the country, Bhumlu rural municipality also played a significant role in information dissemination about awareness raising about COVID-19 and provided the basic support for vulnerable and poor HHs. The local government also provided institutional support to implement the program "Commercial agriculture program for international migrant returnee due to the COVID19", formulated by the Bagmati provincial state government. To promote agriculture practices, the municipality also provided a 50% subsidy on agriculture tools after COVID-19. Along with the local governments, both federal and provincial governments also administered relief packages to support the poor and vulnerable (Ratopati, 2020), though the effectiveness and transparency of such relief packages were problematic.

## 5. Conclusion

COVID-19 pandemic has far-reaching impacts on forest and agriculture-dependent communities in rural Nepal. This study assessed the factors potentially contributing to the disproportionate impacts of COVID-19 and analyzed land use and forest product use dynamics among the forest-dependent communities in the context of migrants returning to the rural communities of Nepal. We found negative impacts of COVID-19 lockdown on the HHs with a larger size, less land holding, lower LSU, return migrants, relying more on daily wage-based occupations, and marginalized caste groups. We also observed that the HHs with higher income from agriculture, high WBI, HH receiving remittance are more resilient from the pandemic impacts. HHs with return migrants are less likely to abandon cropland and more likely to increase LSU. We also found an increased pressure on fuelwood and fodder extraction from community forests after the pandemic. These findings are crucial for post-pandemic recovery efforts and policy prescriptions to revitalize the agriculture based rural economy. While this study contributes to our understanding of the short-term impacts of return migrants on forest resources, this assessment from early days of the pandemic based on a single district might be too early to conclude long-term COVID-19 consequences and major alterations in land-use dynamics in rural livelihoods. Future research should expand the scope of this study with a larger sample over a broader geographical representation, focusing on how COVID-19 influenced forest-dependent communities' livelihoods and dependence on community forests. Similarly, additional research is warranted to evaluate the roles of community forestry as a safety net in moderating COVID-19 impacts on rural livelihoods.

## Declaration of Competing Interest

The authors declare that they have no competing interests associated with this publication. The research also acknowledges financial support received for this work and confirm that there is no role of the financial support on the research outcomes obtained.

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