

Article

Outmigration and Land-Use Change: A Case Study from the Middle Hills of Nepal

Bhawana KC * and Digby Race

Tropical Forests and People Research Centre, University of the Sunshine Coast, Sippy Downs, Queensland 4556, Australia; drace@usc.edu.au

* Correspondence: bhawanakc@gmail.com; Tel.: +61-0480152319

Received: 28 November 2019; Accepted: 13 December 2019; Published: 18 December 2019



Abstract: Outmigration has become a key livelihood strategy for an increasing number of rural households, which in turn has a profound effect on land management. Studies to date have mainly focused on migrant households, and there is limited literature on the differences in land management practices of migrant and nonmigrant households. This article drew on a current study to explore how outmigration affects land management practices in the context of rapidly changing rural communities and economics in the middle hills of Nepal. The data were collected in Lamjung District in western Nepal using a mixed-method approach. We found that underutilization of farmland is a more prominent phenomenon than land abandonment, with rural communities moving to less intensive farming. Importantly, the increasing underutilization of farmland is not just occurring among migrant households. There are a range of complex factors which influence land-use decisions and the subsequent outcomes for landscapes. A high risk of food insecurity in Nepal is likely to be exacerbated if the current trajectory of underutilization and abandonment of farmland continues. A suite of policy tools that can be selectively applied depending on the local context may be more effective than broad-brush national policies in tackling the underlying causes faced by rural communities.

Keywords: agrarian change; food security; land abandonment; land management; land use; livelihoods; Nepal; migration; underutilization

1. Introduction

Humans, directly and indirectly, affect the earth's surface through myriad activities. Patterns of land-use in farmed landscapes are the result of complex and diverse interactions between people and the environment. Yet these interactions are dynamic and at times there can be relatively rapid changes in land-use with uncertain outcomes. Many researchers have identified rural outmigration as an important driver of major changes in land-use, the rural economy, and socio-economic opportunities, with one consequence being a change in the management and scale of farmland [1–5]. It is important to understand these complex interactions and the impacts to design land-use policies that support rural livelihoods, national efforts to achieve food security, and sustainable use of natural resources [6–10].

Outmigration has become a key livelihood strategy for an increasing number of rural households in Nepal [11,12]. According to the last national population census in 2011, one in every four households (25% of 1.38 million households) had at least one member absent or living outside of Nepal [13]. The highest proportion (45%) of absenteeism was from the young adult age group (15 to 24 years old) and 85% of migrants were from rural families [13].

Many studies in Nepal have shown that significant areas of farmland have been abandoned following outmigration [14–19]. Agriculture is one of Nepal's major economic sectors, which contributes approximately one-third of the country's gross domestic product (GDP), and employs 70% of the total population [20]. Yet over recent decades, the contribution of the agricultural sector to GDP has been in

decline, dropping from 40% in 1995 to 27.6% in 2018 [21]; and agricultural imports increased from US\$157 million in 1995/96 to US\$1.378 billion in 2015/16 [20]. In 2010, 27 districts in the hilly and mountainous regions of Nepal were reported to be ‘food insecure’ [22]. Overall, 33% of agricultural land was reported to be uncultivated in 2014/15 [23].

The increasing underutilization or abandonment of farmland in Nepal is likely to diminish the country’s overall agricultural production and exacerbate the issue of food insecurity. In this context, ‘migrant’¹ households are particularly challenged as they often lack available labour from family members and face difficulties in hiring agricultural labourers [24]. However, these households can have access to additional income sources through remittances from their migrant workers. Women’s responsibilities for farming and nonfarming work within and outside the household have also increased, resulting in the feminization of agriculture [25–30]. This phenomenon has a profound effect on land management practices and rural livelihoods as the rural communities adapt to new challenges and opportunities associated with outmigration.

There is still much debate about the effects of outmigration on rural land-use transition. The impacts are complex and are not uniformly experienced. Several studies have shown that the abandonment of agricultural land stimulates forest recovery (i.e., regenerating or transitional forests [31–36]). Alternatively, some authors have questioned this perceived positive impact of land abandonment. For example, there can be an increase in land degradation [37] and wildfires [38,39], a decline in biodiversity [40], and an expansion of invasive species [41,42]. The impacts of outmigration that lead to land-use changes are not uniform and permanent [43,44]. Thus, it is essential to consider the local context in designing location-specific policies and interventions for sustainable natural resource management. Most studies to date on land management practices have mainly focused on migrant households only and not compared the practices of migrant and nonmigrant households. Thus, this study explored the differences in land management practices followed by migrant and nonmigrant households in the middle hills of Nepal. This article also explored the land-use transition associated with the abandonment of farmland in Nepal and its probable consequences for the country’s rural landscapes.

2. Materials and Methods

2.1. Study Area

The study was conducted in Lamjung District in western Nepal (Figure 1). This district is dominated by hilly terrain (81%) and contains the highest proportion of ethnic communities in the country. There are only 29% of Brahmin/Chhetri descent, with the rest being from different non-Brahmin/Chhetri ethnic groups, including 32% of Gurung. Generally, the district is comprised of three categories of farmland—*khet*, *bari*, and *kharbari*. *Khet* is relatively productive and usually irrigated farmland located near waterways. These areas are traditionally set aside for paddy (rice) cultivation. *Bari* is rainfed farmland that is less productive than *khet* and is used to produce grains such as maize and millet. *Kharbari* is the least productive farmland, traditionally growing *khar* grass that is typically used for roof thatching and feed for livestock. This study focused on the experiences of selected villages in the middle hills of Nepal, so the findings may not be relevant in the Terai region or other locations where agriculture is more productive.

¹ This study used the Government of Nepal’s definition of ‘migrant households’ being a household where one or more members are absent for more than six months (for any reason, such as marriage, job, study, children’s education, foreign employment). This definition was used by the Government in the last national population census conducted in 2011. The definition includes migration of household members undertaking either internal (i.e., within Nepal) or international migration. However, we did not include marriage as an indicator to sort households into ‘migrant’ and ‘nonmigrant’ categories as it is the common cultural/social practice of women in Nepal to leave their parents’ houses once married to live with their spouses in their family homes.

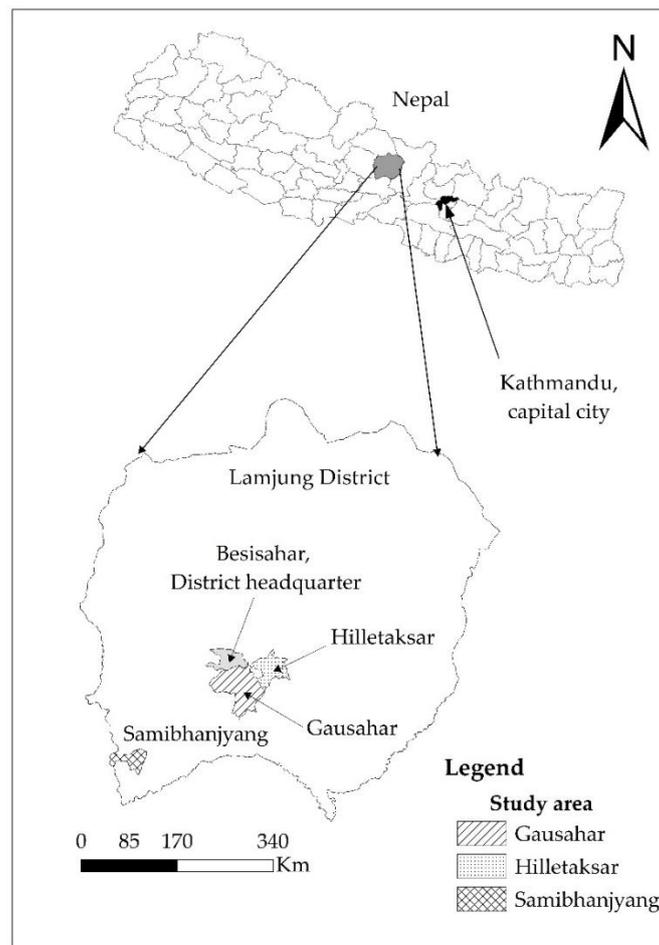


Figure 1. The study area.

The district's main crops are paddy (rice), maize, and millet. Out of the total area of farmland (61,819 ha), only 13% (8230 ha) has access to year-round irrigation, and 23% has only seasonal access to irrigation, leaving most of the farmland in the district as rainfed.

Based on a poverty map of the district, only 26% of the district's population were self-sufficient for more than 10 months of a year, while more than 50% were rated as self-sufficient for less than 6 months [45].

Three case study sites—the wards of Gausahar, Samibhanjyan, and Hiletaksar—were selected to capture a variety of land uses in areas with different ethnic compositions, cultural backgrounds, and livelihood strategies. Among all, the rural population of Gausahar is comparatively more connected to the district headquarter (Besisahar), which is located within a 25 min drive on a sealed highway. The other two sites, Samibhanjyan and Hiletaksar, have only earthen roads, which are highly dependent on the weather conditions for accessibility, and not every village is connected with even earthen roads. Generally, these roads are only usable for around six months a year during the dry season and are unusable during the rainy season. Many families in the study area have moved from remote uphill villages on the steep slopes to the more accessible villages located nearby road-heads or at the bottom of a watershed (e.g., Duipule in the case of Samibhanjyan and Gairi in Gausahar); adjacent to the district's headquarters (Besisahar for Hiletaksar and Damauli for Samibhanjyan); or to cities like Chitwan, Pokhara, and Kathmandu for education, employment, and a more comfortable lifestyle.

2.2. Method

The study adopted a mixed-methods approach, integrating qualitative and quantitative data collection and analysis.

Data Collection

The primary data were collected between January and May 2018 and involved a household survey, in-depth interviews, and group discussions with occasional observation of field conditions. Key points from preliminary analysis of the data were confirmed with a small number of people and groups in June–July 2019.

A total of 119 households across the three study sites were surveyed using a semi-structured questionnaire, with each questionnaire completed by the self-nominated head of selected households or by someone nominated by family members. Pretesting of the questions was conducted in the study area before finalizing the questionnaire for the survey. Similarly, 87 in-depth interviews were conducted in the local language using semi-structured checklists. The quotes from in-depth interviews were translated into English. As with the household survey, the interviews were conducted with a broad representation of people, with a mix of socioeconomic backgrounds, ethnicities, migration status, and levels of engagement within local communities. The interviews were recorded to minimise the disruption to the flow of conversation. The interviews sought to understand the current land management practices, causes of underutilization or abandonment of farmland, scale of land-use transitions, and attitudes towards future farming in the middle hills. All interviewees were informed about the purpose of the research, and their participation was voluntary.

Additionally, ten group discussions (see Table 1) were conducted across the study area with three different types of groups. The first was conducted with women to hear their views on, and experiences with, land management practices. The second type of group discussion was conducted with previous and current members (men and women) of the local Community Forest User Group (CFUG) committee to understand the area’s current land-use transition and dependency on natural resources with changing livelihoods. The third type of group discussion (mixed group) was with men and women from both migrant and nonmigrant households. Topics covered at this discussion included changes in land management practices, the reasons for changing management practices, land cover changes, and farmers’ attitudes towards future farming opportunities. The lead researcher (the primary author of this article) moderated all the group discussions, which lasted between 30 min and 3 h.

Table 1. Details of group discussions.

Study Site	Types of Group Discussions
Samibhanjyang	1 × Community Forest User Group (CFUG) committee members and 1 × women’s group
Hilletaksar	2 × CFUGs committee members, 1 × women’s group, and 1 × mixed group
Gausahar	2 × CFUGs committee members, 1 × women’s group, and 1 × mixed group

Field observations related to different land management practices by migrant and nonmigrant households and land-use transition were conducted at the time of the household surveys and in-depth interviews, with the lead researcher walking through the farmland with the household head/farmer after the interviews. Field observation also included an informal walk around the study area in between interviews and surveys. The observations were captured through photographs and written notes.

2.3. Data Analysis

The data collected from household surveys were analysed using the Statistical Package for the Social Sciences (SPSS) SPSS Version 24. Thematic analysis was conducted to analyse qualitative data derived from in-depth interviews and group discussions [46].

Based on the data from the household survey, the following five categories of farmland summarise current land-use practices of farmers in the study areas—abandoned, partly abandoned, partly fallow, both partly abandoned and partly fallow, and continued historical land-use. Descriptions of each category are provided in Table 2. This study did not take account of those households who have already moved out of the study area.

Table 2. Descriptions of land-use categories.

Category	Description
Abandoned	If the household has retained their farm plots as uncultivated land for at least the last 2 years
Partly abandoned	If the household has retained at least one of their farm plots as uncultivated land for at least two years
Partly fallow	If the household has retained at least one of their farm plots as uncultivated land for three or more months in a year, resulting in a reduced number of crop rotations
Partly abandoned and partly fallow	If the household has retained at least one of their farm plots as uncultivated land for more than two consecutive years and at least one of their farm plots as uncultivated land for three months in a year
Continued historical land-use	If the household is continuing farming without any major change in their land-use practice or scale of farmland during the past 25 years

For easier understanding, the three categories of partly abandoned, partly fallow, and partly abandoned and partly fallow were merged into one “underutilized farmland” category. The abandoned land was characterised into four categories based on data from the household survey, and subsequent verification through field observations, as described below:

- Conversion into grazing/grassland (covered by invasive species, a large proportion of grass cover, or used for grazing land)
- Conversion into shrubland (characterized by a large proportion of shrub cover, cash crops, fodder production, and small trees)
- Conversion into forest (characterized by trees)
- Conversion into urbanized area (characterized by roads and built-up areas)

3. Results and Discussion

3.1. Household Sociodemographic Characteristics

Out of the 119 households surveyed, 92 were ‘migrant’ and 27 were ‘nonmigrant’ households. Survey respondents comprised 61% female and 39% male. In the category of ‘migrant’ households, 42% households were managed by elderly parents, 21% by adult women (with or without children), 20% managed by both elderly parents and women, and the remaining (17%) households were managed by joint families. Approximately 53% of the ‘migrant’ households had more than one member absent from their households at the time of the survey. Details of the socioeconomic characteristics of the surveyed households are presented in Table 3.

Table 3. Socioeconomic characteristics of the surveyed households ($n = 119$).

Gender of the Respondents	Male	Female			
Age of respondents (years)	39%	61%			
	Below 25	26–35	36–45	46–55	60+
	3%	15%	19%	24%	39%
Caste/ethnicity of households	<i>Brahmin/Chhetri</i> ²	<i>Janajati</i> ³	<i>Dalit</i> ⁴		
	39%	41%	20%		
Composition of migrant households	Only parents	Women with/without children	Women with/without children and parents	Others (extended or joint family)	
	42%	21%	20%	17%	
Number of absentee members of migrant households	1	2	3	4	>4
	47%	13%	14%	8%	18%

3.2. Landholding Sizes and Categories

The average household landholding of *khet*, *bari*, and *kharbari* were 8.41, 3.05, and 2.39 ropanies⁵, respectively. Migrant households had larger landholdings of all three land-use types (see Table 4). These data are consistent with national-level data from 2015/16 that suggest 51% of farmer landholdings are less than 9.5 ropanies (0.5 hectares) [47].

Table 4. Landholding size (ropani).

Agriculture Land-Use Types	Overall Average Landholding (Ropanies)	Landholding Size				
		Total Area	Migrant Households		Nonmigrant Households	
			Average landholding	Total area	Average landholding	Total area
Khet (<i>n</i> = 99)	8.41	832.32	9.38	703.33	5.37	128.98
Bari (<i>n</i> = 101)	3.05	308.64	3.29	256.72	2.26	51.52
Kharbari (<i>n</i> = 72)	2.39	172.085	2.67	144.01	1.56	28.06

3.3. Current Land-Use Practices on Khet Land

Five percent (5%) of migrant households and none of the nonmigrant households reported that their *khet* lands were abandoned. However, 80% of migrant and 63% of nonmigrant households reported underutilization of *khet* lands. The underutilization of *khet* lands indicates a substantial shift from traditional farming practices that involved intensive use of *khet* lands. Only 25% of migrant households and 33% of nonmigrant households are continuing traditional farming practices (Figure 2). Moreover, almost equal percentages of migrant and nonmigrant households reported they had sharecropped (*adhiya*)⁶ or rented/leased (*bandage/ujinta*)⁷ their farmland to tenants.

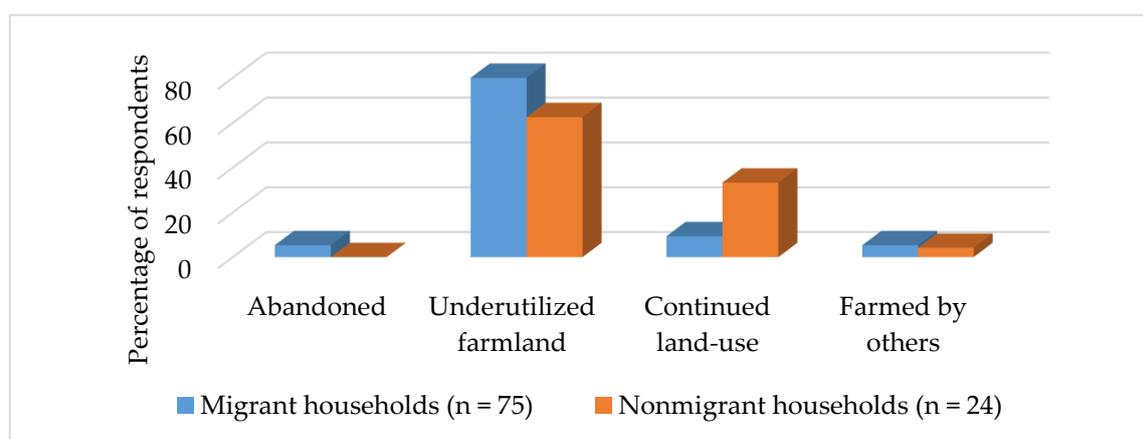


Figure 2. Current land-use practices on *khet* land in Lamjung District, Nepal.

A woman from a nonmigrant household reported: “... the farmland where I used to go for labour exchange (*parma*) for farming are now all fallow, and covered by invasive species” (S011).

⁴ Dalits are considered the untouchables and lower caste groups.

³ Janajati are the middle caste groups.

² Brahmin/Chhetri are the higher caste groups, as per Hindu caste system, also known as upper caste people.

⁵ Ropani is a land unit in Nepal—1 hectare = 19 ropanies.

⁶ Adhiya = sharecropping, usually with an informal contract where the landowner and peasants share 50/50 of the resulting agricultural production.

⁷ Bandage/Ujinta = farmland is leased or rented to tenants for a specified period of time at a fixed price and the price is paid in cash. Unlike the sharecropping arrangement, the tenants do not have to share any production with the landowner.

The survey data show that most households (of both types) have changed their farming practices, and that the biggest change relates to the scale of farmland now being underutilized. Most *khet* land are not fully utilized in both migrant and nonmigrant households due to land abandonment, though *khet* land is considered as the most productive farmland. Most households were found to be moving towards less intensive farming practices and only a few households were farming year-round.

3.4. Current Land-Use Practices on Bari Land

Twenty-one percent (21%) of migrant households reported that their *bari* lands had been abandoned, compared to just 9% for nonmigrant households. Similar to the finding for *khet* land, 63% of migrant households and 53% of nonmigrant households reported underutilization of *bari* land (Figure 3). Only a small number of migrant households (13%) were continuing with traditional farming practices on their *bari* land, compared to nearly 40% of nonmigrant households.

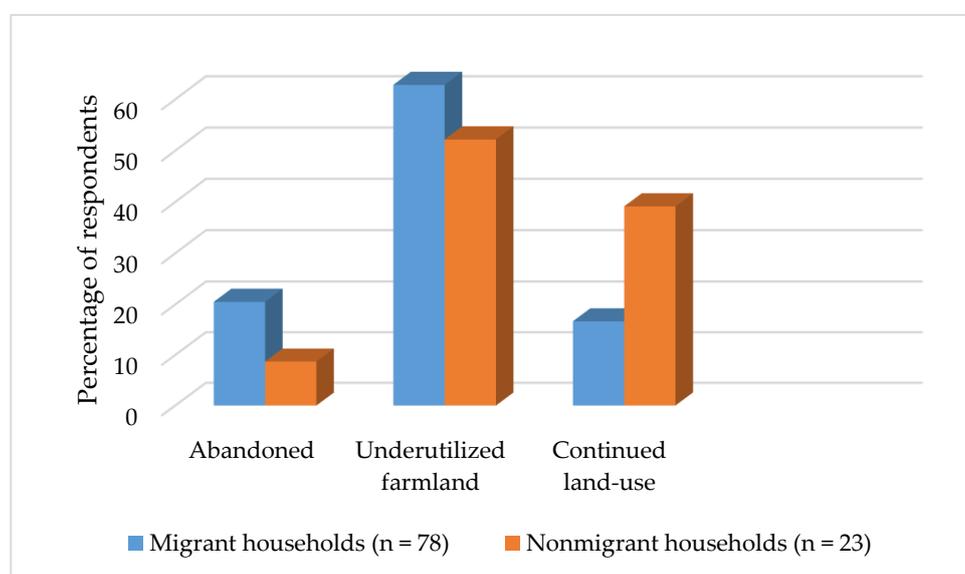


Figure 3. Current land-use practices on *bari* land in Lamjung District, Nepal.

Survey results clearly show that the underutilization of farmland is a key phenomenon, and less so the abandonment of farmland. Surprisingly, there has been little discussion of this issue in the literature, although this finding is consistent with a recent study in Nepal, where 40% of households were found to be retaining at least some of their farmland as uncultivated land [48].

Overall, the underutilization and abandonment of farmland was higher in migrant households than nonmigrant households. This trend is expected to increase in the future, in accordance with recent migration-related studies in Nepal and other parts of the world, where migrant households were more likely to permanently exit farming [49–52] or decrease arable land-use intensity [3].

The observed changes in farming practices of both migrant and nonmigrant households raise critical questions about long-term sustainable land management and food security. The underutilization and abandonment of farmland is not simply a result of outmigration, nor are these phenomena limited to migrant households. This finding suggests that a complexity of factors influence household-level farming decisions.

It is commonly assumed that the most unproductive farmland is abandoned first. However, results from our survey show that underutilization of *khet* land (i.e., the most productive farmland) was higher than *bari* land (i.e., less productive farmland), suggesting that decisions about farming are not only about productivity. The *khet* land in the study area is scattered and located far from settlements. The relatively remote location of *khet* land increases the risk of crop damage by wildlife and incurs high production costs, which influences decisions by farmers about whether to continue farming or not.

Table 5. Frequency of reasons given by respondents for the abandonment and underutilization of farmland in Lamjung District, Nepal ($n = 119$).

Major Causes	Responses by Farmers %
Decrease in the availability of agricultural labour	81
Climate change (drought, flood, erratic rainfall patterns, and decrease in water resources)	71
Less labour available in the home	69
Shifts in occupation (from agriculture to off-farm activities)	65
Unprofitable (high production costs)	60
Decreased production	50
Crop damage by wildlife	47
Unable to farm due to age	41
Farmland located far from home (long distance)	37
Expensive labour	36
Increased workload	25
Hard work/uninterested	20
Little manure available to improve production (less livestock)	16
Unproductive steep land	13
Less access to markets/low prices for agricultural products	7
Increasing cost of agricultural inputs	4
Surrounding neighbours already abandoned their farmland	4
Small and fragmented farmland (leading to high production costs)	3
Rice is available from the market	2

3.5.1. Ageing Farmers and Women with Few Family Members at Home

The average age of farmers is increasing, corresponding to a diminishing physical capacity for farmers to practice intensive farming. An elderly man from a migrant household reported: “... I haven't planted anything this year and I left farmland fallow as I am unable to do any physical work” (S001). For many women in rural households, they also assume primary responsibility for caring for other family members (e.g., young children, elderly), sourcing adequate daily food for their family, attending community meetings, and other obligations—all leading to an increased workload. As a result of these changes, ageing farmers and women with heavy workloads were reducing their farming intensity by reducing their livestock and crop rotations, abandoning labour-intensive crops (e.g., millet), or leaving land temporarily fallow. Many farmers were also planting grasses, fodder, and tree species on their less productive farmland rather than cultivating crops. At the same time, some households were leasing their farmland to tenants or engaging in sharecropping.

After a few years of a husband's absence, it is common for a wife to move to road-heads, nearby towns, or big cities. Moving to enable the education of children was reported as one of the most common phenomena in recent years. Education has become a top priority of many households in recent years, as farmers want their children to be employed in salaried jobs rather than continuing the hard work of farming. In the study area, most government schools were shut down or on the verge of closing due to declining student numbers.

3.5.2. Labour Shortages and Expensive Labourers

Farmers generally used to practice farming as *parma* (also called, *pakhuri sata sat*, *bharoparma*, or *pareli*⁸), which is a local labour exchange system between households. Households headed by females and elderly people commonly reported a reduced timely availability of male labourers and less participation in the farming labour exchange system, as also observed in other parts of Nepal [55]. An elderly woman from a migrant household reported that all her *khet* land (5 haal⁹) was

⁸ *Parma*, *bharoparma*, *pakhuri sata sat*, or *pareli* are different names provided at different places for a local labour exchange system to conduct farming. Under this system, households exchange labour between themselves in an informal arrangement instead of hiring labourers and paying cash.

⁹ *Haal* is a local land measurement unit mainly used by rural people. Generally, it is the amount of farmland plough by oxen in a day.

abandoned because she was unable to do *bharoparma* due to her age and many other tasks having to be done by herself, which has increased her workload. Another woman from a migrant household responded: “... I am only planting maize nearby my house and leaving distant farmland abandoned over the last 4 years. I stopped millet production as it needs many labourers and I have also stopped lentil cultivation last year as I could not find any labour for weeding. I am only farming what I can do by myself” (S002).

Labourers prioritise their availability to households with male members at home, based on an expectation of receiving support from those male members in the future. The traditional labour exchange system is gradually being replaced by paid labour in line with the increase in cash in the rural economy. Additionally, younger people are increasingly less interested in working as agricultural labourers, including on other’s farmland. The reduced numbers of young people in the villages has also led to an increase in the cost of hiring labourers.

Landowners were finding it increasingly difficult to secure agricultural labourers to cultivate their farmland. Members of most of the *Dalit* households and others of poor socioeconomic status, who traditionally worked as sharecroppers or agricultural labourers as *hali* (ploughmen) or *ghothala* (cattle grazers) on their own farmland, were now either aged, engaged in outmigration, or not interested in farming. Instead, they preferred to work in off-farm jobs such as carpenters, masons, drivers, or other high income jobs, as also observed in another study in the middle hills [56].

An elderly woman from a migrant household reported “... nowadays *Dalits* prefer to work as wage labourers and contractors due to high wage rates, which is more profitable for them rather than farming in *adhiya* and/or *bandage*” (S005).

The area of farmland available for sharecropping has also been reduced, according to sharecroppers, because of fewer family members, decreasing productivity and unprofitable farming.

3.5.3. Erratic Rainfall Patterns and Extreme Weather Events

According to the respondents, erratic rainfall patterns and extreme weather events, such as drought and hailstorms, had become more frequent in the study area. This has increased the incidence of crop failures, led to a shift in planting time, and subsequently reduced crop production. Farmers have ceased the cultivation of winter crops, such as millet and mustard, due to a lack of rain.

One survey respondent reported: “... I am not doing any winter farming due to erratic rainfall pattern” (G102).

Previous studies have reported the negative effects of climate change on farming [57–60].

3.5.4. Crop Damage by Wildlife

Crop damage by wild animals, especially monkeys, has increased over recent years, corresponding to a decrease in the area being farmed and an increase in the area of forest. The situation has forced many farmers to reduce the growing of crops, such as maize, that are highly susceptible to damage by monkeys. As a result, cropping is increasingly limited to paddy farming once a year, compared to the traditional approach of paddy followed by maize in combination with lentil, which was widely practiced in the past.

In Samibhanjyan, due to an increase in crop-raiding by monkeys, most farmers now buy vegetables from the market instead of cultivating them. They reported that they are now harvesting only one to two-thirds of past production rates, making farming unprofitable for them. In addition to crop damage, an increase in attacks by predators on livestock was reported to have coincided with the increase in the area of forest and shrubland.

One woman from a nonmigrant household reported: “... I have not done any cropping even in nearby farmland for the last two years due to monkeys” (S011). Another women reported “... abandoned farmland in the neighbourhood has made the remaining farmland more prone to wildlife attack and grazing, and it has forced me to leave my farmland fallow even though we wanted to farm it” (S012).

3.5.5. Lack of Access to Markets and Low Value for Agricultural Products

According to the surveyed respondents, the production of paddy and maize per unit area has increased in recent years, with the increased use of improved varieties or hybrid seeds and chemical fertilizers. However, the overall production from farmland in the study area has decreased over recent decades (i.e., since the late 1990s), with farmers producing less millet, wheat, barley, lentils, soybean, and mustard. Respondents reported being unable to store hybrid varieties of rice and maize for a long time, as they are less resistant to insects. Farmers are now cultivating only small patches of farmland to supply their families rather than aiming to produce a surplus for sale due to the low prices they can obtain for local produce in the market and the increased uncertainty in farming due to changing rainfall patterns, wildlife damage, decreasing productivity, market uncertainties, and other reasons.

During a group discussion in Gausahar, an elderly man reported feeding cabbage that he had grown to livestock due to the low price he would have received in the market. As a result, this farmer had since ceased commercial vegetable farming. Another farmer reported cutting down all their cardamom plants due to the lack of market demand. Farmers commonly reported difficulties with selling their excess agricultural products due to a lack of access to the market and the low prices they receive.

3.5.6. Unproductive Farmland, Small Landholding Size, and Distant Farmland

Farming is becoming more geographically concentrated, being increasingly confined nearer to human settlements.

Farmland that was relatively dry, unproductive, on sloping terrain, located far from the human settlements, and had little access to irrigation had been abandoned first. Small areas of farmland incurred more production costs, especially if located far from the settlements, which increased the cost of labour and other inputs. Also, many households had fragmented or scattered landholdings, which increased the production costs.

An elderly man in a group discussion at Samibhanjyan reported: “... people used to farm even in unproductive distant farmland, now even the productive farmland is left abandoned” (SGD009).

Some families were sharecropping or leasing farmland that was located near their house, and in turn, leaving their distant farmland abandoned/fallow, even when it was relatively productive.

3.5.7. Lack of Interest in Continuing to Farm

Farming as an occupation is increasingly regarded as an undesirable pursuit, with long hours, hard work, and modest financial returns—it was commonly reported that farming was inadequate to support a good lifestyle.

An elderly woman reported: “... I wish my son had done farming but it doesn't provide enough income for living, so he had to go abroad employment” (H010). Another woman from a migrant household reported: “... my husband is working in a foreign land earning a good income and he will only come back to the village during his old age” (H140). One man who is running a small grocery shop in the village reported: “... I prefer business over farming because it is relatively easy compared to farming. All my 23 ropanies of khet land has been abandoned for the last two years ago and all 30 ropanies of bari land for the last eight years. Now, I don't have any livestock either” (S019). He also added that even the productive farmland is fallow in a village where farmers can sell the excess farm produce, as people are not interested in farming as they want an easier lifestyle and a higher income. Also, the capacity of people to purchase food has increased as they have better access to a range of income sources beyond farming, which accelerates the migration of rural people to cities.

Parents want their children to pursue off-farm employment for the better lifestyle, high earning potential, and the social status that alternate employment to farming can provide.

3.5.8. High Production Costs and Unprofitable Farming

Many farmers reported that farming is unprofitable after calculating all the costs from soil preparation to crop harvest. They therefore considered it was not worth continuing to farm, given that production and income are not guaranteed, even after investing much labour and other inputs, and the increasing uncertainty associated with the weather, wildlife, and markets.

One woman from a migrant household said: “... all farmland is left abandoned because it is cheaper to buy produce from the market rather than farming with expensive hired labourers and we can't provide the labour exchange” (S018).

Although it is considered unprofitable, elderly farmers reported farming small fields of their farmland to help feed their families. They also engage in farming as they do not like seeing their farmland fallow and they enjoy keeping physically active.

3.5.9. Increased Access to Markets

Several group discussions revealed that the food consumption patterns of rural communities has changed along with the changing socioeconomic conditions and increased access to markets. Villagers now prefer a diet that includes processed and packaged snacks, such as chicken, biscuits, noodles, and puffed rice, instead of traditional foods, such as corn and beaten rice.

Many respondents reported that it is easier to buy cheap rice from the market using income from two days of labour or remittances rather than doing the year-round hard work to grow the rice themselves, especially considering the high production costs and uncertainties associated with farming. Farmers were also observed buying rice, chicken, processed snacks, and vegetables from the market for their homes and labourers, as also found in Central America, where people in rural areas were buying food from markets with the income from remittances, with little interest in growing produce themselves [61]. According to village-based grocery shopkeepers, sales of agricultural products and processed snacks have increased many fold in recent years. Such purchases were previously considered a somewhat shameful act, but now it is viewed as a sign of prosperity.

During an in-depth interview, one man reported: “... people either used to buy agricultural products during the night or asked other lower caste people to buy agricultural products as they felt shameful and scared of what other people would say. In contrast, now people feel it is prestigious to openly buy food from the market instead of growing it themselves” (G201).

This shows that the causes of underutilization and abandonment of farmland are not straight forward and thus, complex, as also shown by various studies [42,60,62–68].

3.6. Land Cover of Abandoned Farmland

All household respondents, in-depth interviewees, and participants in group discussions reported an increase in trees on their farmland over recent years. One elderly woman from a migrant household reported: “... it is scary to go to bari land alone as it is covered by tall grasses and trees” (G033). Sixty-three percent (63%) of respondents reported their abandoned marginal *kharbari* land was converting to forest through natural regeneration of native trees following the lack of maintenance for *khar* grass (Figure 5). Also, 61% of respondents reported that abandoned *bari* land had started to convert to shrubland (Figure 5). This observation follows a common pattern in Nepal and other countries where farmland is being abandoned [14,69–71].

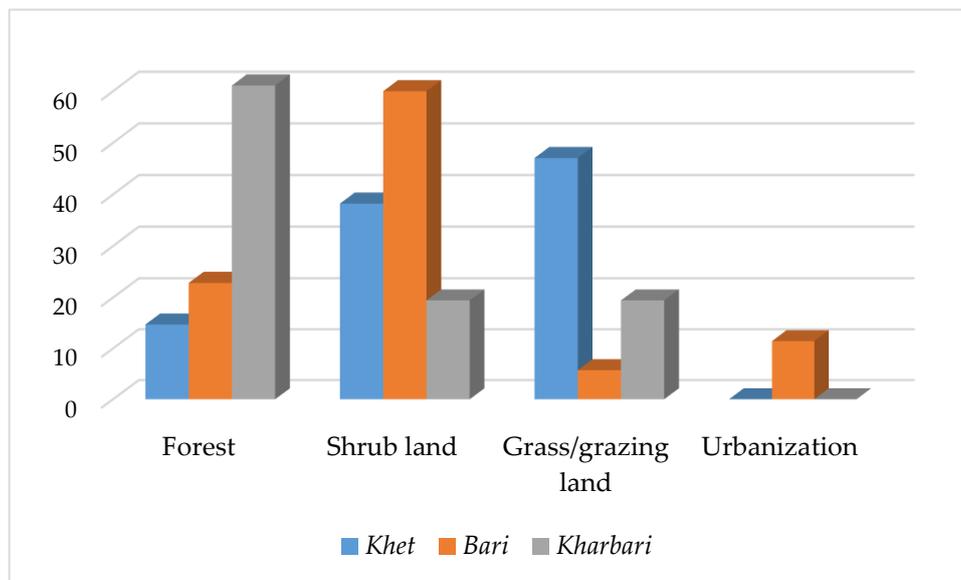


Figure 5. Current land cover of abandoned farmland in Lamjung District, Nepal.

Farmers were found to be moving towards less intensive farming practices, such as planting fodder and timber trees, grasses, and cash crops on *bari* land, rather than regularly cultivating land for annual crops. During an in-depth interview, a woman living with only her children said: “... I left my *bari* abandoned for the last five or six years. Instead I have planted a few grasses and fodder trees on the abandon *bari*. The trees are regenerating by themselves” (G007). A few areas of *bari* land had been converted to urban uses such as housing and roads.

More than one-third of abandoned *khet* land had been converted into grazing land, which is now the largest land-use category. Similarly, it was observed and reported that abandoned *khet* lands in the study area are quickly overcome by the invasive species *nilo gandhe* (*Ageratum houstonianum*), which is unsuited as livestock feed due to its toxicity. *Nilo gandhe* is also considered to cause soil degradation by rapidly drawing nutrients from the soil. The incursion of invasive species has long-term land degradation consequences and suggests that the consequences of farmland being abandoned are not straightforward or necessarily environmentally positive. Many previous studies in Nepal and other parts of world have shown that abandoned terraced farmland leads to slope instability, gully erosion, and terrace failure, leading to further soil degradation [15,18,37,72] and expansion of weeds into agricultural fields [41,42].

3.7. The Future of Agriculture

Among all the households interviewed, 15% stated they were planning to cease farming within the next five years. The major reasons for this were being unable to farm due to old age, a lack of human resources at home and difficulties with finding labourers when needed (56%), moving or planning to move (22%), and being increasingly involved in nonfarming activities, such as local or overseas employment or establishing a grocery business (22%).

An elderly man from a migrant household whose four sons all engaged in foreign employment reported: “... I am unable to do farming any more but those who can are not interested for farming ...” (G020). An elderly woman from a nonmigrant household reported: “... after two years, all my farmland will be abandoned when my son joins the army and my daughter moves to Besisahar ... we (i.e., husband and wife) are already old and unable to keep farming” (H026). Another elderly man from a migrant household reported: “... after I move, all my farmland will be abandoned because no one in my family wants to do farming. All the people who are able to work are engaged either in the army, foreign employment or have moved to other villages near towns, no one is left at this village” (S020).

Among the farmers interviewed who were interested in continuing farming ($n = 101$), 74% reported they would continue with subsistence farming as long as they can, while 26% (mostly migrant households) were interested in continuing commercial farming (e.g., off-season tunnel farming¹⁰ of vegetables, ginger, poultry, goat farming, and nurseries). Not all of these commercial farming enterprises (including oranges, cardamom, and coffee) have led to enduring profitable enterprises, as pests and diseases are encountered and poor market prices and/or price fluctuations can lead to business failure. The remaining nonmigrant households included wealthy households and others headed by people who were employed outside the agricultural sector, ex-migrants, or pension holders. These data illustrate that it is still important for most households, especially headed by elderly people, to continue farming at least partly for subsistence reasons until their physical capacity becomes limited, and few households want to move from subsistence to commercial production, if they have adequate alternate income sources.

Ninety-two percent (92%) of household survey respondents reported either that their children would not continue farming or that they did not want them to be a farmer, and 6% were not sure about their children's future as they were still very young. Only 2% of respondents from the household survey wanted their children to be farmers. A man from a nonmigrant household reported: "... I want my son to be a doctor, an engineer or join the army, I don't want him to become a farmer because it is difficult and hard work" (S019).

A woman from a nonmigrant household reported: "... I don't believe my son will do farming because he has not done any farm work with us before, he would rather clean pots at a hotel than farming. We will continue farming for as long as we can but our son won't. Currently, he is studying which we encourage him to do. After finishing high school, he plans to join the army, seek foreign employment or train to become a teacher" (S012). Another woman reported: "... my son won't continue farming. Farming will be his last option if he cannot find another job elsewhere. My father-in-law used to farm 15 ropanies, my husband is only farming 7.5 ropanies and my son will only be able to farm about half of what my husband is doing out of total farmland" (G108). Similarly, an elderly woman from a migrant household, whose son is currently working as a security guard, said: "... my son will engage in foreign employment whilst he is young, then work at home only during his old age ..." (G146).

These comments indicate a general mood among rural communities to move away from farming, with this trend likely to continue in coming years, given the current economic conditions for agriculture and the availability of employment options beyond agriculture. Similar results have been reported in eastern parts of Nepal, where many young people regarded agriculture as a "dirty job" [73].

In the current context of Nepal having a pronounced agricultural trade deficit and an increasing reliance on imported food, a high risk of food insecurity is likely to be exacerbated if the current trajectory of underutilization or abandonment of farmland continues. This is a critical issue that must be addressed by government.

The provisions related to land-use changes and farmland abandonment in Nepal's new land-use bill have attracted the attention of policymakers, with the introduction of new regulations in 2018, which categorise farmland into ten land-use zones and state that permission is required to convert one type of land-use to another [74]. There are also new penalties for farmers who retain two-thirds or more of their arable farmland fallow for three consecutive years. This is a proactive strategy by the Nepal government to restrict the amount of abandoned farmland in the country. However, the broader context for agriculture in Nepal is unlikely to change without addressing the diminishing viability of agriculture for smallholders. More focused locally-specific adaptive strategies targeting the needs of farming communities is of the utmost importance for creating a positive policy environment to attract further investment and participation in an evolving agricultural sector. It is important to consider the country's changing population dynamics together with the changing socioeconomic and

¹⁰ Tunnel farming is when a small plastic greenhouse-like structure is used to keep the soil warm and promotes germination.

environmental contexts at more local levels to address the underlying issues of underutilization and abandonment of farmland for sustainable development and food security.

Community-based farming, and complementary food forest systems (e.g., agroforestry), could be pursued as strategies to optimize farmland in areas where the majority of households have limited access to labour. Commercial farming should be promoted in potential villages by establishing village-based collection centres (i.e., market coordination), securing market access, and ensuring fair prices for agricultural products to ensure fair and consistent income for producers. Activities, such as establishing agricultural infrastructure (such as irrigation facilities), providing crop insurance, improving farming techniques, and enhancing farmers' capacity, could help to reduce the increasing uncertainty surrounding farming in the middle hills, and thereby encourage farmers to continue their farming practices.

4. Conclusions

This study provides strong evidence of how outmigration affects land management practices and the land-use transition underway in the middle hills of Nepal. The in-depth study reveals the complex and varied impacts of outmigration in a context of rapidly changing rural communities and economics. It also shows that nonmigrant households (i.e., households not directly involved in the process of outmigration) are also changing their farm management.

Our research shows that the underutilization of farmland is a common and widespread phenomenon occurring in rural landscapes, much more so than the widely reported abandonment of farmland. Land-use change is also being observed with nonmigrant households, and whilst some of this change may be associated with impacts from migration (e.g., lack of available labour), it is also likely that broader social and economic factors are influencing decisions. Contrary to a common assumption, underutilization of productive *khet* land was found to be on a larger scale in the study area compared to the less productive *bari* land, and farming is being increasingly concentrated nearer to the human settlements. However, the impacts of land-use change are highly specific since the location of farmland and villages will differ and in turn, affect decisions about farming. This suggests that farming is not solely about maximising productivity. There are a range of complex factors that influence a household's farming decisions and subsequent land-use.

Land-use decisions, and consequent land-use change, associated with outmigration, are complex and not necessarily uniform. Underutilization and abandonment of agricultural land is leading to an increase in other negative environmental pressures, including an increase in invasive species, increase in crop damage, and predation on livestock by wildlife. Current trends indicate that rural communities are moving towards less intensive farming, away from farming altogether, and focusing on subsistence farming. Very few households are investing in agriculture for the next generation. This suggests that Nepal is likely to face a social tipping point in the next decade, whereby a large proportion of arable land will transition into woody shrubland and forests.

The continued loss of farming knowledge and skills from rural communities will be difficult to reverse once the current ageing generation of farmers leave farming. In turn, this will leave Nepal's increasing population at greater risk of food security issues and increasingly reliant on food imports. Nepal's government needs to quickly develop an integrated national agricultural and rural development policy that attracts and encourages a new generation of farmers and investment to revitalise this vital sector of the country.

Broad-brush policies that focus on punitive measures to regulate land-use change, such as fines, are unlikely to succeed and may indeed prove to have unintended negative consequences, for example, by discouraging adoption of agroforestry if this is considered a land-use change. A suite of policy tools that can be selectively applied depending on the local context may be more effective and more likely to succeed in tackling the underlying causes of limited economics and depopulation faced by rural communities. For example, promoting mixed agroforestry systems, community-based farming and cropping in areas where there is potential to develop value-added market chains, providing

financial incentives (e.g., tax-based, soft loans or supporting village-based banking and loan systems), and/or technical support are potential options to encourage farmers to continue farming and/or adopt approaches that require less labour and other inputs.

Author Contributions: Conceptualization and methodology, B.K.C. and D.R.; data collection and analysis, B.K.C.; writing—original draft preparation, B.K.C.; writing—review and editing, D.R. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by an Australian Government Research Training Program (RTP) Scholarship for the first author.

Acknowledgments: The authors thank the many household and in-depth interviewees and focus group participants who provided much of the primary data for this research. The authors also gratefully acknowledge the critical advice and suggestions provided by Robert Fisher and William Jackson on earlier drafts of the article. Additional academic and editing support was received from John Meadows. Anonymous reviewers provided valuable comments and suggestions.

Conflicts of Interest: The authors declare no conflict of interest in terms of the material presented in this article.

References

- Chen, R.; Ye, C.; Cai, Y.; Xing, X.; Chen, Q. The impact of rural out-migration on land use transition in China: Past, present and trend. *Land Use Policy* **2014**, *40*, 101–110. [[CrossRef](#)]
- Xu, D.; Deng, X.; Guo, S.; Liu, S. Labor migration and farmland abandonment in rural China: Empirical results and policy implications. *J. Environ. Manag.* **2019**, *232*, 738–750. [[CrossRef](#)] [[PubMed](#)]
- Liu, G.; Wang, H.; Cheng, Y.; Zheng, B.; Lu, Z. The impact of rural out-migration on arable land use intensity: Evidence from mountain areas in Guangdong, China. *Land Use Policy* **2016**, *59*, 569–579. [[CrossRef](#)]
- Radel, C.; Jokisch, B.D.; Schmook, B.; Carte, L.; Aguilar-Støen, M.; Hermans, K.; Zimmerer, K.; Aldrich, S. Migration as a feature of land system transitions. *Curr. Opin. Environ. Sustain.* **2019**, *38*, 103–110. [[CrossRef](#)]
- Hecht, S. The new rurality: Globalization, peasants and the paradoxes of landscapes. *Land Use Policy* **2010**, *27*, 161–169. [[CrossRef](#)]
- Lambin, E.F.; Meyfroidt, P. Global land use change, economic globalization, and the looming land scarcity. *Proc. Natl. Acad. Sci. USA* **2011**, *108*, 3465–3472. [[CrossRef](#)]
- GLP. *Global Land Project: Science Plan and Implementation Strategy*; IGBP report no. 53/IHDP report 19; IGBP: Stockholm, Sweden, 2005; pp. 1–64.
- Kates, R.W.; Parris, T.M. Long-term trends and a sustainability transition. *Proc. Natl. Acad. Sci. USA* **2003**, *100*, 8062–8067. [[CrossRef](#)]
- Zimmerer, K.S. Biological diversity in agriculture and global change. *Annu. Rev. Environ. Resour.* **2010**, *35*, 137–166. [[CrossRef](#)]
- Jokisch, B.D.; Radel, C.; Carte, L.; Schmook, B. Migration matters: How migration is critical to contemporary human–environment geography. *Geogr. Compass* **2019**, *13*. [[CrossRef](#)]
- Acharya, C.P.; Leon-Gonzalez, R. How do migration and remittances affect human capital investment? The effects of relaxing information and liquidity constraints. *J. Dev. Stud.* **2014**, *50*, 444–460. [[CrossRef](#)]
- Choithani, C. Understanding the linkages between migration and household food security in India. *Geogr. Res.* **2017**, 1–14. [[CrossRef](#)]
- CBS. *National Population and Housing Census 2011 (National Report)*; CBS: Kathmandu, Nepal, 2011; pp. 1–270.
- Jaquet, S.; Schwilch, G.; Hartung-Hofmann, F.; Adhikari, A.; Sudmeier-Rieux, K.; Shrestha, G.; Liniger, H.P.; Kohler, T. Does outmigration lead to land degradation? Labour shortage and land management in a western Nepal watershed. *Appl. Geogr.* **2015**, *62*, 157–170. [[CrossRef](#)]
- Khanal, N.R.; Watanabe, T. Abandonment of agricultural land and its consequences. *Mt. Res. Dev.* **2006**, *26*, 32–40. [[CrossRef](#)]
- Jaquet, S.; Shrestha, G.; Kohler, T.; Schwilch, G. The effects of migration on livelihoods, land management, and vulnerability to natural disasters in the Harpan watershed in western Nepal. *Mt. Res. Dev.* **2016**, *36*, 494–505. [[CrossRef](#)]
- Paudel, K.P.; Dahal, D.; Shah, R. *Abandoned Agriculture Land in Mid Hills of Nepal. Status, Causes and Consequences*; IUCN Nepal and ForestAction Nepal: Kathmandu, Nepal, 2012; pp. 1–42.

18. Jackson, W.J.; Tamrakar, R.M.; Hunt, S.; Shepherd, K.R. Land-use changes in two middle hills districts of Nepal. *Mt. Res. Dev.* **1998**, *18*, 193–212. [[CrossRef](#)]
19. Thapa, G. Land use, land management and environment in a subsistence mountain economy in Nepal. *Agric. Ecosyst. Environ.* **1996**, *57*, 57–71. [[CrossRef](#)]
20. MoAD. *Agriculture Development Strategy (ADS) 2015 to 2035 (Part: 1)*; Ministry of Agricultural Development (MOAD): Singh Durbar, Kathmandu, Nepal, 2016.
21. MOF. *Economic Survey 2017/18*; Ministry of Finance (MOF): Singh Durbar, Kathmandu, Nepal, 2018.
22. WFP. *WFP Food Security Atlas of Nepal*; U.N. World Food Programme: Rome, Italy, 2010.
23. MoAD. *Statistical Information on Nepalese Agriculture 2014/2015*; Ministry of Agricultural Development (MOAD): Kathmandu, Nepal, 2015.
24. Doss, C.R. Designing agricultural technology for African women farmers: Lessons from 25 years of experience. *World Dev.* **2001**, *29*, 2075–2092. [[CrossRef](#)]
25. Adhikari, J.; Hobley, M. “Everyone is leaving who will sow our fields?” the livelihood effects on women of male migration from Khotang and Udaypur districts, Nepal, to the gulf countries and Malaysia. *Himalaya* **2015**, *35*, 11–23.
26. Gartaula, H.N.; Niehof, A.; Visser, L. Feminisation of agriculture as an effect of male out-migration: Unexpected outcomes from Jhapa district, Eastern Nepal. *Int. J. Interdisciplinary Socail Sci.* **2010**, *5*, 565–577. [[CrossRef](#)]
27. Maharjan, A.; Bauer, S.; Knerr, B. Do rural women who stay behind benefit from male out-migration? A case study in the hills of Nepal. *Gen. Technol. Dev.* **2012**, *16*, 95–123. [[CrossRef](#)]
28. Maharjan, A.; Bauer, S.; Knerr, B. International migration, remittances and subsistence farming: Evidence from Nepal. *Int. Migr.* **2013**, *51*. [[CrossRef](#)]
29. Tamang, S.; Paudel, K.P.; Shrestha, K.K. Feminization of agriculture and its implications for food security in rural Nepal. *J. For. Livelihood* **2014**, *12*, 20–32.
30. Schwilch, G.; Adhikari, A.; Cuba, E.; Jaboyedoff, M.; Jaquet, S.; Kaenzig, R.; Liniger, H.P.; Machaca, A.; Penna, I.; Sudmeier-Rieux, K.; et al. *Impacts of Out-Migration on Land Management in Mountain Areas of Nepal and Bolivia*; Sudmeier-Rieux, K., Fernandez, M., Penna, I.M., Jabouedoff, M., Gaillard, J.C., Eds.; Springer International Publishing Switzerland: Cham, Switzerland, 2017; pp. 1–17.
31. Mather, A.S.; Needle, C.L. The forest transition: A theoretical basis. *Area* **1998**, *30*, 117–124. [[CrossRef](#)]
32. Mather, A.S. Forest transition. *Area* **1992**, 367–379.
33. Díaz, G.I.; Nahuelhual, L.; Echeverría, C.; Marín, S. Drivers of land abandonment in Southern Chile and implications for landscape planning. *Landsc. Urban Plan.* **2011**, *99*, 207–217. [[CrossRef](#)]
34. Grau, H.R.; Aide, T.M. Are rural–urban migration and sustainable development compatible in mountain systems? *Mt. Res. Dev.* **2007**, *27*, 119–123. [[CrossRef](#)]
35. KC, B.; Wang, T.; Gentle, P. Internal Migration and Land Use and Land Cover Changes in the Middle Mountains of Nepal. *Mt. Res. Dev.* **2017**, *37*, 446–455. [[CrossRef](#)]
36. Schwilch, G.; Adhikari, A.; Jabouedoff, M.; Jaquet, S.; Kaenzig, R.; Liniger, H.; Penna, I.M.; Sudmeier-Rieux, K.; Upreti, B.R. *Impacts of Outmigration on Land Managment in a Nepali Mountain Area*; Sudmeier-Rieux, K., Fernández, M., Penna, I., Jaboyedoff, M., Gaillard, J., Eds.; Springer International Publishing Switzerland: Cham, Switzerland, 2017; pp. 177–194.
37. Melendez-Pastor, I.; Hernández, E.I.; Navarro-Pedreño, J.; Gómez, I. Socioeconomic factors influencing land cover changes in rural areas: The case of the Sierra de Albarracín (Spain). *Appl. Geogr.* **2014**, *52*, 34–45. [[CrossRef](#)]
38. Lasanta, T.; Arnáez, J.; Errea, M.P.; Ortigosa, L.; Ruiz-Flaño, P. Mountain pastures, environmental degradation, and landscape remediation: The example of a Mediterranean policy initiative. *Appl. Geogr.* **2009**, *29*, 308–319. [[CrossRef](#)]
39. Romero-Calcerrada, R.; Perry, G.L.W. The role of land abandonment in landscape dynamics in the SPA ‘Encinares del río Alberche y Cofio, Central Spain, 1984–1999. *Landsc. Urban Plan.* **2004**, *66*, 217–232. [[CrossRef](#)]
40. Robson, J.P.; Berkes, F. Exploring some of the myths of land use change: Can rural to urban migration drive declines in biodiversity? *Glob. Environ. Chang.* **2011**, *21*, 844–854. [[CrossRef](#)]
41. Schneider, L.; Geoghegan, J. Land abandonment in an agricultural frontier after a plant invasion: The case of Bracken Fern in Southern Yucatán, Mexico. *Agric. Res. Econ. Rev.* **2006**, *35*, 167–177. [[CrossRef](#)]

42. Prishchepov, A.V.; Müller, D.; Dubinin, M.; Baumann, M.; Radeloff, V.C. Determinants of agricultural land abandonment in post-Soviet European Russia. *Land Use Policy* **2013**, *30*, 873–884. [[CrossRef](#)]
43. Taylor, M.J.; Aguilar-Støen, M.; Castellanos, E.; Moran-Taylor, M.J.; Gerkin, K. International migration, land use change and the environment in Ixcán, Guatemala. *Land Use Policy* **2016**, *54*, 290–301. [[CrossRef](#)]
44. Hecht, S.B.; Yang, A.L.; Sijapati Basnett, B.; Padoch, C.; Peluso, N.L. *People in Motion, Forests in Transition: Trends in Migration, Urbanization, and Remittances and their Effects on Tropical Forests*; 9786023870134; CIFOR: Bogor, Indonesia, 2015; 37p.
45. DDC Lamjung. *District Profile of Lamjung District*; District Development Committee (DDC), Lamjung: Kathmandu, Nepal, 2013.
46. King, N.; Horrocks, C.; Brooks, J. *Interviews in Qualitative Research*, 2nd ed.; Sage: Thousand Oaks, CA, USA, 2019.
47. CBS. *Annual Household Survey 2015/16 (Major Findings)*; National Planning Commission Secretariat, Government of Nepal: Kathmandu, Nepal, 2016.
48. Khanal, U. Why are farmers keeping cultivatable lands fallow even though there is food scarcity in Nepal? *Food Secur.* **2018**, *10*, 603–614. [[CrossRef](#)]
49. Bhandari, P.B. Rural livelihood change? Household capital, community resources and livelihood transition. *J. Rural Stud.* **2013**, *32*, 126–136. [[CrossRef](#)]
50. Khanal, U.; Alam, K.; Khanal, R.C.; Regmi, P.P. Implications of out-migration in rural agriculture: A case study of Manapang village, Tanahun Nepal. *J. Dev. Areas* **2015**, *49*, 331–352. [[CrossRef](#)]
51. Qin, H. Rural-to-urban labor migration, household livelihoods, and the rural environment in Chongqing municipality, southwest China. *Hum. Ecol.* **2010**, *38*, 675–690. [[CrossRef](#)]
52. Xie, Y.; Jiang, Q. Land arrangements for rural-urban migrant workers in China: Findings from Jiangsu Province. *Land Use Policy* **2016**, *50*, 262–267. [[CrossRef](#)]
53. KC, B. *Land Use and Land Cover Change in Relation to Internal Migration and Human Settlement in the Middle Mountains of Nepal*. Master's Thesis, University of Twente, Enschede, The Netherlands, 2015.
54. Robson, J.P. *The Impact of Rural to Urban Migration on Forest Commons in Oaxaca*. Ph.D. Thesis, University of Manitoba, Winnipeg, MB, Canada, 2010.
55. Sunam, R.K.; McCarthy, J.F. Reconsidering the links between poverty, international labour migration, and agrarian change: critical insights from Nepal. *J. Peasant Stud.* **2016**, *43*, 39–63. [[CrossRef](#)]
56. Ojha, H.R.; Shrestha, K.K.; Subedi, Y.R.; Shah, R.; Nuberg, I.; Heyojoo, B.; Cedamon, E.; Rigg, J.; Tamang, S.; Paudel, K.P.; et al. Agricultural land underutilisation in the hills of Nepal: Investigating socio-environmental pathways of change. *J. Rural Stud.* **2017**, *53*, 156–172. [[CrossRef](#)]
57. Paudel, B.; Zhang, Y.; Yan, J.; Rai, R.; Li, L. Farmers' perceptions of agricultural land use changes in Nepal and their major drivers. *J. Environ. Manag.* **2019**, *235*, 432–441. [[CrossRef](#)] [[PubMed](#)]
58. Sujakhu, N.M.; Ranjitkar, S.; Niraula, R.R.; Pokharel, B.K.; Schmidt-Vogt, D.; Xu, J. Farmers' Perceptions of and Adaptations to Changing Climate in the Melamchi Valley of Nepal. *Mt. Res. Dev.* **2016**, *36*, 15–30. [[CrossRef](#)]
59. Rai, R.; Zhang, Y.; Paudel, B. Status of farmland abandonment and its determinants in the transboundary gandaki river basin. *Sustainability* **2019**, *11*, 5267. [[CrossRef](#)]
60. Kolecka; Kozak. Wall-to-wall parcel-level mapping of agricultural land abandonment in the Polish Carpathians. *Land* **2019**, *8*, 129. [[CrossRef](#)]
61. Hecht, S.B.; Saatchi, S.S. Globalization and forest resurgence: Changes in forest cover in El Salvador. *BioScience* **2007**, *57*, 663–672. [[CrossRef](#)]
62. Blair, D.; Shackleton, C.; Mograbi, P. Cropland Abandonment in South African Smallholder Communal Lands: Land Cover Change (1950–2010) and Farmer Perceptions of Contributing Factors. *Land* **2018**, *7*, 121. [[CrossRef](#)]
63. Kuntz, K.; Beaudry, F.; Porter, K. Farmers' perceptions of agricultural land abandonment in rural western New York State. *Land* **2018**, *7*, 128. [[CrossRef](#)]
64. Lieskovský, J.; Bezák, P.; Špulerová, J.; Lieskovský, T.; Koleda, P.; Dobrovodská, M.; Bürgi, M.; Gimmi, U. The abandonment of traditional agricultural landscape in Slovakia - Analysis of extent and driving forces. *J. Rural Stud.* **2015**, *37*, 75–84. [[CrossRef](#)]

65. Yan, J.; Yang, Z.; Li, Z.; Li, X.; Xin, L.; Sun, L. Drivers of cropland abandonment in mountainous areas: A household decision model on farming scale in Southwest China. *Land Use Policy* **2016**, *57*, 459–469. [[CrossRef](#)]
66. Baumann, M.; Kuemmerle, T.; Elbakidze, M.; Ozdogan, M.; Radeloff, V.C.; Keuler, N.S.; Prishchepov, A.V.; Kruhlov, I.; Hostert, P. Patterns and drivers of post-socialist farmland abandonment in Western Ukraine. *Land Use Policy* **2011**, *28*, 552–562. [[CrossRef](#)]
67. Alcántara, C.; Kuemmerle, T.; Baumann, M.; Bragina, E.V.; Griffiths, P.; Hostert, P.; Knorn, J.; Müller, D.; Prishchepov, A.V.; Schierhorn, F.; et al. Mapping the extent of abandoned farmland in Central and Eastern Europe using MODIS time series satellite data. *Environ. Res. Lett.* **2013**, *8*. [[CrossRef](#)]
68. Levers, C.; Schneider, M.; Prishchepov, A.V.; Estel, S.; Kuemmerle, T. Spatial variation in determinants of agricultural land abandonment in Europe. *Sci. Total Environ.* **2018**, *644*, 95–111. [[CrossRef](#)] [[PubMed](#)]
69. Gellrich, M.; Baur, P.; Koch, B.; Zimmermann, N.E. Agricultural land abandonment and natural forest re-growth in the Swiss mountains: A spatially explicit economic analysis. *Agric. Ecosyst. Environ.* **2007**, *118*, 93–108. [[CrossRef](#)]
70. Queiroz, C.; Beilin, R.; Folke, C.; Lindborg, R. Farmland abandonment: Threat or opportunity for biodiversity conservation? A global review. *Front. Ecol. Environ.* **2014**, *12*, 288–296. [[CrossRef](#)]
71. Kolecka, N.; Kozak, J.; Kaim, D.; Dobosz, M.; Ginzler, C.; Psomas, A. Mapping Secondary Forest Succession on Abandoned Agricultural Land with LiDAR Point Clouds and Terrestrial Photography. *Remote Sens.* **2015**, *7*, 8300–8322. [[CrossRef](#)]
72. Tarolli, P.; Preti, F.; Romano, N. Terraced landscapes: From an old best practice to a potential hazard for soil degradation due to land abandonment. *Anthropocene* **2014**. [[CrossRef](#)]
73. Gartuala, H.; Niehof, A.; Visser, L. Shifting perceptions of food security and land in the context of labour out-migration in rural Nepal. *Food Secur.* **2012**, *4*, 181–194. [[CrossRef](#)]
74. GON. *Land Use Bill*; Government of Nepal: Kathmandu, Nepal, 2018.



© 2019 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>).