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Addressing the Uncertain Future of Agriculture in Nepal: Agents of Food System Changes and Immediate Need for Intervention

Sudan Prasad Uprety and Tobin Hindle
Florida Atlantic University, US
Corresponding author: Sudan Prasad Upreti; email: sudanuprety1990@gmail.com

ABSTRACT

Food systems are complex and dynamic in the sense that they are affected not just by the amount of food produced and available but by several social, physical, cultural, environmental, and economic aspects of farming households.. It is imperative to study the agents of such changes in food systems and plan, develop, and adopt site and locally specific mitigation measures to ensure the continuation of agricultural practices to move closer towards a sustainable and food secure region. The study among 245 respondents from Chitwan, Dhading, and Rasuwa districts revealed that the major drivers of food system changes in these districts were a lack of agricultural labour, a lack of government support, crop damage by wildlife, land abandonment, and shifts in occupation. Along with these factors, increased outmigration in the districts from rural to city and more urban areas, climate change, better and improved access to markets and processed foods in the markets act as major drivers of food system changes in these districts. Small-scale and community-targeted Farming, along with complementary food forest systems, along with economic incentives for young populations from rural areas, might be the key to continuing subsistence farming and promoting commercial farming in potential districts. Activities such as better infrastructure for agriculture (i.e., irrigation, markets, storage facilities, roads, and electricity), providing subsidies for farming communities, increased training for better production, crop insurance, better farming techniques, and enhancing farming households' economic status and buying capacity are crucial for reducing the increasing uncertainty in agriculture.

Keywords: Agriculture,Food-security, Local-livelihood, Sustenance farming

INTRODUCTION

Agricultural development is a pre-requisite for enhancing food security and economic advancement of agriculture-based countries (Uprety et.al, 2024). The earth's landscapes consist of continually changing features due to periodic natural and human modification (Paudel et al. 2016b' Ramankutty and Foley 1999). Changes in agricultural and food systems are predominantly an outcome of land use change induced by various human activities coupled with natural system changes. Such changes and their links to agricultural production have been long highlighted (Ortiz et, al., 2020). The economic and social implications of drivers on food security are profound and far reaching, affecting livelihoods, incomes, and food systems at local, national, and global scales (Enthoven and Broeck, 2021). Analyzing such changes in past and present helps us cope with the negative effects of such changes and

allow us to make timely intervention in time of need to ensure sustainable agriculture in future. The drivers of food system changes operate at all levels: global, national, and local. Proper examination of factors influencing changes can aid ongoing dialogue and help promote adaptation techniques (Steiner et, al., 2020). The small scale farming households make changes to agricultural and food systems based on their adaptive capacity to these changes while being equally affected on a much larger scale. 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 (MoAD, 2016). 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 (MoF, 2018); and agricultural imports increased from US$157 million in 1995/96 to US$1.378 billion in 2015/16 (MoAD, 2016). In 2010, 27 districts in the hilly and mountainous regions of Nepal were reported to be 'food insecure' (WFP, 2010). Overall, 33% of agricultural land was reported to be uncultivated in 2014/15 (MoAD, 2015). Although there is much room for improvement in agricultural sector and its role in enhancing food security for the growing population, the rapid decline in agriculture sector contribution to the GDP proves that the reliance on agriculture has been rapidly declining.

Nepal is currently experiencing a transitional phase in agriculture where the ancient and traditional farming system is slowly being replaced by more intensive and technology dependent practices mostly in peri- and semi urban areas. These changes in agricultural systems are mainly the result of increased market access and links to urban centers. Recent studies have also shown that more areas have been converted to agricultural lands in the recent past. However, the urbanization of agricultural sector has left the subsistence farming households facing the impacts and threatens their agricultural practices in the near future. Despite government prioritizing the agricultural sector and marginal improvements in irrigation facilities, hybrid seeds varieties and a shift towards commercial farming, Nepalese agriculture is unable to alleviate poverty and food insecurity (Dahal et. al, 2007). In such scenarios, while promoting commercial farming is essential and could possibly yield positive results towards food security, enhancing and empowering small farming household and continuation of sustenance farming is equally important. This paper analyzes the various agents of food system changes in farming households and addresses the uncertainty in agriculture among these households.

A number of researches have focused on various determinants of this decline in agricultural production on a household level. Agricultural land underutilization is a major problem in the mid-hills and other rural region of the country. Ojha et al, 2017 investigated the various socio-environmental pathways responsible for the land underutilization. They determined that evolving economic opportunities making farming less profitable, policy context largely undermining the impacts of land abandonment and socio-cultural changes were the drivers of such abandonment and underutilization. A separate study emphasized on the urbanization and population growth as the main drivers of agricultural land decline in one of the rapidly growing cities in Nepal (Rimal, 2012). The study concluded that the urban area cover had increased from 6.33% in 1977 to 51.42% in 2010 while the agricultural land had decreased significantly from 6.073% to 20.27% in the same time period. Many researches have also identified rural outmigration as an important driver of

major changes in land-use, the rural economy, and socio-environmental opportunities, with one of such consequences being a change in the management and scale of farmland (Chen et. al, 2014). Feminization of agriculture caused by the rampant outmigration has been paid a lot of attention to. These factors collectively induce socio-cultural, economic, physical changes to agriculture and the overall food system, and a holistic understanding of the combined effect is imperative in developing specific goals and intervention techniques to maintain the balance between agricultural sector and sustainable food systems. Engagement of stakeholders across sectors and scales, including governments, civil society organizations, research institutions, and the private sector, in collaborative efforts is imperative to address climate change and food security challenges (Islam and Kieu, 2020).

LITERATURE REVIEW

The food system changes along with their agents and the impact they have on our livelihoods is a relatively researched topic. Numerous studies have aimed to quantify the effects of various food system changes along with their short- and long-term impacts for individuals, families, societies, nations and the global context. These studies prove to be pivotal when implementing similar strategies for new research.

A recent study conducted by Anupam Uprety and his colleagues in 2024 focused on the trends and drivers of land conversions in the district of Dhading. The research primarily focused on the increasing trend of fertile land being transformed into non-agricultural uses threatening food security for households. They utilized the GIS tools in order to access land use patterns along with household surveys among the growers to identify the drivers determining land use change for the study area. The land use and land cover data from the study pointed out that the productive agricultural land decreased by 60.28% while non-farm uses increased by 93.14% in Dhunibeshi Municipality in Dhading. The use of cross-sectional data using farm level also indicated that 36% of the individuals were eager to switch from farming to non-farm use of the lands. The study suggested that the land use change is a complex and global phenomenon influenced by socio-economic factors (gender, education, economically active family members, land proportions, farm attributes (farm income, crop diversification), farm proximity to urban areas, adaptation strategies available, and opportunities for non-farm use. They also suggest that the promotion of widespread low-cost production technology and making the agricultural sector lucrative could eventually contribute towards sustainable agriculture land management in the future.

Another study that was carefully examined was the one conducted by Pramod Koirala, Sanjeev Kumar Karn, and Prateek Joshi for the Ministry of Agriculture and Livestock Development. The research mainly focused on the issues of food insecurity and the legal frameworks governing agricultural issues in Nepal. It went in detail about the past, present, and future policies, provisions, the development process of regulation, roles of key stakeholders, and the challenges in the effective implementation. The findings indicated that the recent 2024 approved "The Right of Food and Food Sovereignty Regulation" was made to formulate the legal frameworks to ensure food security and pave a transformation pathway for farmers to receive the needed assistance from the government sectors. Some of the major challenges being faced by the nation for the successful implementation of such approaches were mentioned as well. These included the availability of financial resources, lack of technical manpower,

difficulty regulating the prices of agricultural products, and the technical capacity of the implementing agencies. In addition to these issues, policy coherence across government tiers, the interests of external development partners, and cultural factors pose significant obstacles to the successful implementation of the regulation's provisions. Finally, they argued that the comprehensive approach combining legal reforms, economic support, and social initiatives were needed to transform the right to food from a theoretical concept into a tangible reality for the Nepali citizens.

RESEARCH METHODOLOGY AND STUDY SITES

Methodology

The study aims to determine the various levels of impact from the drivers of changes to the food systems. It also ranks different agents of change and varying levels of impact it has depending on the region and the complexities of the land use change and the geography deciding the agricultural practices in the region. The study focused first on the current state of agricultural practices, changes in land-use over time to predict the possible future of agricultural practices in the study sites and then identified the major drivers of food system changes. The mix of qualitative and quantitative data was collected from farming households from three districts from province 3, Nepal. The data were collected between December and May of 2018. The field research included a baseline survey covering 245 respondents throughout the district selected using a simple random sampling method in each of the study sites. Furthermore, based on the demographic characteristics and experiences in agricultural practices as well as association with various governmental, non-governmental, and community groups, 20 households from Chitwan, 15 from Dhading and 12 from Rasuwa were selected for an in-depth interview in order to gain more and relevant insights into the agents of food system changes and the perception of these individuals regarding the land use change and the future of agriculture for these regions. The selection was done in a way to try and cover diverse range of economic, social, gender based differences in respondents. Along with the survey and the in-depth interviews, 10 Focus Group Discussions (FGD) were also held with the district and village level stakeholders in each district along with repeated field visits and observations. The focus group discussions had participants from farming households (both male and female) local leaders and members of the community groups, and administrative officials appointed and employed by development agencies working towards the betterment of agricultural and economic development for each region.

The FGD were held before the household survey in order to get a better idea of the major drivers of food system changes for the particular region. These drivers were then cross referenced with the ones explained in the literature and were selected to be included in the survey to be administered to the household. Since each household had a vague and different perception regarding the drivers of food system change as each household were affected differently by each driver, a total of 15 drivers for food system change were selected through extensive literature review and FGD and each of the respondent s were asked to rank the drivers. Data on existing land use system and their changes were also collected through the household survey for further analysis. The selected drivers of food system change and their role is explained in Table 1.

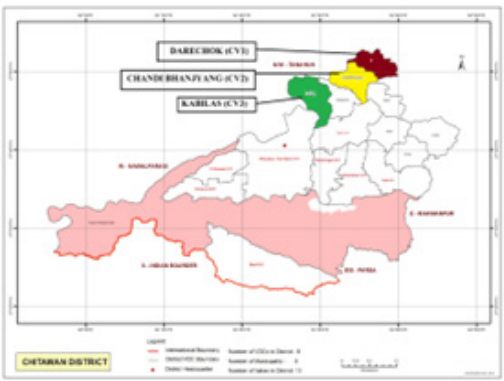
Table 1: Major Drivers of food system changes and their role

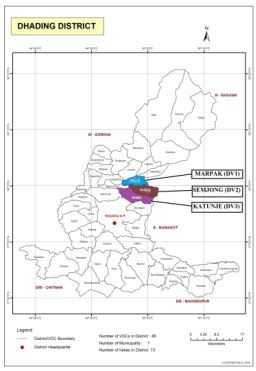
Major Drivers of Food System Changes	Role in food system changes
Outmigration/Lack of Agricultural worker	Lack of agricultural workers hinders faming household's capacity to produce food and deter labor demanding agricultural practices.
Climate Change	Increased natural hazards such as droughts, floods along with erratic patterns of rainfall combined with decrease in water availability increases the risk of farming household and dictate abandonment of land, lower production, and shift from agricultural to alternative occupations.
Shifts in occupation	Availability of alternative source of income causes people to refrain from risky and low output but highly demanding agricultural sector.
Unprofitable	Small scale sustenance farming is less profitable and season dependent compared to year round off-farm activities. Youth population is hesitant to involve in agricultural practices as the profit is low compared to alternatives.
Decreased Production	With climate change and decrease in labor along with soil degradation caused by increased pests and loss of soil quality, the production further decreases making it harder for farming households to meet their basic needs.
Expensive Labor	The shortage of agricultural labor increases the price of remaining and available labor making it even more risky to farm on a much larger scale.
Less access to markets	Lack of better roads and transportation service to connect a farming community to nearest and bigger markets leave very little option to a farming household about how much to produce and be able to sell for economic profits.
Land Abandonment	Outmigration, shifts of occupation or hazards such as earthquake has led to massive abandonment in rural areas leading to decrease in agricultural production.
Urbanization and easier access to food	With urbanization, stores and markets close by have provided farming households with an option to easily access their foods rather than having to produce much of it on their own.
Long distance to farmlands	The farmlands for major cash crops are usually located far away from home. The longer distance to travel and increased damage by wildlife in these distant lands forces many farmers to leave their lands barren.
Crop damage by wildlife	The agricultural production is being heavily affected by wildlife leading to massive land abandonment in rural areas. Numerous animals affect the productivity of various crops and force farming household to leave distant lands barren.

Lack of government support	The lack of government support in agriculture has led to the decrease in agricultural practices as farmers are left to bear the risks of natural, climatic, social, and economic pressures and uncertainties in farming practices.
Age restrictions to farming	Much of the households are reliant on elderly populations on agriculture limiting their ability to farm. The use of traditional old school and less productive methods also lead to lack of productivity.
Enhancement of buying capacity	Most of the families have members involved in foreign employment or off-farm activities and provide financial support to these rural farming households enhancing their buying capacity and reduce their reliance on agriculture.
Shifts in food choices	With globalization and availability of processed food, the food choices are changing rapidly with people preferring to buy food from supermarkets rather than producing it on their own.

Study Sites

The study was conducted in three districts from province 3, Nepal. Ichyakamana Rural Municipality from Chitwan, Netrawati Municipality from Dhading and Gosaikunda Rural Municipality from Rasuwa were chosen for the study. The districts were selected from three different ecological regions from the country. Chitwan district is located in the terai region of the country; Dhading lies in the hilly region while Rasuwa lies in the mountainous region of the country.





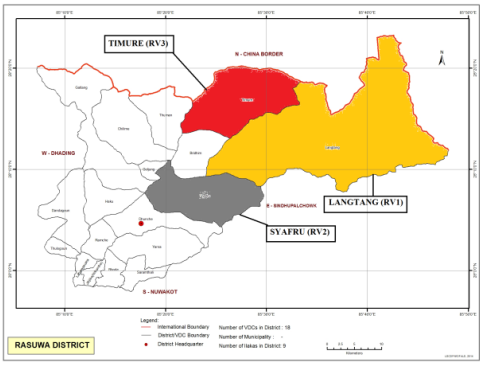


Figure1: Maps of Chitwan Dhading and Rasuwa district with the study sites

RESULTS

Socio-Demographic Characteristics of Household

Out of the three districts in the study, Dhading had the highest percentage of HH below the age of 25 (10%). Rasuwa district had the highest percentage of people aged 25-65 years of age (86%), while Dhading had the highest percentage of respondents aged more than 65 (28%). At least 72% household in Chitwan, 58% in Dhading and 86% of households from Rasuwa had at least one migrant worker in the last three years. The average number of migrants from Rasuwa was the highest (3.26). Rasuwa also had the highest number of parents residing in the household. 64% of members in Rasuwa were only the parents followed by 24% in Chitwan. Gurung/Tamang was the dominant caste group with 62% in Rasuwa, 48% in Dhading followed by 38% in Chitwan. Chitwan also had the highest number of dalits (30%).Rasuwa district had the highest percentage of male headed household (86%) while Dhading had the highest percentage of Female headed Household (26%). The socio-demographic characteristics of the districts are summarized in table 2.

Table 2: Socio-demographic characteristics of surveyed household (n=245)

Socio-Demographic Indicators	Chitwan	Dhading	Rasuwa
Age of respondents (%)			
Below 25	4	10	2
25-45	28	28	40
45-65	42	34	46
65+	26	28	12
Outmigration			
% HH with at least one migrant	72	58	86
Average Migrant HH	2.84	1.24	3.26
Gender of HH			
Male	82	74	86
Female	18	26	14
Caste (%)			
Brahmin/ Chetri	32	34	16
Gurung/ Tamang	38	48	62
Dalit	30	12	22
Composition of HH (%)			
Only Parents	24	14	64
Parents with kids	42	48	34
Extended family	34	38	12

Landholding size and current land use practices

The average land owned by the farming household varied greatly within the districts along with the current land use patterns in these holdings. In Nepal, the distribution and ownership of land is greatly skewed according to class, gender and ethnicity (Upreti 2008). Households from Chitwan had the least amount of land holdings (2.48ropanis) while households from Rasuwa had the highest amount of landholdings (18.46 Ropanis). The average landholding with the current land-use practice in the study districts are summarized in table 3.

Table 3: Average landholdings and current land-use pattern in study districts

Land holding and use indicators	Chitwan	Dhading	Rasuwa
Average land holdings (In Ropanis)	2.48	12.62	18.46
Average historical land use	0.52 (21%)	4.26 (34%)	3.48 (19%)
Average partly utilized land use	1.02 (41%)	5.46 (43%)	6.24 (34%)
Average Abandoned land use	0.94 (38%)	2.9 (23%)	8.74 (47%)

The results also indicate that Rasuwa district has the least percentage (19) of the total land holdings that have continued their historical land use and agricultural practices while having the highest percentage of abandoned lands (47%). Dhading district had the highest percentage of lands with continued historic agricultural practices (345%), a highest percentage of land that is partly utilized (43%), and a lowest percentage

of abandoned land (23%).

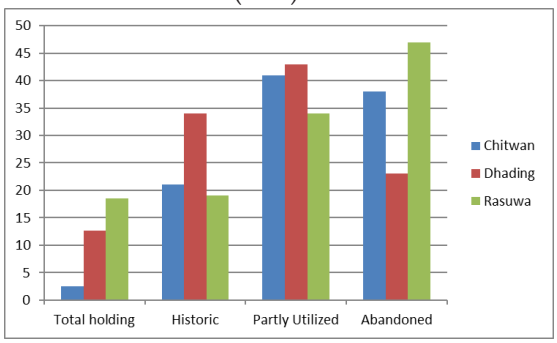


Figure 2: Bar graph Showing total landholding and land-use at current times in study districts

Respondents preference to farming

Out of the respondents who were asked about their future preference in agricultural activities, 68% of respondents from Dhading, 42% from Chitwan and only 26% from Rasuwa reported their willingness to continue their agricultural practices. The highest percentage (44) from Rasuwa reported that they were desperate to leave or quit their practices while 38% from Chitwan also reported being desperate to lower their dependence on agriculture or completely quit for alternative source of income. Those classified as unsure were individuals who do not completely want to quit agriculture but only want to involve in small patches of fields closer to home in order to grow garnishes and seasonal vegetables in contrast to cash crops or intensified agriculture. The highest number of unsure respondents was from Chitwan district (30%). One of the respondents from Chitwan Village (CV2, 16) described "*I have been in agriculture my whole life, that is all I know how to do, but I am old now and cannot spend a lot of time in the fields, I also do not make enough money to employ others to continue in this occupation. I have no idea what is going to happen to my lands after I am deceased. I do not believe my children will ever want to come back to farm here. I am worried my existence in farming and agriculture along with my heritage in this place will be gone. They will most probably sell all of this land and leave this village for good.*"

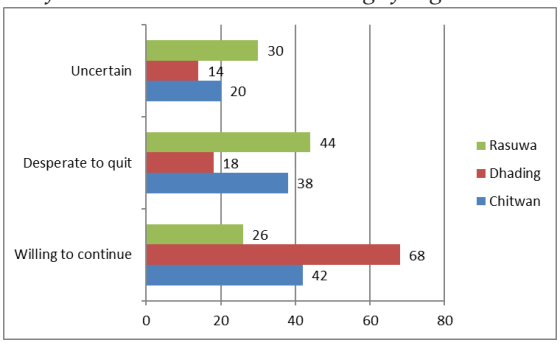


Figure 3: Future preference in agricultural activities among the respondents

Agents of food system changes

The respondents from each district were asked to rank the major drivers of food system change in order of the impact it is having on the food systems in the particular districts. The chosen major drivers were selected from the existing literature on food security and food system changes in the region and then cross verified through FGD and in-depth interviews to be included in the list. Top 15 of such drivers were selected for the study. The ranking for each of those majors in percentages of respondents are shown in the table below;

Table 4: Major drivers of food system change ranking among respondents

Major Drivers of Food System Changes	Chitwan (%)	Dhading (%)	Rasuwa (%)	Mean (%)	Rank
Outmigration/Lack of Agricultural worker	78	84	86	82.667	**1**
Climate change	46	38	56	46.667	**10**

Lack of Water	54	78	32	54.667	**8**
Shifts in occupation	64	46	72	60.667	**5**
Unprofitable	24	12	18	18.000	13
Decreased Production	54	10	34	32.667	12
Expensive Labor	38	24	42	34.667	11
Less access to markets	46	32	84	54.000	**7**
Urbanization and easier access to food	12	16	8	12.000	14
Land Abandonment	54	54	82	63.333	**4**
Crop damage by wildlife	62	64	78	68.000	**3**
Lack of government support	74	68	84	75.333	**2**
Age restrictions to farming	76	54	22	50.667	**9**
Enhancement of buying capacity	38	64	76	59.333	**6**
Shifts in food choices	6	10	8	8.000	15

Based on the results, the most prominent and effective drivers of food system change throughout the study districts were lack of agricultural workers, lack of government support, crop damage by wildlife, long distance to farmlands, and shifts in occupation in order of ranking. It is also important to note that some of these drivers have huge impact on one of the districts while moderate on low on others indication regional variation in food system changes and household perception to the major drivers to such changes.

Lack of agricultural worker, Outmigration, and Expensive labor

All three of the study districts mentioned the lack of agricultural labor to be the most significant driver of food system changes. Chitwan (78%), Dhading (84%), and Rasuwa (86%) of the respondents have had problems finding labor for intensive agriculture. Lack of agricultural workers is a combined effect of outmigration to cities and urban areas, shifts to alternative occupations, and lack of interest in agriculture. Traditionally, farmers from all districts shared labor work between households, paid for labor work or had enough family members in the household to fulfill their needs. At present times, most of young family members have moved out of the village leaving older populations behind unable to engage in laborious work actively. The remaining populations from the villages are also less interested in working as labors for others farmland or their own. People from socially underprivileged groups such as dalits were farm workers but they have now gradually shifted to various non-farm activities and exacerbated the lack of workers situation. *"I am a dalit, we do not have cows or major crops as no one would buy from a dalit. My dad ploughed others fields all his life, he got paid nothing and got no respect at all. I had no choice but to help him when I was a kid but I no longer plough fields for others or involve in this dirty work. I am a truck driver for a sand mining company. I get paid way better than I would from labor for others. I also feel good about driving a truck rather than working for others. I have no desire to go back to farming."* (CV3: 34).

Those who remain in villages or still engage in agricultural activities charge higher rates for labor work. The lowered number of workers available for agricultural work combined with higher prices for available help

deters traditional farmers from continuing their traditional farming practices and limits the amount of land that can be utilized by a smaller manpower. Most of the families have reduced their land utilization and are limited to small areas closer to their houses. "*Most of my lands have been barren for years now. I have 5 children, 2 daughters and 3 sons. My daughters are married and two of my sons are in Qatar while the third one stays with my daughter in the city. My wife and I are the only ones here. We plant what we can on our own. Paying for labor work is very costly and we no longer share labors between families. We survive on what we can grow and the rest we buy with the money they send us time to time. It is much easier that way.*" (RV1: 8).

Lack of government support

Most of the respondents from the study district also mention receiving very little to no help from government when it comes to agricultural practice. The government has enacted a number of plans to enhance the farming household capacity to cope with these drivers of food system changes but more often; these plans and policies never get executed at an efficient level to help these smalls scale farming households. Households mention of times when they receive seeds or small grants as livestock or trainings, these are never actually followed up or adapted to reflect the changes in future. Majority of respondents recollect getting more help from non-governmental agencies and non-profit interventions along with generation of small community or social groups dedicated to various practices such as livestock farming, fishing or fruit farming. Most of the respondents, 74%, 68%, 84% from Chitwan, Dhading, and Rasuwa have mentioned that the government help and intervention are not enough to cope with the increased risk with agricultural practices induced by changing climatic and natural conditions coupled with low productivity, lack of labor force, and urbanized food practices. "*The government does not care about small farmers like us. We see them only during election times when they act as if they care about us. Once a while they will send some people like you from the city to know about how our life is and this and that. Years go by and we do not get any help. The money they allocate must be distributed between them as we have never seen a dime towards our help. I do not depend on or believe the government involvement." (DV2:5).*

Crop Damage by wildlife

The damage of crops has always been one of the major problems in farming households. However, recent studies show that there has been a dramatic increase in the events. Number of wildlife such as monkeys, bears, boars, birds, and others greatly impact the production of crops such as maize, fruits and paddy. As a result, farming away from home is very limited. The farmland that would be continuously planted for rice followed by maize followed by other crops and now only seasonally planted. Much of the lands left barren were due to the potential damage caused by wildlife. On average the respondents reported being able to harvest at most two thirds of their regular production. Most of the respondents also reported buying much of the required food in contrast to cultivating them due to the wildlife impacts. "*I have not planted anything in my distant field for the past 5 years. The monkeys destroy them all. I can no longer keep watch as I am old. Back in the days they were limited to the outskirts and forest area but after the earthquake when a lot of people moved to the city, they started encroaching into the village. It is impossible to grow anything without some of the wildlife impacting it. It is much easier to just buy the flour from the store than go through all the trouble for it to be damaged by the monkeys" (Rasuwa, 28)*. Highest percentage of respondents

from Rasuwa (78) reported crop damage as wildlife as one of the major reasons for reducing their agriculture. The percentage of respondents reporting similar problems was 62 and 64 for Chitwan and Dhading respectively.

Land Abandonment

The abandonment of land is a combined effect of a number of factors such as lack of agricultural workers, distant farmlands, crop damage by wildlife and lack of interest of youth and active populations in agricultural activities. Highest percentage of respondents from Rasuwa district (84) reported leaving majority of their lands fallow, even the most productive ones. The percentage of respondents leaving their land abandoned in both chitwan and Dhading district were 54. The fertile lands that are located in rugged and sloppy areas, distant lands, are the first ones to be abandoned. The agricultural practices have been very confined to small patches of lands located very closer to the households. In addition to these, lack of proper irrigation, increased cost of agriculture and easier access to foods in the market has caused massive abandonment in the recent past. "*Most of my lands are barren. I remember a time when none of the farmland was left barren. It was considered bad to leave your land barren. Now it is different, we only grow some vegetables and greens nearby and around houses. The land that created so much drama and trouble in the past for ownership is all left barren today. It is not just our house, many families have abandoned majority of their lands and involve in more off-farm activities now. I had never thought that we will be buying the same food we have grown for years from market but that is the way now" (Rasuwa, 2).* . Several studies have shown that the abandonment of agricultural land stimulates forest recovery (i.e., regenerating or transitional forests (Diaz et al., 2011, Grau, H.R.; Aide, T.M., 2007). Alternatively, some authors have questioned this perceived positive impact of land abandonment. For example, there can be an increase in land degradation (Melendez-Pastor, I.; Hernández, E.I.; Navarro-Pedreño, J.; Gómez, 2014) and wildfires (Lasanta T et al., 2009, Romero-Calcerrada, R.; Perry, G.L.W., 2004), a decline in biodiversity (Robson, J.P.; Berkes, F., 2011), and an expansion of invasive species (Schneider, L.; Geoghegan, J., 2006, Prishchepov, A.V et al., 2013).

Shifts in Occupation

One of the socio-economic factors that have caused major changes in food system is the shifts in occupation in these regions. The way and the type of food that is consumed is affected by shifts in occupational preferences. Majority of youths and residents of the village are attracted more towards year round paying jobs in contrast to agriculture. The percentage of respondents reporting shifts in occupation to be a major driver of food system change was 64, 46, and 72 percent in Chitwan, Dhading, and Rasuwa respectively. For villages in Rasuwa district, being close to the Nepal-China border and being a tourist destination has driven such changes. Occupations such as hotels, trekking, restaurant and lodges have more in return for a less hard work demanding agricultural field. For villages in Dhading district, about 64 % of adults worked in the British Army force causing feminization of agriculture and increased trends for youths to follow the same path. As a result the agriculture is entirely dependent on elderly and female populations causing a gradual decrease in farming as females are also required to carry out all other household activities. Prevalence of alternative occupational opportunities both as development projects and urbanization has allowed for easier decrease of reliance on agriculture by enhancing the buying capacity in the residents, exemplified most appropriately

by the findings from Rasuwa district where most of the families had some form of earnings from hospitality industry or being involved in seasonal porter and guide activities to international and domestic tourists visiting the region. One of the elderly respondents from Dhading reported "*My wife and I are the only ones for what little agriculture we have now. We used to have a lot of cows and goats and cultivated entire land but my kids do not want to work in agriculture. One of them has a shop and the other one is in British Army. Soon there will be no agriculture as I am old" (Dhading, 34).*

Enhancement of Buying Capacity

As a result of more involvement in off-farm activities, and foreign remittances to Nepal, the buying capacity for farming household has increased. 38, 64, and 76 percent of respondents reported this increase in buying capacity to be a driver for food system change where families have easier access to food products in the super market. The young and adult populations from these families are involved in year round off-farm activities or employed in foreign countries to help out their family buy things that they need rather than growing it on their own. As much as 86 percent of households from Rasuwa had at least one migrant in the family. Majority of the household in the region are also involved in either stores, hotels or trekking business allowing them to generate higher incomes. This trend has resulted in massive shifts where the agriculture has been limited to less-intensive and seasonal practices where most of the resources are spent in other activities. The people from this region also had the highest percentage of land left abandoned. In the past where the labor was readily available and buying was less of an option, a farming household would have to grow most if not all of the agricultural products on their own. The increase in buying capacity has allowed most farming households to limit their practices and obtain most of their requirements easily from nearby markets. "*We make a lot more money from the restaurant we have on season compared to agriculture. We could only grow enough food for about 5 to 6 months average doing hard work but now we only stay in the village during peak tourist season. My husband also works for a trekking company and we buy what we need rather than grow it. It is not worth the time and effort and it is not rewarding when everything can be bought easily" (Rasuwa, 24).* Studies on migration, more recently, have focused on the effects of out-migration as well as the uses of remittances in both receiving as well as sending countries (Adams, 2011; De Brauw, 2007; De Brauw, Taylor & Rozelle, 1999; Jokisch, 2002; Seddon, Adhikari & Gurung, 2002).The uses of remittances in productive and/or consumptive purposes have received much attention in academia and policy arena. Scholars note that a large proportion of the remittances received by households in developing countries is used for consumption (Adams, 2011; Brown & Ahlburg, 1999; Hoermann & Kollmair, 2009; Massey & Bassem, 1992; Reichert, 1981; Seddon, 2004). This was also true in the case of the study where 30% of families from Chitwan, 22 % from Dhading and 12% from Rasuwa reported receiving some form of financial support in the form of remittance. This allows respondents to have much easier access to food products and limits their interest in agriculture.

Less Access to Markets

Although the transportation and access to markets have been better in the recent past, many of the villages are still not connected properly with a major market making it harder to have agricultural supplies as well as selling of surplus goods. The average distance to a major market for Chitwan district was 20 km, 8 km for

Dhading and 16km for Rasuwa. To make matters worse, much of these places only had one or two daily public bus services making it awfully hard to travel to and back from these major markets. The goods that finally get to these villages on a small scale are then sold at a much higher prices due to the transportation cost associated. Labor and resources for agricultural practices also cost more for these regions compared to those with much easier and shorter access to major markets. Lack of proper access to markets also deters those involved in farming. The longer distance to these markets also mean that youths who involve in off-farm activities are not able to help out with farming activities. 46, 32, and 84 percent of respondents from Chitwan, Dhading and rasuwa reported this lack of access to be one of the major drivers for food system change in the regions. Facilities such as seed banks, clinics, medications, fertilizers, pesticides are harder to find nearby resulting in decreased production and further abandonment of land. "*I used to sell the surplus vegetables and milk in the village but then everyone started carrying it out to major cities and there was no one left to sell to in the village. I am old and cannot travel long distances to sell anything. I had no choice but to cultivate only what is necessary for my family. I just use the seeds I save from a harvest in the next season and use only organic manure as fertilizers" (Dhading, 12).*

Lack of water

One of the major changes brought about by the massive earthquake in April, 2015 was the change in availability of natural water sources in the study districts. The available sources of water in the form of springs and small streams dried up and water became scarce. While Rasuwa district had an ample amount of water supply compared to Chitwan and Dhading, 32 percent of respondents reported that lack of water was one of the major reasons for decreased agricultural activity. 54 and 78 percent respondents from Chitwan and Dhading also mentioned lack of water to be one of the reasons for switching from agriculture to non-farm activities. More than 40% of the total households surveyed reported having problems with clean drinking water let along that for agricultural practices. The average time to fetch water from the nearest sources was as much as an hour in some cases. In these circumstances and without a stable source of water for irrigation, much of the agriculture is reliant on rain water. Some of the villages in Dhading and Chitwan have water storage facilities that were built mostly by non-governmental and non-profit projects in the past while the rest still rely on natural sources of water supply for their daily needs. The distant lands that have water supply for irrigation are mostly left barren while those farmlands near household suffer from lack of water for agriculture. The lack of proper irrigation facilities helps to make the situation even dire. "*There is not enough water for drinking let alone for agriculture. There used to be a small spring nearby but the earthquake damaged it. We depend on rain water for everything and lack proper water storage facilities so farming has been real tough" (Chitwan, 46).* The impact of water scarcity in mid hills, increased both due to drying up of the resources and unreliable water supply, has disproportionally affected women and girls of poor households (Gurung et al., 2019). While about 96% of water is utilized in the agriculture sector, the country has year-round irrigation in only one-third of its irrigated area (MoEWRI, 2018).

Age restrictions to farming

The lack of interest in youth population towards farming, massive outmigration for off-farm activities and foreign employment and urbanization creating alterative opportunities

have left only the elderly and few members from farming household in agriculture. 76, 54, and 22 percentage of respondents reported these restrictions in age to be one of the drivers of food system changes. Chitwan and Dhading were the most affected by age restrictions. About 40% of the households from Chitwan had only individuals above the age of 50 involved in agriculture. "*I am too told to cultivate all of my lands now. I only have my wife who is also old already. She cannot even work as much as I do. My kids do not want us to work anymore but I do what I can in the farmlands near house. This is the problem with many other families where young people want nothing to do with agriculture and elderly couple have no choice but to limit or quit agriculture" (Chitwan, 98).*

The increased average age of the farming household and those involved in farming relates to diminished physical capacity. There is an increase in abandonment of labor intensive crops such as millet and maize and the lands that were traditionally used for these crops are left partly or completely fallow. The ageing farmers also have little to no incentives to continue their livestock farming or crop rotation that requires physical work after a harvest and before planting of new crops. Households where men have emigrated for foreign employment leave behind women for a few years but then they migrate to bigger towns and cities for better education for their kids increasing the abandonment of agricultural practices and increasing the pressure for remaining members.

Climate Change

Another important cause of productivity loss is temperature rise, as heat waves impact the physiology of plants. Moreover, scientists have confirmed that an increase in temperature plays a great role in changing precipitation. Most of the respondents from the farming household perceive the impacts of climate change to be real. According to the respondents, erratic rainfall patterns along with extreme weather events such as droughts and hailstorms have become more frequent and unpredictable making farming even riskier. The erratic rainfall and extreme weather events have led to crop failures and shifting in planting and harvest time ultimately resulting in decreased crop production. Farmers from all districts reported abandoning crops such as millets and maize due to the lack of rain and erratic rainfall affecting these crops. "*I have not planted any maize or millet for a couple years as rainfall is not predictable anymore. The temperature is also different than it used to be where the winters are not as cold as they used to be but summer time brings more droughts and water problems" (Dhading 62).* 46, 38 and 56 percent of respondents reported climate change and its impacts to be a driver for the food system changes. .

Urbanization and shifts in Food Choices

Along with the natural and physical factors inducing changes in food systems, Global factors such as urbanization, and shift in food choices is becoming increasing prominent and can only be expected to increase in the future. Villages from the district report easier access and increased preferences to more processed and packaged foods in contrast to traditional crops. The urbanization has changed the food consumption patterns for rural communities through increased socio-economic conditions and increased access to the markets. Respondents also reported that it is much easier to buy products from the market with the remittances and increased buying capacity through off-farm activities. The grocery shops from the villages also reported that the sale of snacks and agricultural products have increased in the recent past. Purchase of such products was once a shameful act but at current time is a sign of prosperity and considered to be

for upper class and wealthy families. Farmers were observed buying rice, chicken, processed snacks, and vegetables from market for their homes and laborers, as also found in central America, where people from rural areas were buying food from markets with the income from remittances, with little interest in growing produce themselves (Hecht, S.B, 2007). This shift in preference of food consumption has deterred most of farming households from traditional agricultural practices. This in turn increases the price of agricultural products. . The prices of rice, wheat, and cereal grains—the three major staple foods in Nepal—are expected to rise significantly by around 26%, 36%, and 44% respectively by 2080. Future of Agriculture

Among all the respondents, at least 20 percent of all the farming households reported that they were desperate to cease farming for good and live off the remittances and income from off-farm activities. Most of the respondents, more than 80 percent from each district also reported that they did not want their young kids to involve in agriculture and wanted them to get educated in the cities or work on alternative activities such as carpentry, labor work, masons, drivers, hotel, trekking and others. "*I want my kids to do something else besides farming. I have seen how hard it is" (Dhading, 14).* Those who remain in traditional agriculture and are willing to continue also constitute some of the most elderly populations increasing the uncertainty in agriculture in future. These factors combined create a real reason to worry about the potential future of agriculture in about 20 years' time and creates for a desperate need for intervention and measures to involve youth populations in farming and create environment preferable for increased production.

The adverse impacts of changes in agricultural practices through a combined effect of the aforementioned factors are evident through a decrease in agricultural production combined with a huge increase in imports of such products. While the demand for food has increased through years naturally with population growth, shift in preference for food, and easier access to markets, the involvement in agriculture has significantly decreased.

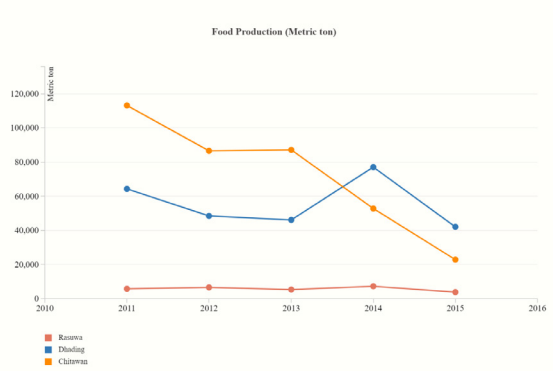


Figure 4: Total food production for study districts between 2010 and 2015

Between the years of 2010 and2015, the total production of food in Chitwan, Dhading, and Rasuwa district decreased by 79.8, 35, and 34.33 percent respectively. The situation is worse when it comes to Chitwan where production has decreased by 80 percent. The ongoing socio-economic, cultural, and environmental changes can only be expected to decrease the food production in the future.

The in depth-interviews with the farming households indicate a general willingness in rural communities to drift further apart from agriculture as possible. This trend will most likely continue in the future owing to the current economic conditions for agriculture, socio-demographic constraints, and the availability of employment options beyond agriculture. Similar results were also reported in eastern parts of Nepal, where many young people regarded agriculture as a "dirty job" (Gartuala, H., Niehof, A& Visser, L. 2012). Therefore, it is

safe to assert the future of agriculture for small scale farmers in rural communities are very uncertain and continuation or strengthening of the aforementioned factors will make the situation worse for future.

DISCUSSION

The change in food systems is a gradual, natural, and global phenomenon impacted by economic, financial, demographic, geographic, social, political, climatic, and psychological factors. The population growth coupled with the increased demand for infrastructures and utilization of agricultural lands for other purposes have greatly impacted nation's ability to fulfil their demands and have created food insecurities. For an agrarian country like Nepal, the impacts of such changes in food systems can have a huge impact of the economy of the country.

Among the most significant drivers for the changes in food systems is outmigration leading to lack of manpower for agricultural practices. Outmigration plays a significant role in determining how the land available is utilized. Lack of individuals to work on these lands and the lack of labor force it creates. Most importantly, rural to urban migration relocates labor from rural to urban areas, with direct consequences for agricultural labor supply (Stark and Bloom, 1985; Rozelle et al., 1999; Angelsen et al., 2020). A labor loss may induce a shift from labor-intensive to labor saving agricultural activities (Angelsen et al., 2020). This could mean a shift from annual crops such as grains to less labor-intensive perennial or tree crops, which could have environmental benefits such as improved carbon storage, water and soil conservation, and provision of wildlife habitat (Glover et al., 2007; Tilman et al., 2009; Glover et al., 2010). The findings from the research are supported by the study conducted by Brewer and his team (Brewer et al., 2024) in 2024 analyzing the land use consequences because of the outmigration.

Another key factor driving changes in food systems is the government involvement and participation in the sector of agriculture and the support farmers receive from them. The government of Nepal has created a National Food Council for providing such support to the farmers. The establishment of the National Food Council involves defining its roles, duties, and rights under the following provisions: identifying issues related to food rights policies and laws for recommendation to the Nepali government; coordinating the implementation of recommendations from constitutional bodies and various agencies on food rights issues; managing resources for nutrition security programs through government and non-governmental coordination; ensuring equitable distribution of resources for national food plans; preserving and enhancing traditional livelihoods and food production sources identified by local communities for food security; coordinating, supporting, and facilitating the translation and implementation of policies, laws, plans, strategies, and programs related to food security, food availability, storage, supply, and distribution systems; and adopting other appropriate measures to achieve the objectives of the law (MoALD, 2024). Despite notable strides in agricultural development and policy formulation, the effective implementation of the right to food policies remains hindered by a myriad of obstacles. The government's commitment to guaranteeing this fundamental right is enshrined in the Constitution of Nepal, yet practical execution is fraught with difficulties that span financial, technical, and sociopolitical dimensions (Koirala et al., 2024).

Human wildlife interaction and the damage this wildlife has on crops is another driver causing

changes in food systems. Many parts throughout Nepal are experiencing huge impacts caused by the wildlife on the crops. The Himalayan region is experiencing an unprecedented problem of human-wildlife conflict in the farmlands, creating a new set of livelihood challenges for the smallholder rural communities (Baral et al., 2021; Bista & Song, 2021; Sharma et al., 2021; Wangchuk et al., 2023). For instance, Kantipur and Gorkhapatra, two major national daily newspapers, published cover stories of wildlife problems from various parts of the country in 2022 (Bhattarai, 2022). Such stories have not only highlighted the instances of crop damage, livestock killings and human casualties but also attempted to draw policy makers' attention highlighting the broader impacts to the rural livelihood. A story from far western Nepal presented a heart-wrenching story of how the growing problem of the monkeys has forced the villagers to out-migrate (Singh & Saud, 2023). The findings of our research is also in line with that of (Khatri et al., 2023) where they examined various regions throughout Nepal and determined that there were areas from all geographical regions impacted by wildlife although the impact varied depending on the types of crops and the wildlife that thrived in the region.

Many other factors have also been associated with the changes in food systems because of changes in land use patterns that are affected by phenomenon such as Climate change, shifts in occupation, Land abandonment, which is primarily a result of outmigration, wildlife impact, lack of government support, lack of access to markets and fair prices. Together, these factors determine the present as well as future land use practices and are major drivers of the changes in food systems.

CONCLUSION

The study provides critical and strong evidences for study districts in regards to how various social, economic, natural, environmental, and global factors are affecting the food systems in these regions. The in-depth interviews along with quantitative data on migration, remittance collection, and shifts in food choices have deemed agriculture an unwanted profession quickly diminishing. With this trend expected to further increase in the future, there is a desperate need for intervention regarding maintaining a sustainable amount of agriculture in these districts to lower the reliance on imported and low nutritional food.

The impacts of the factors responsible for inducing such changes in Food systems are not uniform throughout the study districts and are a result of different land-use decisions derived as a result of combined impacts of such factors. Current trends indicate that rural communities are moving away from agriculture at an alarming rate. The increase in natural vegetation occurred primarily due to the transformation of agricultural land areas into such areas resulting from the abandonment of farming practices, followed by the greening of bare land. Studies indicate the abandonment rates of 37–49% for arable land in various mountainous regions of Nepal (Dahal et al., 2020; Sitaula, Sharma, & Chidi, 2024). Those involved in traditional farming and willing to continue farming into the next generation belong to a very few number of households. The remaining population actively involved in agriculture also constitute some of the elderly and ageing individuals implying that in the near future, rural communities from Nepal will face a tipping point where most of the agricultural practices will have been lost or marginal. This further implies greater reliance on imported food products which in many cases

have been linked to decreased nutritional value and increase in diseases and general reduction in health quality. Thus, it is imperative to act quickly so that the traditional and valuable information related to agricultural practices is completely lost for most of these rural areas. It will most likely be impossible to revert the complete abandonment of agriculture, the problem of which looms nearer than is realized. The government has enacted a number of bills and acts in an attempt to re-vitalize the diminishing agricultural practices in rural areas of the country. This was an attempt from the government to limit the abandonment of agriculture in rural areas and guarantee a stable production of food. However, in a context situation like that of rural Nepal, it is almost close to impossible to monitor and punish those individuals who abandon farming practices in search of a better lifestyle and education for their children. In contrast to these national level provisions dictating the abandonment of agriculture, more focused and locally specific adaptive strategies targeting the neediest communities might yield better results. The immediate role of government in these circumstances is to create a positive policy and environment to attract the youth generation and generate further investment and participation during the transitional phase of agriculture in the country. However, it is important to scrutinize the changing social, economic, and environmental contexts at more local levels to better address the underlying issues of food system changes and adoption of the most efficient and region specific measures in attempt to ensure food security for these regions.

Food security and sustainable agriculture are the pre-requisites for the development of a nation. The implication of food security goes far beyond just the dietary requirement of a locality and is a pre-curser for alleviating poverty from rural and economically affected regions. The advancement of agricultural sector is equally complex and extremely difficult to obtain from a narrow or one-sided perspective. As the study has suggested factors from social, physical, economic, environmental, natural, infrastructural aspects work together in determining the present and future status of agriculture in the region. Measures spanning each of these aspects need to be incorporated into a site-specific plan to limit the negative impacts of these factors causing decreased involvement and preferences to agriculture. The next phases of plans and policies should therefore strongly focus on betterment of infrastructures for agriculture, social development of the area to discourage massive outmigration, better educational and training facilities for those still involved, better economic incentives through subsidies, loans and government supported commercial farming, better access to agricultural products and farming products, and increasing awareness in individuals about the importance of consumption of quality and nutritional food products.

REFERENCES

Adams, R. H., Jr. (2011). Evaluating the economic impact of international remittances on developing countries using household surveys: A literature review. *The Journal of Development Studies*, 47(6), 809–828.

Angelsen, Arild, Mariel Aguilar-St en, John Herbert Ainembabazi, Edwin Castellanos, and Matthew Taylor, Migration, remittances, and forest cover 30 change in rural Guatemala and Chiapas, Mexico, Land, 2020, 9 (3), 88

Aydinalp, C., and Cresser, M.S., 2008, The effects of global climate change on agriculture. Am.

Eurasian *J. Agr. Envrion*. Sci., 3(5),672-6.

Baral, K., Sharma, H. P., Kunwar, R., Morley, C., Aryal, A., Rimal, B., & Ji, W. (2021). Human wildlife conflict and impacts on livelihood: A study in community forestry system in Mid-Hills of Nepal. Sustainability, 13(23), 13170.

Bartlett, R., Bharati, L., Pant, D., Hosterman, H., and McCornick, P., 2010, Climate changeimpacts and adaptation in Nepal. International Water Management Institute (IWMI) Working Paper no 139, Colombo, Sri Lanka; 2010.

Bhattarai, B. (2022). Wildlife terrorism: Leopard kills livestock and other animals destroy crops, in Kantipur Daily.

Bista, R., & Song, C. (2021). Human-wildlife conflict in the community forestry landscape: A case study from two Middle Hill districts of Nepal. Human Dimensions of Wildlife.

Brewer, J., Larsen, A., & Noack, F. (2024). The land use consequences of rural to urban migration. *American Journal of Agricultural Economics*, *106*(1), 177-205.

Brown, R. P. C., & Ahlburg, D. A. (1999). Remittances in the South Pacific. *International Journal of Social Economics,* 26, 325-344.

CBS, 2011, National Population and Housing Census-2011. Government of Nepal, National Planning Commission Secretariat, Kathmandu, Nepal; 2011.

Chalise, S., 2012. In: Lynch, S. (Ed.), Combating Climate Change: A Real Threat to Nepal. Academic Publishing, Germany: Lambert.

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.

Dahal, G. R., Pandit, B. H., & Shah, R. (2020). Abandoned agricultural land and its reutilisation by adoption of agro forestry: A case study from Kaski and Parbat Districts of Nepal. Journal of Forest and Livelihood, 19(1), 1–16.

Dahal, B.D.; Sitaula, B.K.; Bajracharya, R.M. Sustainable agricultural intensification for livelihood and food security in Nepal. *Asian J. Water Environ. Pollut.* 2007, 5, 1–12.

De Brauw, A. (2007). Seasonal migration and agriculture in Vietnam (No. 07–04). Retrieved from Agricultural and Development Economics Division of the Food and Agriculture Organization of the United Nations (FAO - ESA).

De Brauw, A., Taylor, J. E., & Rozelle, S. (1999). The impact of migration and remittances on rural incomes in China. Proceedings, 1999 American Agricultural Economics Association Annual Meetings, Nashville, August 8-11, 1999.

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.

El Bilali, H., Bassole, I.H.N., Dambo, L., & Berjan, S. (2020). Climate change and food security. Agriculture & Forestry/Poljoprivreda i Sumarstvo, 66(3).

Elbehri, A., Burfisher, M., 2015. Economic modelling of climate impacts and adaptation in agriculture: a survey of methods, results and gaps. In: Elbehri, A. (Ed.), Climate Change and Food Systems - Global Assessments and Implications for Food Security and Trade. FAO, Rome.

Enthoven, L., & Van den Broeck, G. (2021). Local food systems: Reviewing two decades of research. Agricultural Systems, 193, 103226

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.

GON. Land Use Bill; Government of Nepal: Kathmandu, Nepal, 2018.

Grau, H.R.; Aide, T.M. Are rural–urban migration and sustainable development compatible in mountain systems? *Mt. Res. Dev*. 2007, 27, 119–123.

Gurung, A.; Adhikari, S.; Chauhan, R.; Thakuri, S.; Nakarmi, S.; Ghale, S.; Dongol, B.S.; Rijal, D. Water crises in a water-rich country: Case studies from rural watersheds of Nepal's mid-hills. *Water Policy* 2019, 21, 826–847.

Hecht, S.B.; Saatchi, S.S. Globalization and forest resurgence: Changes in forest cover in EI Salvador. *BioScience* 2007, 57, 663–672.

Hertel, T.W., Burke, M.B., Lobell, D.B., 2010. The poverty implications of climateinduced crop yield changes by 2030. *Glob. Environ. Change* 20 (4), 577–585.

Hoermann, B., & Kollmair, M. (2009). Labor migration and remittances in the Hindu Kush-Himalayan Region. 20. ICIMOD Working Paper. Kathmandu, Nepal.

Islam, M.S., & Kieu, E. (2020). Tackling regional climate change impacts and food security issues: A critical analysis across ASEAN, PIF, and SAARC. Sustainability, 12(3), 883.

Jokisch, B. D. (2002). Migration and agricultural change: The case of smallholder agriculture in highland Ecuador. *Human Ecology*, 30(4), 523–550.

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.

Khanal, R.C., 2009, Climate change and organic agriculture. *J. Agric.Environ.,* 10(1),100-10.

Khatri, D., Paudel, D., Poudyal, B. H., Khatri, S., Poudel, D. P., & Marquardt, K. (2024). Examining socio□ecological transitions and new human–wildlife relations in farming landscapes of the Nepal Himalaya. *Journal of Agrarian Change*, *24*(4), e12594.

Koirala, P.; Karn, S, K; Joshi, P. Right of Food and Sustainable Food Systems in Nepal: Legal Frameworks, Achievements, and Challenges. *International Journal of Applied Sciences and Biotechnology,* Vol 12(3): 115-125.

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.

Lohani, S.N., 2007, Climate change in Nepal-shall we wait until bitter consequences? *J. Agric. Environ*., 8(1),38-45.

Massey, D. S., & Bassem, L. C. (1992). Determinants of savings, remittances, and spending patterns among U.S. migrants in four Mexican Communities. *Sociological Inquiry*, 62(2), 185-207.

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.

Ministry of Energy, Water Resource and Irrigation (MoEWRI). *Present Status of Energy, Water Resource and Irrigation Sector and Future Road Map (Nepali Version)*; Ministry of Energy, Water Resource and Irrigation, Government of Nepal: Kathmandu, Nepal, 2018.

MoAD. Agriculture Development Strategy (ADS) 2015 to 2035 (Part: 1); Ministry of Agricultural Development (MOAD): Singh Durbar, Kathamandu, Nepal, 2016.

MoAD. Statistical Information on Nepalese Agriculture 2014/2015; Ministry of Agricutural Development (MOAD): Kathmandu, Nepal, 2015

MOEST/UNDP, 2008, National adaptation programme of action on cliamte change. Ministry of Environment, Science

and Technology and United Nations Development Programme, Kathmandu, Nepal; 2008.

Morioka, M. and Kondo, T. (2017). Agricultural Productivity Growth and Household Food Security Improvement in Nepal. *Review of Development Economics,* 21(4).

Muluneh, M.G. (2021). Impact of climate change on biodiversity and food security: a global perspective—a review article. Agriculture & Food Security, 10(1), 1-25

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.

Ortiz-Bobea, A., Ault, T.R., Carrillo, C.M., Chambers, R.G., & Lobell, D.B. (2021). Anthropogenic climate change has slowed global agricultural productivity growth. Nature Climate Change, 11(4), 306-312.

Paudel B, Zhang Y, Li S, Liu L, Wu X, Khanal NR (2016b) Review of studies on land use and land cover change in Nepal. *J Mt Sci* 13: 643–660.

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.

Ramankutty N, Foley JA (1999) Estimating historical changes in global land cover: croplands from 1700 to 1992. *Glob Biogeochem Cycles* 13:997–1027.

Reichert, J. (1981). The migrant syndrome: Seasonal U.S. wage labor and rural development in Central Mexico. *Human Organization*, 40(1), 56–66.

Rimal, B. Urbanization and the decline of agricultural land in pokhara sub-metropolitan city, Nepal. *J. Agric. Sci*. 2012, 5, 54–56.

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.

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.

Rozelle, Scott, J Edward Taylor, and Alan DeBrauw, Migration, remittances, and agricultural productivity in China, American Economic Review, 1999, 89 (2), 287291

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.

Sharma, P., Chettri, N., & Wangchuk, K. (2021). Human–wildlife conflict in the roof of the world: Understanding multidimensional perspectives through a systematic review. Ecology and Evolution, 11(17), 11569–11586.

Seddon, D. (2004). South Asian remittances: Implications for development. *Contemporary South Asia*, 13(4), 403-42.

Seddon, D., Adhikari, J., & Gurung, G. (2002). Foreign labor migration and the remittance economy of Nepal. Critical Asian Studies, 34(1), 19–40. Brown, R. P. C., & Ahlburg, D. A. (1999). Remittances in the South Pacific. *International Journal of Social Economics*, 26, 325-344.

Singh, B. P., & Saud, L. (2023). Monkeyes forcing farmers to out-migration: Villabes are being abandoned. Daily. Subedi, Y. R., Kristiansen, P., Cacho, O., & Ojha, R. B. (2021). Agricultural land abandonment in the hill agro-ecological region of Nepal:

Analysis of extent, drivers and impact of change. Environmental Management, 67, 1100–1118

Sitaula, R., Sharma, P., & Chidi, C. L. (2024). Agricultural land abandonment and its impact on soil erosion in the Madi Watershed, Gandaki Province, Nepal. Geographical Journal of Nepal.

Stark, Oded and David E Bloom, The new economics of labor migration, American Economic Review, 1985, 75 (2), 173178.

Steiner, A., Aguilar, G., Bomba, K., Bonilla, J.P., Campbell, A., Echeverria, R., Gandhi, R., Hedegaard, C., Holdorf, D., Ishii, N., & Quinn, K.M. (2020). Actions to transform food systems under climate change.

Uprety, A., Panta, H. K., Bhandari, T., & Timsina, K. (2024). Agricultural land conversion: trends and drivers in Dhading, Nepal. *GeoJournal*, *89*(5), 221.

Upreti, B. R. (2008). Land as a source of marginalization and conflict in Nepal. In B. R. Upreti , S. R. Sharma and J. Basnet (Eds.), *Land Politics and Conflict in Nepal: Realities and Potentials for Agrarian Transformation* (pp. 3–21).

Wangchuk, S., Jennifer, B., Thwaites, R., & Finlayson, M. (2023). Exploring human and wildlife conflict and implications for food self-sufficiency in Bhutan. Sustainability, 15(5), 4175.

WFP. WFP Food Security Atlas of Nepal; U.N. World Food Programme: Rome, Italy, 2010.

World Bank 2006, Nepal - Resilience amidst conflict: an assessment of poverty in Nepal, 1995-96 and 2003-04, *Washington, DC: World Bank*.