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Land Fragmentation and Occupational Diversification in the Western Terai of Nepal

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Abstract

The study explores the relationship between land fragmentation and occupational diversification in Western Terai, Nepal. It is a universal particularity of all agricultural systems that distresses farmland efficiency and forces adoption of alternate occupations for the subsistence of life. The key objective of this study was to assess the trend of land fragmentation and occupational diversification. This study was based on both qualitative and quantitative methods, including primary and secondary sources of data. It was found that 64.2 percent of the total respondents reported their land fragmentation began after 1983 AD. The main determinants of land fragmentation were inheritance of property and population growth, along with the selling and buying of land, migration, infrastructure development (such as roads and canals), disasters (including floods and erosion), and land plotting. Of the total the respondents, 81.5 percent reported an increase in input cost relative to output due to the scattering of farmland into small, irregular plots, with parcels located an average of 300 to 1,500 meters from farmsteads. This spatial dispersion reduced the priority given to agricultural investment. Consequently, 71 percent of respondents were compelled to seek alternative livelihood activities for their subsistence, driven by land fragmentation, conversion of farmland into built-up areas, and the gradual disappearance of agricultural fields.

Keywords: Land fragmentation, land consolidation, infrastructure development, farm production, sustainable livelihood

Introduction

Land fragmentation, where a single farm consists of numerous separate plots, is a common agricultural phenomenon worldwide and is widely recognized as a constraint to efficient crop production and agricultural modernization (Van Dijk, 2003; Niroula & Thapa, 2007). In the Western Terai of Nepal, this fragmentation not only undermines agricultural productivity but also accelerates occupational diversification, as farmers increasingly shift toward non-agricultural livelihoods (Rasul et al., 2012; Thapa, 2007).

The chief determinants of land fragmentation and their implications on agricultural production are necessary subject to explore for the country where agriculture is the mainstay of the economy, and more than 65 percent of the population depends upon the agriculture sector which contributes 27 percent of the national GDP. Nepal's land holdings are highly fragmented, with an average of more than three parcels per holding (NSO, 2021a). Households with larger holdings, between five and ten hectares, had the highest average number of parcels (about 7.5 per household) (CSRC, 2009). A high proportion of households in Nepal depend on agriculture for the generation of livelihood (MoAD, 2012).

In Nepal, the structure of the land inheritance system, unplanned housing and urbanization, and weakly enforced policies have all contributed to land fragmentation (CRSC, 2012). Moreover, land fragmentation tends to decrease with increasing farm size, while parcels located closer to homesteads are generally more fragmented than those situated farther away (Dhakal & Khanal, 2018). High levels of land fragmentation and the rapid conversion of agricultural land are major challenges to Nepal's food security, compelling many households to adopt alternative occupations for subsistence (Poudel et al., 2014). Land fragmentation arises from various drivers, including traditions related to inheritance and broader economic processes (Burton, 1988). In Nepal, it is particularly entrenched in customary traditional performs in which the patriarchal land is divided equally among sons (Sapkota, 2004).

The benefits of land disintegration refer to lowering the risk involved through growing different crops on many parcels, each of them with different appearances. Mounting different crops on different plots involves a lower risk associated with the harmful weather effects (Todorova & Lulcheva, 2005). The weaknesses of land fragmentation are mostly associated with incompetent distribution of resources (labor and capital), leading to enlarged costs of production, and obstructing agricultural modernization, then forces to explore other options (Sundqvist & Andersson, 2006). Farm disintegration in survival agriculture is repeatedly considered a hurdle in agricultural advancement. It also obstructs farm modernization, often decreases production, and needs massive

assets in the alternative (Rahman & Khan, 2008). Most scholars have agreed that the law of inheritance, population growth, land market, and poverty are four major factors responsible for farm fragmentation (Khan & Rehman, 2018). In the deficiency of specific strategies on land alliance or development control, it is tough to perceive somewhat predictable change in landholding and farm fragmentation, and continued incursion of farmland by urban uses, then they should consider the alternatives.

In their study, Niraula and Thapa (2007) found that small land parcels can be more productive than larger ones due to higher input applications, which positively impact farmers' incomes. However, overall production efficiency is generally higher on larger parcels. Land fragmentation, by creating smaller and scattered plots, negatively affects production efficiency and consequently constrains agricultural development.

Land fragmentation decreases marginal productivity, which has an important influence on agricultural labor decisions and increases non-agricultural labor supply. So, it is essential to grow the supply of mechanized amenities and facilitate the development of small-sized agricultural instruments that can be used on smaller landholdings (Lu et al., 2019). By keeping the farm size constant, reducing the number of plots, and expanding the size of each plot enhance to economies are enhanced in each plot by either land consolidation or land transfer, as well as by joint farming and joint implication (Lu et al., 2018). Insecurity of tenure and resource rights are the key factors for land fragmentation that result from unsuitable agricultural development procedures and unproductive land use planning, which have negative impacts on agricultural productivity and can be reduced or mitigated (Mayele et al., 2024). Age of the household head, family size, and level of education are the noteworthy issues in causing difference in the size of land holding (Doti, 2017). Fragmented land with scattered numbers of plots and unmanaged shape and size of parcels suffered more costs in farm production, that have a significant negative impact on crop production (Ali et al., 2023). Land fragmentation increases the cost of crop production, which decreases household income and is positively related to household food insecurity, which is obligatory for alternate occupations for their livelihood (Phan et al., 2022). Land consolidation and efficient land management are crucial in increasing agricultural productivity, securing livelihoods, and supporting policies dealing with the efficient use of limited land resources to adopt sustainable measures in development (Kibisu et al., 2024).

According to the national census, it has been found that although the number of farm holdings is increasing, the farm holding area is decreasing. There are 4,130,789 households (62 percent of the total households) engaged in agriculture-related activities, which occupy 2,218,410 hectares of land. It was 2.52 million hectares of land and 3.83

million holdings in the country (71 percent of all the households) during the 2011 census. This indicates that while the number of farm households increased by 7.8 percent, the total area under farming decreased by 12.2 percent (NSO, 2021b). Instead, the average number of parcels per holding declined from 3.2 to 2.8. Likewise, the average parcel size also reduced from 0.21 hectares in 2011/12 to 0.19 hectares in 2021/22.

However, the total farm population decreased by 5.7 percent during inter-census period (it was 20.55 million in the 2011 census and reached 19.45 million in the 2021 census). This indicates that the number of households diversifying from agriculture to other occupations is increasing day by day.

Census data reveal that the average parcel size in Nepal has decreased from 0.21 hectares in 2011/12 to 0.19 hectares in 2021/22 (NSO, 2021c), indicating that more people rely on increasingly smaller and more fragmented landholdings for their livelihoods. Despite recognition that high land fragmentation and rapid conversion of agricultural land pose significant challenges to food security, there is limited research analyzing how these trends specifically affect access to resources such as irrigation and overall agricultural productivity. Furthermore, previous land management policies aimed at land redistribution have not effectively addressed fragmentation issues, and there is a notable gap in understanding the socio-economic impacts of these policy shortcomings.

This study aims to fill these gaps by focusing on the nature, trends, and drivers of land fragmentation in Sunwal Municipality of Nepal's Western Terai region. It also explores the relationship between land fragmentation and occupational diversification, highlighting how farmers adapt to the challenges of scattered and shrinking land parcels by shifting toward alternative livelihoods. The findings are intended to provide valuable insights for planners and policymakers to promote sustainable land use and agricultural development, helping to mitigate the adverse effects of fragmentation and support the socio-economic well-being of rural communities.

Methods and Materials

Conceptual framework

This study explores the present condition, nature, and the trend of changes in parcels by size and numbers; furthermore, the causes or factors responsible for developing such a trend were identified, and finally, the relation of land fragmentation in terms of diversified occupation was evaluated (Figure 1).

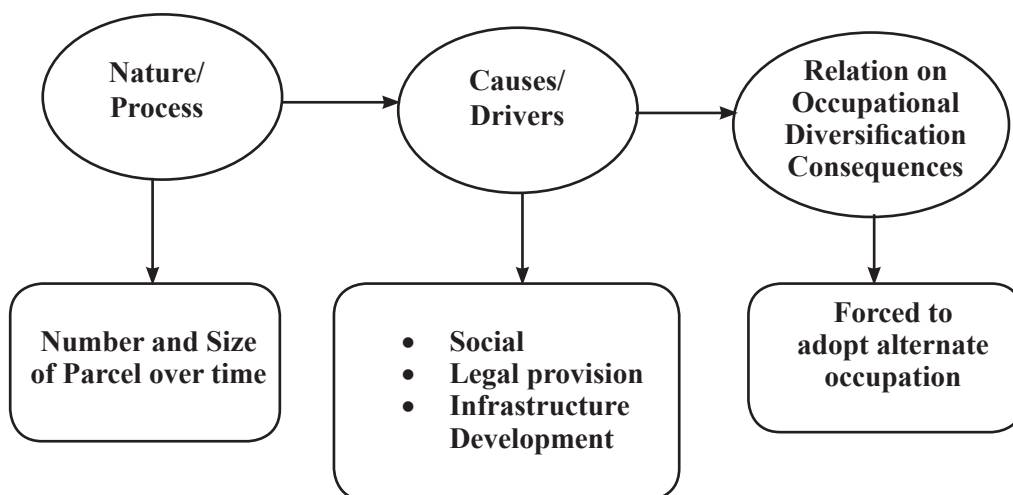


Figure 1. *Conceptual framework*

Research design

This study adopts a pragmatic research paradigm, which uses both qualitative and quantitative approaches. A mixed-methods research design is employed to address the research objectives.

The study was planned to carry out in three different phases. Throughout the pre-field work, numerous pertinent literatures were studied from varied reports and documents to recognize the research objectives and monitor additional activities. Furthermore, diverse resources like maps and satellite images of the study area were gathered and evaluated to delineate the research area. The ground investigation was conducted to gather obligatory evidence through a quantitative method using a household questionnaire, and adopted a qualitative method through observation, Focus Group Discussion (FGD), and Key Informant Interview (KII). Additionally, in the post survey phase, collected data were processed, analyzed, tabulated, and presented in the form of a final research paper.

Tools of data collection

This study is based on both qualitative and quantitative methods, including primary and secondary sources of data and information. Perception and recalled historical information of the respondents was compiled, processed, and coded for tabulation as a source of qualitative data collection. The main sources of primary data were collected through a household-based face-to-face questionnaire survey, key informant interviews, focus group discussions, and field observations. The main sources of secondary data/

information were reports, documents, maps/images, journals and books, published by various institutions and organizations.

Sampling techniques

At first, the purposive sampling survey technique was adopted with farm households. Then, the name list of people having farmland with more than 10 *kattha* (338.623 sq. meters) (1 Bigha = 20 *Kattha* = 6772.63 sq. meters) with multiple number of parcels was collected from the consultation with Key Informants (Ward member, school teachers and senior citizens). Afterward, field work was conducted through household survey covering 124 farmers. (There are altogether 1853 households in ward number 4 of Sunwal Municipality as per NSO, 2021). Maximum attempts were made to follow the absolute ethics of research throughout the research period. Based on the determined sampled households, direct interviews with farm owners and farmers were carried out by using structured questionnaires in the selected ward, followed by direct observation and key informant interviews.

Data analysis

After the field-level survey, data processing, verification, and inconsistencies arrangement were carried out on the evidence resulting from the household questionnaire survey, FGD, and KII, as well as ground observation. Then local units (*pathi, muri, kattha, bigha*) were transformed into SI units. The minutes and field-level debates were categorized by matters and coded to summarize the findings. Spatial, qualitative, and quantifiable approaches were implemented to investigate consequent information in this study through GIS, MS Excel, and SPSS for presentation of the findings.

Study area

This study was conducted in ward number four of Sunwal municipality. It is located in Nawalparasi (Bardaghat-Susta West) district of Lumbini Province of Nepal (MoFALD, 2017) and extended between 83°24'26" to 83°45'05" east longitude and 27°32'24" to 27°41'38" north latitude within the surface area of 139.10 sq km. The total population of Sunwal Municipality is 72,085, where 33,793 are male and 38,292 are female as per the 2021 census. The total number of households in the municipality is 17,418. The population growth rate of the district between 2011 and 2021 is 1.44, which is higher than the national average of 0.93 percent (NSO, 2021b). The population density of the municipality is 518 persons/sq km, which is less than the district level of 525 persons/sq km, and higher than the national level of 198 persons/sq km.

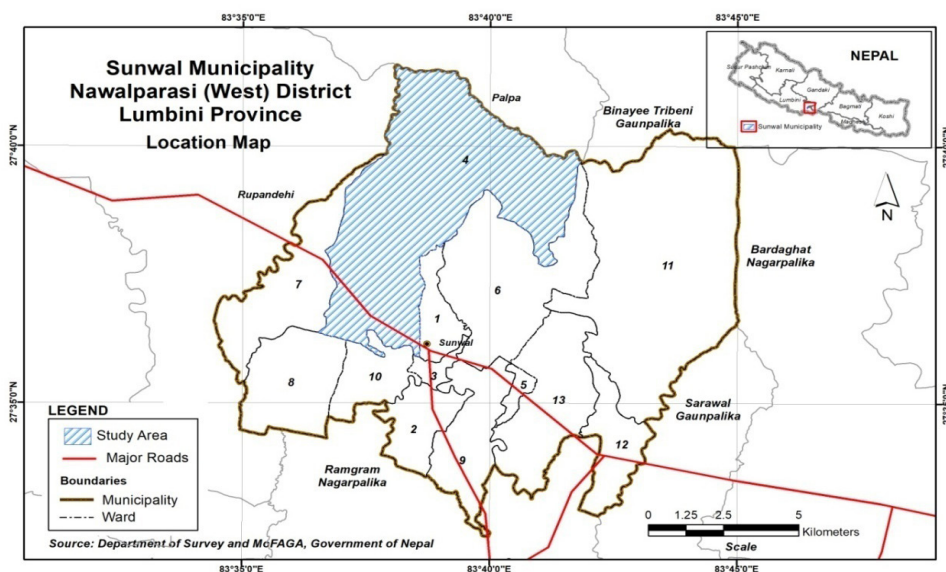


Figure 2. Location map of the study area

Results and Discussion

Distribution of land parcels

This study explored that there were several numbers of land parcels distributed in the study area. In an average, single to more than five parcels, even up to 17 parcels were recorded during the field study. Most of them (50.8 percent of the total respondents) had three parcels. Similarly, 33.9 percent of them have two parcels beyond the farmstead. Likewise, 12.1 percent of them had 4 to 5 parcels, whereas 2.4 percent (3 respondents) had more than five parcels (Table 1).

Table 1. Distribution of the number of parcels by respondents

SN	Categories and Number of Parcels	No of HHs	Percentage
1	More than 5 (3)	3	2.4
2	4-5(42)	15	12.1
3	3 (63)	63	50.8
4	2 (15)	42	33.9
5	1 (1)	1	0.8
Total	362	124	100.0

Source: Field survey, 2024/25

Note: Numbers in parentheses indicate the number of parcels by categories.

The process of parcel verification on the cadastral map was very difficult in the field; however, only seven respondents were able to identify their parcels with the help of parcel number, cadastral sheets, and topographical map (Figure 3).

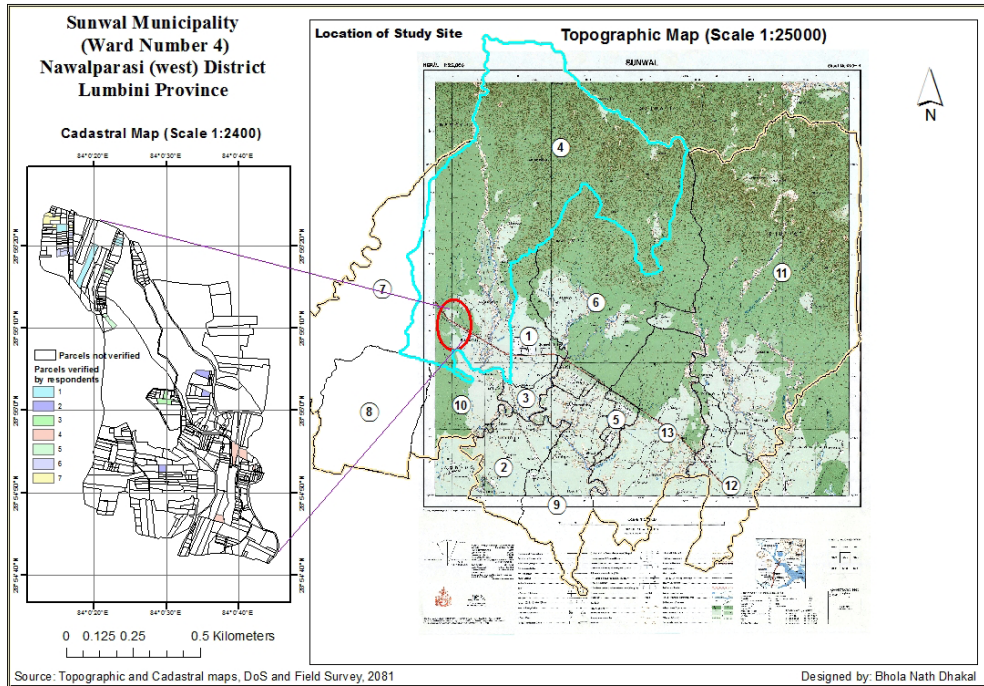


Figure 3. Location of the study site along the topographic map and the cadastral sheet

Land Fragmentation Trends

Table 2 shows the historical trends of the fragmentation process. According to the settlement history of the study area, the period to the present was divided into five-time periods with equal years of interval. However, it was predominantly influenced by immigration and population growth. Most of the respondents (44.4 percent) started their land fragmentation during the 1984 to 2003 period. Similarly, in recent years, this trend has been increasing rapidly around the country, not only in the study area. The table below reflects that 21.8 percent of the respondents' farmland was fragmented after 2004 AD. Keeping in view that this trend started before 1963 BS by 8.9 percent of the total respondents.

Table 2. *Trend of land fragmentation*

SN	Fragmentation period	No of HHs	Percentage
1	Before 1963	11	8.9
2	1964-1983	26	21.0
3	1984-2003	55	44.4
4	2004 to present	27	21.8
4	No	5	4.0
Total		124	100.0

Source: Field survey, 2024/25

Causes of land fragmentation

This study explored the main causes behind the land fragmentation based on the perception and reality of the respondents in the study area. Of the total, 49.2 percent of the respondents and their farmlands were fragmented due to the buying and selling of their land. Whereas 29 percent of the respondents claimed that population growth and the right of inheritance property forced them to divide their land into various numbers of plots. In addition to this, 12.1 percent of their farmland was separated due to the extension of the road and the construction of an irrigation canal along the agricultural farmland. Furthermore, 5.6 percent of respondents' farmland was detached due to flood and erosion in the riverside area. Additionally, 4 percent of the respondents reported that their farmland was separated for land plotting and land use change (Table 3).

Table 3. *Main reasons for land fragmentation for individual respondents*

SN	Causes	No of HHs	Percentage
1	Inheritance property/population growth	36	29.0
2	Selling/buying and migration	61	49.2
3	Infrastructure development (road/canal)	15	12.1
4	Disasters (flood and erosion)	7	5.6
4	Others (land plotting)	5	4.0
Total		124	100.0

Source: Field survey, 2024/25

Land fragmentation and occupational diversification

Land fragmentation has posed many challenges in the study area. A total of 63.7 percent of the respondents noticed the challenges of loss in agricultural land and farming system, 71 percent of them identified that they were forced to explore alternate activities for their subsistence due to the loss and disappearance of agricultural farms that happened due to land fragmentation and conversion to build up area. Most of them (43 percent

of the total) were involved in business and off-farm activities, 38 percent of them went abroad for foreign employment, others (19 percent) were involved in various activities like land selling and buying, contractors, drivers, daily wages, employment supply agents, etc. Similarly, 49.2 percent of them mentioned the challenges of insufficient food security, and 17.7 percent of them noticed the disappearance of typical crops. However, 33.1 percent of them agreed to follow intensive farming and 23.4 percent for crop diversification, even in small size and scattered land parcels. In addition, a few of them were suggested to follow other activities like livestock and fish farming, beekeeping, poultry farming, horticulture, and so on, related to agriculture rather than cropping only to sustain and to adjust to the challenges of land fragmentation (Table 4).

Table 4. *Challenges of land fragmentation*

SN	Challenges	No of HHs	Percentage
1	Loss of agricultural land	79	63.7
2	Force to explore alternate income sources/activities	88	71.0
3	Insufficient food security	61	49.2
4	Typical crops disappearing	22	17.7
5	Intensive cropping	41	33.1
6	Crop diversification	29	23.4
7	Others (livestock, fish farming, beekeeping, poultry farming, horticulture, and so on)	13	10.5

Source: Field survey, 2024/25

Conclusion

This study found the uneven and irregular distribution of farmland among the farmers in the study area. Most of the respondents were found with three parcels and a decrease in cropping area coverage. However, production and productivity were observed in both increasing and decreasing conditions. Of the total, 64.2 percent of respondents reported that their land fragmentation started after 1983 AD. Inheritance property and population growth, selling/buying and migration, infrastructure development (road/canal), disasters (flood and erosion), and others (by land plotting) were the key determinants reported behind the land fragmentation in the study area. Among them, 49.2 percent of the respondents' farmland was fragmented due to buying and selling of land. Further, this study concluded that 81.5 percent of the total respondents have faced difficulties in input use and harvesting during farming due to scattered and irregular plots. Of the total, 69.4 percent of respondents faced the problem of a decreasing trend in their product, whereas 30.6 percent of them shared the positive impact of the fragmentation. Moreover, 10.5 percent of the respondents decided to change their farming activities to others like livestock, fish farming, poultry farming, beekeeping, and so on. In addition,

71 percent of them recognized that they were forced to explore alternative activities for their subsistence due to the loss and disappearance of agricultural farms due to land fragmentation. about 43 percent of total respondents were involved in business and off-farm activities, 38 percent of them went abroad for foreign employment, and others (19 percent) were involved in various activities like land selling and buying, contractors, drivers, daily wages, employment supply agents, etc.

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