The Impact of Land Use Land Cover Changes on Livelihood Strategies of the Households in District Abbottabad, Pakistan

Zartashia Anwa[1], Arif Alam[2], Basharat Khan[3]

[1]Department of Humanities and Social Science, Bahria University Islamabad Pakistan

[2]Department of Development Studies, COMSATS University Islamabad, Abbottabad Campus, Khyber Pakhtunkhwa, Pakistan

[3]National logistic corporation Pakistan head office harding Road Rawalpindi

zartashia.buic@bahria.edu.pk,　　arifalam@cuiatd.edu.pk ,　　　basharatjadoon@gmail.com

Corresponding Author: arifalam@cuiatd.edu.pk

Abstract

This study investigates the intricate relationship between Land Use Land Cover (LULC) changes and livelihood strategies in the study area over the past three decades. Employing Geographic Information System (GIS) data and household surveys involving 130 participants, the research highlights a substantial rise in built-up areas (3.12%), contrasting with a decline in agricultural and barren land (15.7%) from 1989-2019. Through correlation analysis, the study delves into the link between LULC shifts and transformations in livelihoods. Descriptive findings indicate notable shift in occupational focus, with engagement in agriculture, livestock, and wild resources dropping from (42.9%, 18.4%, and 6.2%) in 1989-1999 to (12.4%, 6.8%, and 4.3%) in 2009-2019. LULC changes emerge as influential factors driving shocks such as migration, decreased rainfall, agricultural challenges, unplanned urbanization, and 2005 earthquake. Consequently, residents adapt by transitioning from traditional livelihoods to alternative off-farm income sources, enabling them to navigate and recover from these multifaceted challenges.

Keywords: Land use land cover change; GIS spatial analysis; livelihood strategies; shocks and coping strategies

1. Introduction

The land being a fundamental factor of production supports human existence and living organisms to survive. Most of human sustenance activities such as food production, shelter, development of infrastructure coupled with natural resource extraction are solely dependent on land. Globally, land is considered to have a significant socio-economic value as it is a main source of earning livelihood for majority of population. However, due to continued exploitation and mismanagement the land resources are shrinking globally (Lambin, 2006). Land use land cover (LULC) changes have a direct impact on livelihood earning pattern of the population dependent directly or indirectly on land. Livelihood refers to capital activities and assets required by the people to make a living (Babulo et al., 2008). Livelihood strategies are various combinations of activities and different modes adopted by people to earn their livelihood goals (FAO, 2005). The quantitative measure of livelihood strategies divides it into three parts i.e asset based, income based and combination of both (Ellisand, 2004 Walelign et al., 2017) The people in rural areas generate their livelihood through three main strategies i.e., diversification, agricultural intensification, and migration (Scoones, 1998 & Ellis, 2000). Through livelihood diversification, rural households are engaged in different sets of activities with variety of social support which is reflected in their struggle for survival and improvement in living standards (Ellis, 1998). Subsequently, diversified livelihood assets also diversify the livelihood of households (Perz, 2005; Walelign, 2017; Wang, 2015). In the last few decades, numerous institutions (FAO, 2006; UNDP, 2001; DFID, 2005) have developed number of frameworks to analyze sustainability of livelihood. Most commonly used Livelihood frameworks in development practice is 'Sustainable Livelihood Framework' (SLF) developed by UK Department for International Development (DFID).

LULC change and its resultant implications for natural ecosystem has been a matter of concern for researchers and practitioners around the globe. LULC change has been recognized as an important driver of environmental change and its significance for management and monitoring for natural resource base has rapidly gained the attention of researchers (Gamble et al., 2003 & Mei et al., 2016). Burkhard et al., (2012) reveal considerable impacts of LULC change on the capacity of ecosystem to provide goods and services and functioning of socioeconomic and ecological systems.

The landscape diversity and changing pattern in landscape structure is monitored by multi temporal analysis of the land in combination with Geographic Information System and historic document material (Yah, et al., 2009). Pakistan is just one of many countries in which high population growth has fueled urbanization, unemployment, and depletion of resources. Almost 25 million people moved to cities during the last 10 years and annually approximately 1000 hectares of non-urban land is converted to urban land (Haq, 2009). The expansion of human settlement is a universal phenomenon, which is caused by human activities. These activities are converting agriculture and barren land into built up areas. While, built up area with spatial expansion is linked with various geographical, socio economic aspects and rapid population increase, which are major driving forces behind this phenomenon in developing countries like Pakistan (Adeel, 2010).

Population growth, urbanization, and development of infrastructure has not only resulted in over-exploitation of natural resources but also forced people to adopt diversity in earning livelihood. As a result, it directly threatens sustainable development in agriculture, forestry, and conventional methods of earning livelihood. This phenomenon is triggering diversification in livelihood strategies. Simultaneously, natural resources are under increasing stress due to their over-exploitation in the form of deforestation and land degradation. In this vein, an in-depth scientific analysis of the nexus dynamics of LULC and rural livelihood is necessary. This will help in developing the associated coping strategies for developing a better understanding of this dynamic interaction. Ellis (2000) pointed out that livelihood strategies aim not only to diversify the financial capital but also other valuable assets like social, natural, and human capitals.

According to Rehman et al., (2008) with the increase in population growth, the share of farming which is primary livelihood activity of district has significantly reduced as more and more households are getting oriented toward non-farm activities. The findings of the study on LULC in Abbottabad reveals that agricultural land has decreased by 15.73% and bare land 3.81% whereas water has decreased significantly by 0.58% (Anwar et al., 2021). Green and serene valley's got mostly occupied by built up areas which emerged like mushrooms during past three decades' time (Anwar et al., 2022). This fast moving land use land cover changes trend was slowly and gradually grabbing agriculture land. This aspect became the triggering point for undertaking study on LULC changes and its impact on livelihood earning for local population. These changes also triggered socioeconomic imbalance which is being mitigated through diverse means.

This study will unfold as to how much agriculture land was reduced during the period of study, how it impacted age old means of earning livelihood, what factors affected rearing of livestock, why the area experienced water shortage and what mitigating strategies were adopted by rural population to overcome shortfalls in livelihood earning. Therefore, this study is to analyze the major trends of LULC changes for the last three decades and evaluate its impact on livelihood and future to establish relationship between livelihood divergence and LULC change in study area. . This land use change is foremost reason to conduct this study to see the impact of these LULC changes in the form of shocks experienced and the associated livelihood coping strategies adopted by inhabitants of district Abbottabad.

2. Materials and Methods

Pragmatic approach was used for the collection of primary and secondary data. Cross-sectional primary data was gathered through field survey; observations, interviews, questionnaire and interpretation of satellite imagery to get quantitative and qualitative information for better understanding and interpreting the LULC change. Data collection was conducted through triangulation.

2.1 Study area

District Abbottabad is situated in Hazara Division, Khyber Pakhtunkhwa and encompass area from 33 50' and 34 23' North, longitude and 73 35' and 73 31' East, latitude. In the East, Abbottabad is bordered by Muzaffarabad and Rawalpindi, Mansehra in the North; to the South it is bordered by Haripur and Rawalpindi and District Haripur in the West. According to Population Census 2017, 83% of 1.3 million inhabitants of district Abbottabad live in rural areas (Census, 2017). The total area is 1,967 sq. km and is encircled by rugged terrains and mountains. Moreover, around 20% of the total area is occupied by forests, 48% by agriculture and the rest of the area is covered mostly by range land, shrub land and thin vegetation fig 1. Moreover, the Abbottabad valley is having moderate weather conditions throughout the year with hot temperature in summer and cold to mild temperature during winter. Similarly, the rugged and scenic terrain and its location at the base of Himalayas maintain the pleasant climatic conditions of the valley. Abbottabad valley is bestowed with a variety of natural resources. The inhabitants of Abbottabad depend on various livelihood sources ranging from the production of agricultural products, tourism, mining, industries of several products and

reliance on natural resources. The economic fate of the valley is heavily relied on these livelihood activities.

People living in this part of the world are very hard working. Valley's, mostly housing urban settlements provided most scenic views which have been mostly filled with building structures over a period of more than three decades reducing green impact to quiet an extent. Agriculture is the primary source of livelihood in Abbottabad as approximately 48% of land is used for farming. Local population mostly lived off the land using agriculture lands, agroforestry and cattle farming as main source of earning livelihood. LULC changes had a serious impact not only on overall serenity of the area but also posed a serious challenge for livelihood earning.
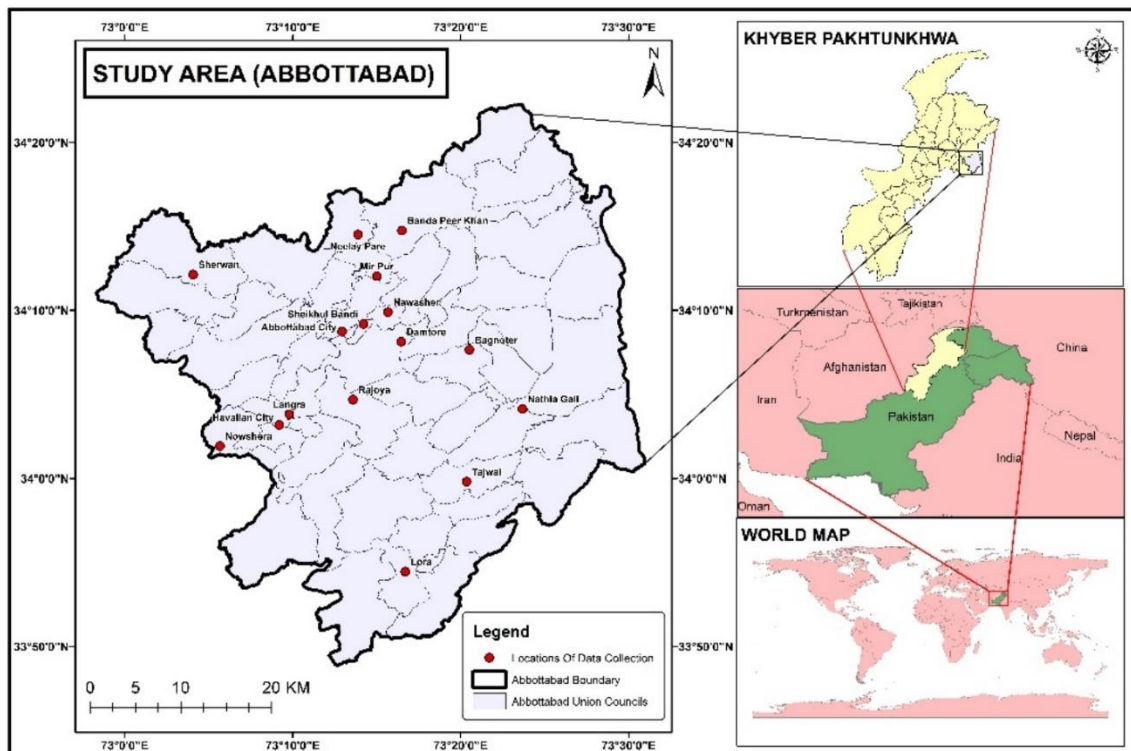

Fig 1. Map of study area

2.2. Field Survey

This study relies on mixed methods approach for data collection, where both primary and secondary data are collected. Cross-sectional primary data are collected through field survey to get quantitative and qualitative information for better understanding and interpreting the impact of LULC change. Data collection is conducted through triangulation which uses

multiple methods for studying a phenomenon or a problem. In the context of thethis study, the methods included interpretation of satellite imagery, questionnaire, interviews, and field observations. As a strategy, these methods grouped on one platform to collect information and facilitate cross checking of facts. Structured questionnaire prepared for household level survey to collect data on various aspects of LULC changes, and livelihood activities in urban and rural areas namely; Abbottabad city, Havalian city, Rajoya, Langra, Bagnoter, Nathia Gali, Tajwal, Lora, Sherwan, neelay pare, Banda peer khan, Mir pur, Nawasher, Dhamtore, Sheikul Bandi(refer to Fig.1).

2.3. Satellite Data Acquisition

Satellite images for the years 1989-2019 are collected for analyzing the spatial and temporal changes in LULC classification in the study area. Cloud-free Landsat satellite images, (Landsat 5-TM, Landsat 7-ETM+ and Landsat 8- OLI) from 1989, 1999, 2009 and 2019 are used for multi-temporal change detection(table1). Data is retrieved from the USGS Earth Resource Observation System (http://glovis.usgs.gov).

Table 1. Description of satellite images used in the study

Year	Satellite	Sensor	Path/Row	Date of Acquisition	Cloud Cover (%)	Number of Bands
1986	Landsat 5	TM	150/036	28th September	3	7
1999	Landsat 7	ETM	150/036	08th October	4	9
2009	Landsat 5	TM	150/036	19th September	1	7
2019	Landsat 8	OLI	150/036	04th September	6	11

2.4 Preprocessing and classifications

Prior to change detection, satellite image pre-processing is pivotal in to integrate the acquired data and biophysical phenomenon (Abd El-Kawaya et al., 2011). Remotely sensed data from aircrafts or satellites are typically geometrically distorted as a result of acquisition system and platform movements. Per-pixel signatures were assigned to all satellite data and the land area was divided into five different classes based on specific Digital Number (DN) value of different landscape elements before the images were geo-referenced, mosaiced and subset based on the Area of Interest (AOI). The resultant categories of classes are Agriculture, Built-

up area, Forest, Water and Barren area with distinctive recognition and color. Moreover, training samples were selected by delineating polygons around representative sites for each land use/cover class. For each of land cover types derived from satellite imagery, spectral signatures were recorded with the help of pixels covered by these polygons.

According to (Gao.J, et al., 2010) minimal confusion among the mapped land covers is crucial for satisfactory spectral signature. The maximum likelihood algorithm is applied on the images to perform supervised classification. In this type of image classification, a representative pixel of the desired class is selected by the analysts.
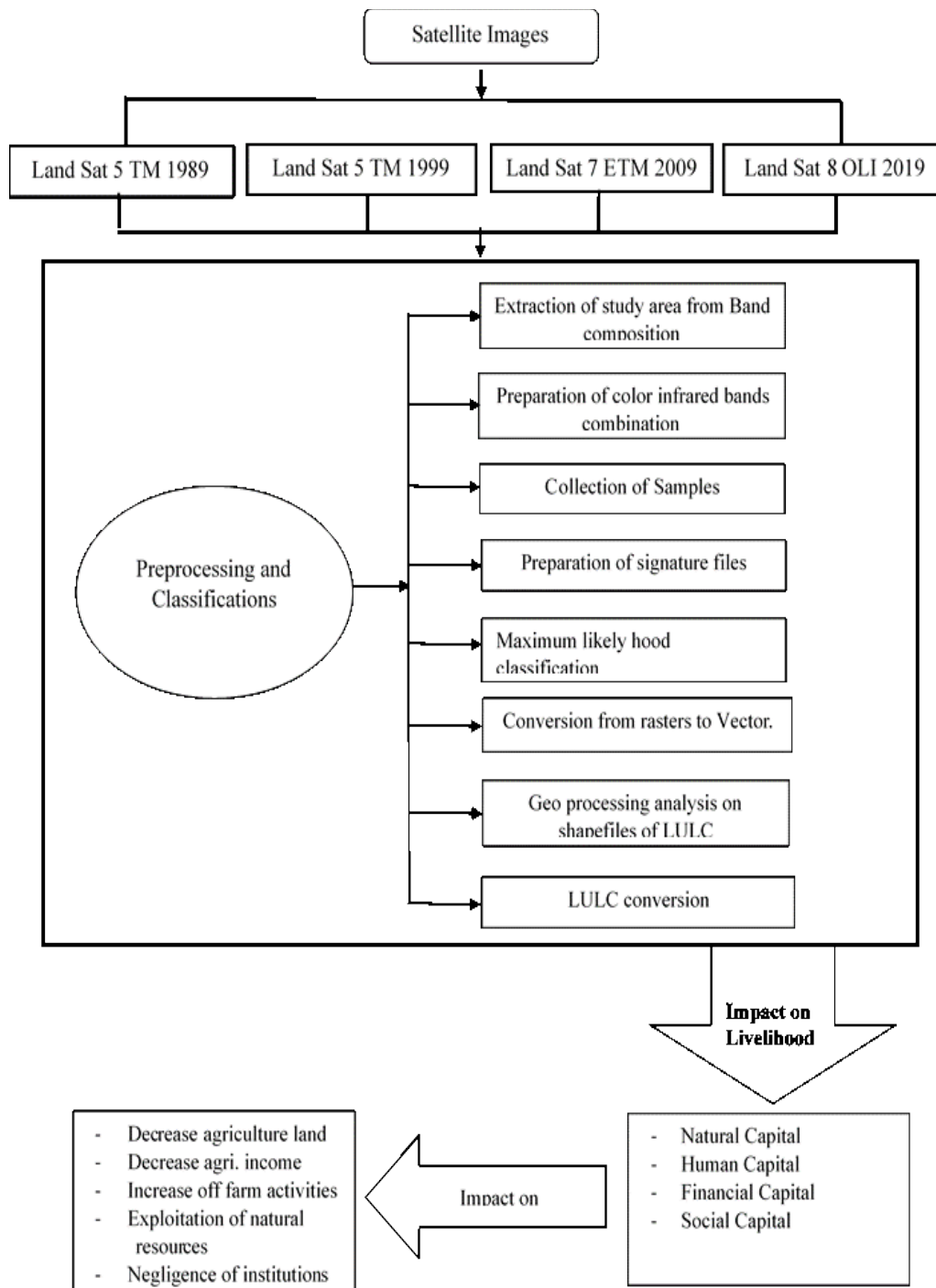
Fig 2. Analytical framework

For effectiveness and simplicity of the method as well as to improve classification accuracy and reduction of misclassifications, post-classification and refinement was employed (Harris and Ventura, 1995). The issue of mixed pixel which is common in heterogeneous mixtures of features including buildings, grass, roads, soil, trees and water was addressed through visual interpretation. Visual interpretation is important in enhancing the classification accuracy and quality of land use/cover maps produced. Therefore, reference data, indigenous knowledge as

well as visual interpretation significantly refined the results obtained using supervised algorithm (Fig.3).

2.5. Socio-economic analysis

The socioeconomic factors of LULC and their impact on livelihood of the district are examined by employing both qualitative and quantitative research designs. Further, the respondents are asked close-ended questions within quantitative research design and open-ended interviews are conducted in qualitative research design by guiding the respondents to explain the issues affecting their livelihood. In particular, the households' heads are targeted to get an in-depth understanding of the issues of LULC change affecting the study area. Lopez-Fernandez and Molina-Azorín (2011) noted that the use of both qualitative and quantitative research methods not only reflect the accurate responses of the respondents, it also provides flexible methodology in research. Moreover, descriptive and inferential statistics such as frequencies and correlation are employed to analyze the data in the form of graphs, charts and tables. The correlation is used to know the strength and direction of the relationship between dependent and independent variables.

3. Results and Discussions

The results described in this section interpret the trend of LULC change in the study area through geospatial techniques. Key socioeconomic results pertaining to livelihood interventions were analyzed in terms of five livelihood capitals. Each capital consisted of a set of variables. Moreover, correlation analysis was applied to check the relationships between variables. Furthermore, results related to the transformation of livelihood activities, changes in crop production shocks and coping strategies confronted by respondents are shown with graphical representation.

3.1. Major LULC Transformation from 1989 to 2019

Table 2 explains major LULC conversion from 1989 to 2019. Agriculture land has experienced a massive conversion to other land cover types during this period. It shows that a total of 11276.07 Ha of agricultural land has been converted into bare land, 3,221 Ha into built up area, 790 Ha into forest, 23,170 Ha into vegetation and 177 Ha into water bodies. In a similar way the bare land also witnessed conversion into other land cover types; majority of which converted into vegetation (11,869Ha)
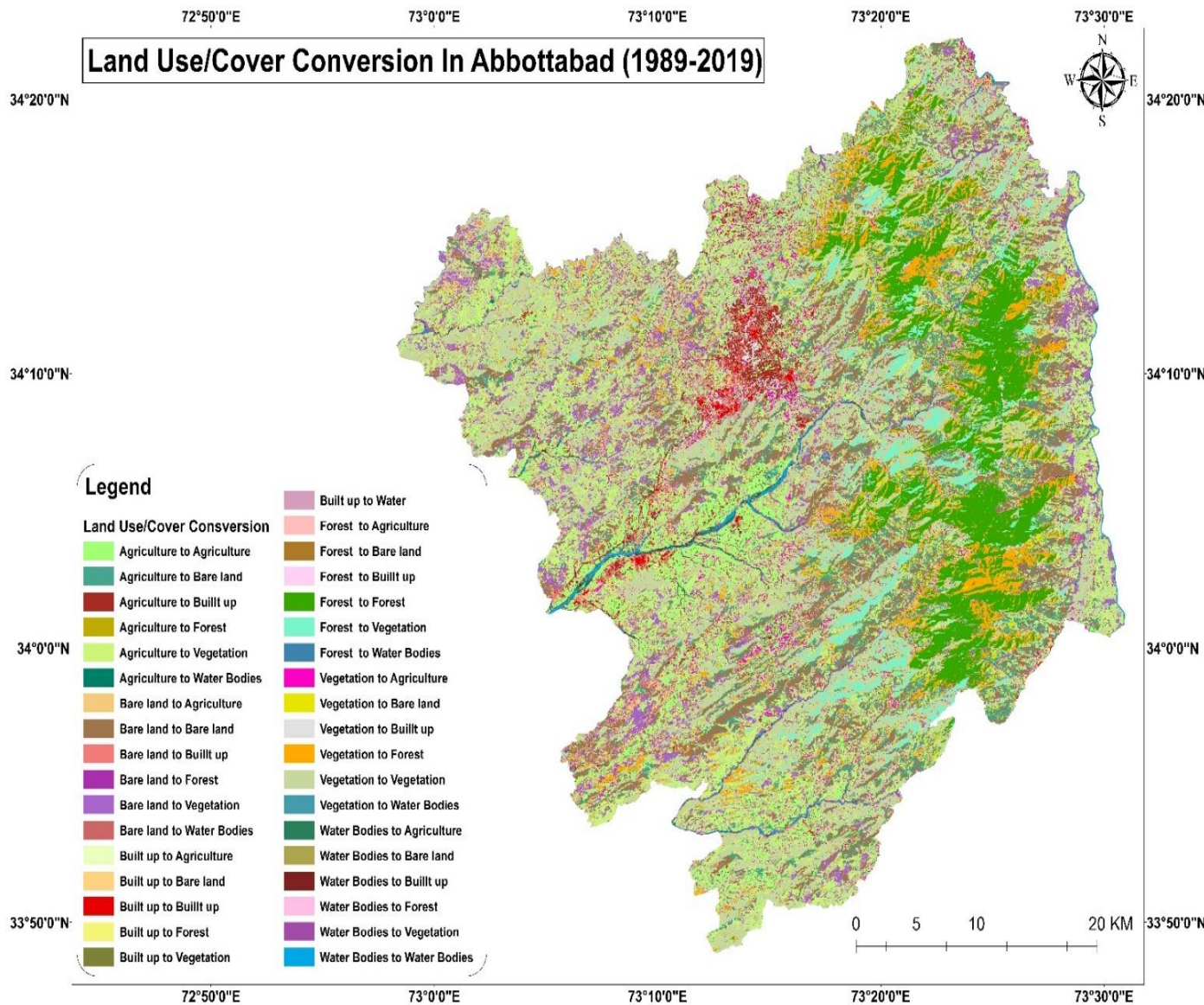
Fig 3. Major LULC Transformation from 1989 to 2019

On the other hand, a total of 230.10 Ha of built-up area was converted into agriculture, 205.50 Ha into bare land, 12.26 Ha into forest, 354.37 Ha into vegetation and 32.40 Ha into water. In the forest land, major conversion was observed into vegetation (5,056 Ha) during this period. Similarly, about 5,691 Ha of vegetation land was converted into agriculture and other land cover types. Water bodies also experienced significant conversion into other land cover types where 621.14 Ha water bodies were converted into agriculture, 96.20 Ha into bare land, 333.14 Ha into built-up areas, 65.59 Ha into forest and 747.13 Ha into vegetation**.**

Table 2. Major Land Use Land Cover Conversion from 1989 to 2019

From Class	To Class	1989-2019 Area (Ha)
Agriculture	Bare land	11,276.07
	Built up	3221.44
	Forest	790.14
	Vegetation	23,170.43
	Water	177.04
Bare land	Agriculture	6432.24
	Built up	1994.03
	Forest	453.24
	Vegetation	11869.01
	Water	120.18
Built up	Agriculture	230.10
	Bare land	205.26
	Forest	12.26
	Vegetation	354.37
	Water	32.14
Forest	Agriculture	40.76
	Bare land	30.10
	Built up	169.72
	Vegetation	5056.02
	Water	0.54
Vegetation	Agriculture	5691.88
	Bare land	2531.17
	Built up	2852.08
	Forest	1991.01
	Water	313.14
Water bodies	Agriculture	621.14
	Bare land	96.20
	Built up	333.14
	Forest	65.59
	Vegetation	747.13

3.2. Household Livelihood Capitals and Socio-economic Information

The results reveal that the average members of the household in the study area are 6.9 persons. In the recent past, the trend of nuclear family system is becoming increasingly practiced, which is evident from the quite modest family size of the households. The results have shown that the respondents' age ranged from 30 to 80 years with a mean age of 54.5, where all the respondents are the heads of household. The mean literacy of households is 91.5%. This is quite satisfactory due to the availability of better educational institutions and high literacy rate in the district. Moreover, the mean for non-farm occupation is 40.8% as people are now diversifying their livelihood to various income earning activities.

The findings also revealed that the mean land holding size of the households interviewed is 2.0%, which was comparatively lower than previous decades. Almost 90% of the respondents had less than 3 Ha of land. The responses of households regarding the natural capital showed that it still plays significant role in influencing the livelihood of people, despite the fact, that its vitality was declined in the recent past due to LULC changes. The responses of the households showed that decreased soil fertility status was 29.7%, whereas the water availability status was 45.6%. The overall natural resource exploitation was 63.8%. Furthermore, the mean income from farm activities is 18,000, whereas the mean income from non-farm activities was 56,000. Household's responses also showed that 25.4% were possessing additional assets other than their primary sources of income. Social assets also played crucial role in sustaining livelihood of the households in the study area. Household information regarding the social relations show 12.2%. Social institutions show 22.2%, whereas the networks for cooperation are 5.3%. The information regarding physical assets shows that 28.1% of the household interviewed has access to market. Similarly, 4.2% of household has access to paved road. Lastly, 81.2% of the respondents have access to water supply.

3.3. Transformation of Livelihood Activity for Three Decades

The past three decades have witnessed a rapid transformation in livelihoods for the inhabitants of District Abbottabad. This transformation was evident in the form of significant reduction in the percentage of people engaged in agriculture, livestock, and wild resource use during the study period (Tab 4). During the first decade i.e., from 1989-1990, the percentage of people engaged in agriculture sector was 42.9%. Subsequently, LULC induced changes triggered the transformation in livelihood activities from agriculture to other commercial activities exacerbated by huge migration and rising cost of land in the study area. Thus, during the period from 1999-2009, the dependency of people on agriculture sector further decreased to 29.9%. In 2009-2019 about 12.4% people were found to be dependent on agriculture sector showing a substantial decline during the period of three decades.

Table 3. Household livelihood capitals

Livelihood asset	Indicators	Scale
Human asset	Members of household (Mean)	6.9

	Age (Mean)	54.5
	Education (Mean)	91.5
	Occupation (Nonfarm mean)	40.8
	Land holding size (Hectare mean)	2.0
Natural Asset	Decreased Soil fertility status	29.7%
	Water availability status	45.6%
	Natural resource exploitations)	63.8%
	Income from farm activities (Mean)	18,000
Financial Asset	Income farm non-farm activities (Mean)	56,000
	Additional Assets)	25.4%
Social asset	Social relation)	12.2%
	Institutions	22.2%
	Network for cooperation)	5.3%
	Access to market	28.1%
Physical asset	Paved road)	4.2%
	Water supply	81.2%

During the study period, the percentage of people engaged in livestock also decreased up to a greater extent due to massive decrease in their natural habitat and wild pastures catalyzed by LULC changes. In 1989-1999, about 18.4% inhabitants of the district were engaged in the livestock sector, while in the last decade i.e., 2009-2019 the percentage of people engaged in livestock sector was recorded at 6.8%. Wild resource use also experienced a decrease from 6.2% during 1989-1999 to 4.3% during 2009-2019. Contrary to agriculture, the dependency of people on remittances, rentals and pensions increased substantially during this period. The percentage of people dependent on remittances went up from 2.2% during 1989-1999 to 4.9% in 2009-2019. Due to rapid construction activity and a boost in real estate business the dependency of people on rentals increased from 1.1% in 1989-1999 to 14.9% in 2009-2019. Likewise, the reliance of people on pensions also rose from 0.7% in 1989-1999 to 7.8% in 2009-2019. During this period the ratio of employment in government and private sectors also surged rapidly, where the percentage of people engaged in government went up from 11.1% during 1989-1999 to 13.4% in 1999-2009, while in 2009-2019 the percentage of

government employment was recorded at 18.9%. The percentage of self-employment increased from 10.7% in 1989-1999 to 19.5% in 2009-2019. Due to shortage of agricultural land and the associated decrease in natural resource use the inhabitants of the study area witnessed a diversification in their livelihood activities as obvious from the increase in self and wage employment during this period. The wage employment also increased from 2.5% during 1989-1999 to 5.8% during 2009-2019. Lastly, the percentage of people engaged in business as a source of livelihood increased from 4.3% in 1989-1999 to 12.7% during 2009-2019. Overall, the study area experienced a transformation in livelihood from agriculture sector to the services sector during the last three decades. One of the major reasons responsible for this transformation is shrinking of agricultural land and reduced productivity in the study area. In addition, increasing water scarcity coupled with the division of agricultural land has significantly affected the agricultural production, which has compelled the people to shift their livelihood from agriculture to other sectors.

The perceptions of respondents and their life experiences about the transformation of livelihood activities during the study period revealed quite interesting facts. Key informant interviews with households also showed reduction in agriculture, livestock and wild resource use, while a substantial increase in government and self-employment, pensions, and dependence on remittances as source of livelihood. During key informant interviews with households, most of the respondents stated that;

Table 4. Transformation of livelihoods

Livelihood Activity	1989-1999 %	1999- 2009%	2009-2019%
Agriculture	42.9	29.9	12.4
Livestock keeping	18.4	14.2	6.8
Wild resource use	6.2	4.1	4.3
Remittances	2.2	2.4	4.9
Rentals	1.1	5.5	14.9
Govt employment	11.1	13.4	18.9
Self-employment	10.7	13.9	19.5
Wage employment	2.5	3.8	5.8
Pensions	0.7	3.8	7.8

Business	4.3	6.9	12.7

"Almost 30 years back, we used to extract major portions of our earnings from farming and livestock rearing by selling our produce in the nearby markets. As of now, very few people in the area do farming due to shrinking agricultural lands and other natural resources and it fulfills only the subsistence needs of the farmers".

Likewise, the households tend to diversify their livelihood when they see that their previous sources are no more practicable. This diversification was obvious in a shift from agriculture to other activities.

"Majority of the households who previously relied heavily on natural resource use were now engaged in government and self-employment. Some of them also stated that population growth and migration were the main factors for conversion of agricultural land into built-up area, which resulted in the rising prices of these lands and decreased agricultural production. Thus, we have to search for livelihood sources other than natural activities as majority of the people in our area are now working as government or private employees. Some of the respondents also depended on pensions, remittances and rentals".

3.4 Impacts of LULC Changes on Major crop production

Analysis of primary data collected through questionnaire from the households revealed significant reduction in agricultural land and crop production between 1989 and 2019. The perceptions of households during the survey shows decline in agricultural land and crop production during the study period. Moreover, the household survey also revealed that the major determinants of decline in crop production include high cost of agricultural inputs, lack of finance for inputs, soil infertility and unreliable rainfall patterns. The ratio of various crop production in the last 30 years in District Abbottabad is shown in (Fig 4). It shows that wheat production was 28.2% in 1989-1999 which increased up to 30.7% during 1999-2009 and stood at 35.1% during 2009-2019. The production of maize was recorded at 24.1% in 1989-1999. In 1999-2009 the maize production experienced a slight growth and stood at 26.9%. During 2009-2019, the production of maize was 29.1%. In 2009-2019, Vegetables' production has also increased from 23.3% to 31.2% in the last three decades. Similarly, in 1989-1999 the production of peanuts was 0.8%, while in 2009-2019 it went up and recorded at 1.5%.

On the other hand, the production of pulses, peanuts, fruits, and rice has decreased in the last three decades. Pulses' production was about 14.2% during 1989-1999 which dropped to 3.1% during 2009-2019. The production of fruits also experienced a reduction of about 6% due to decrease in rain-fed area because of climatic changes and resultant LULC changes. In 1989-1999 the fruits production in the study area stood at 6.3% which went down to 0.7% in the 2009-2019. In the same vein, rice production decreased from 3.3% in 1989-1999 to 0% during 2009-2019.
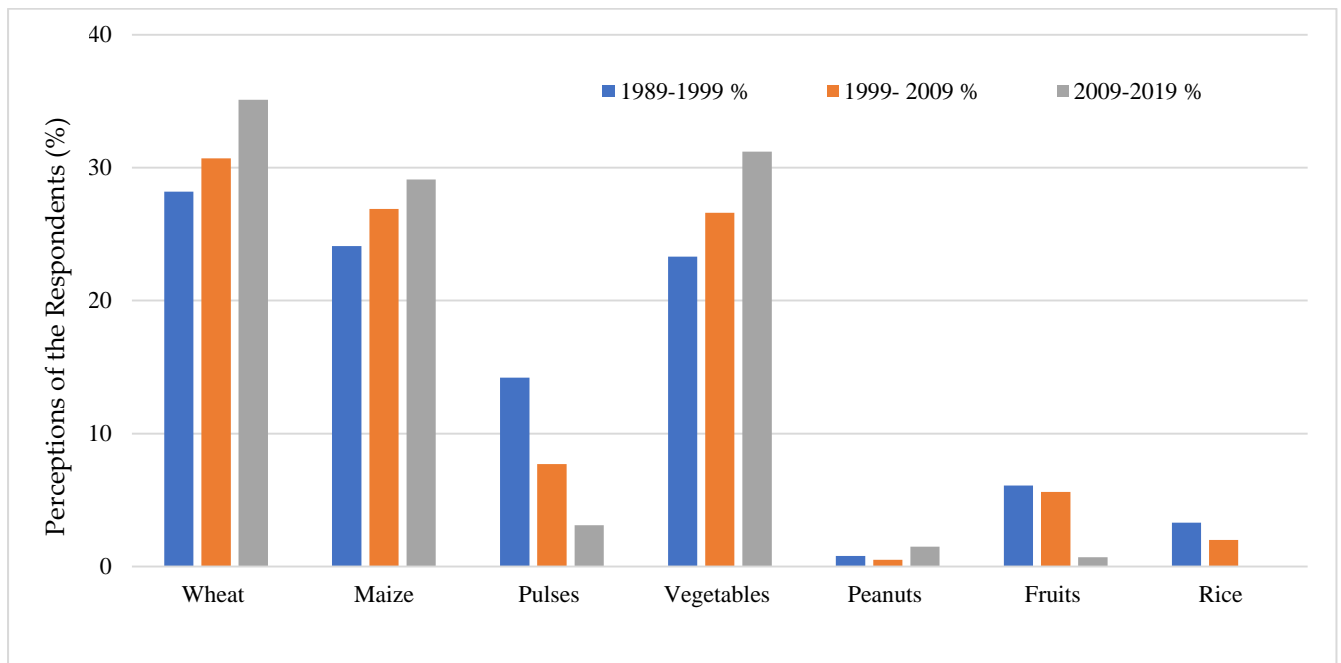

Fig 4. Major cropes cultivation

Overall, the study area has experienced an increase in the production of maize, wheat, and vegetables, while a reduction in production of pulses, fruits, and rice. This is because, majority of the people have shifted their focus from producing the latter crops as the study area is mostly rain-fed while due to climate change the ratio of rainfall has reduced rapidly. Most importantly, the production in the study fulfills only the subsistence need of the households in the study area.

Reduction in agricultural land coupled with climatic changes such as reduction in rainfall, changes in weather conditions, high costs of inputs and lack of finance significantly affected various crop production in District Abbottabad. The subjective experiences of households during key informant interviews confirmed the quantitative information discussed above. The respondents of the households regarding decrease in major crops are categorized as;

"Our primary produce in this area was fruits and rice, and it was sufficient for satisfying not only our subsistence needs but also we were able to earn significant amount from this production. In the past few years, reduction in rainfall and soil infertility due to various reasons has seriously affected the productivity of such crops. Additionally, we do not possess the quantity of land we used to 20 or 30 years back, which has left our production to meet merely the subsistence needs of our families".

Similarly, these issues were responsible for a shift from production of fruits, pulses and rice to the vegetables, wheat and maize. Majority of the respondents stated that;

"Those of us who have cultivable lands tend to grow vegetables and wheat etc, due to the ease with which these crops are cultivated as compared to fruits and rice".

3.5. Main socio-economic factors of LULC

The fig 5 shows the impact of socio-economic factors of LULC on livelihoods in district Abbottabad through the decrease in agriculture and increase in built-up areas. About 11.2% respondents stated that agricultural activities were the major factors of LULC influencing livelihoods in the study area. While two-third i.e. 29.1% respondents viewed residential buildings, 14.2% stated commercial activities, 7% viewed land tenure systems and 7.3% respondents stated that industrial activities are having significant impact on livelihoods in district Abbottabad. In addition, 31.2% stated that cultivation to off-farm income sources was the main factor of LULC affecting livelihoods in district Abbottabad.
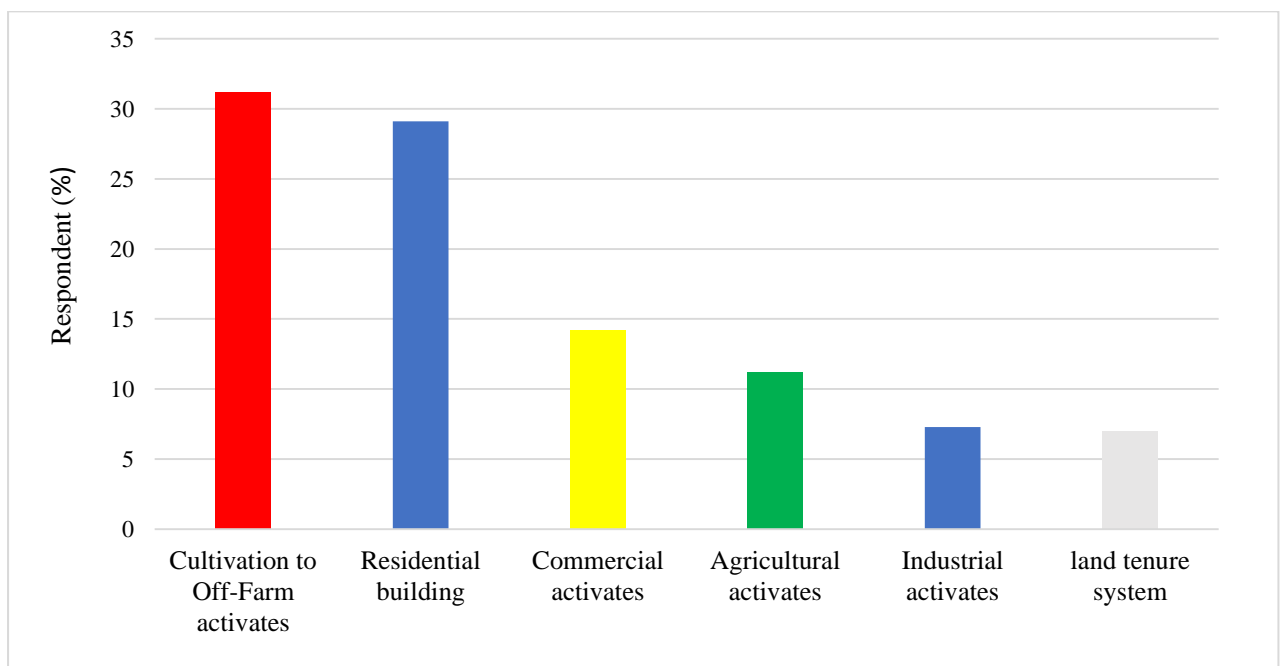
Fig 5. Main socio-economic factors of LULC

The perceptions of households revealed several social and economic factors of LULC which affected their livelihoods. Majority of the respondents stated that;

"Keeping in view the rapid decrease in agricultural land, we are left with no options but to adopt a diverse sources of livelihood as one can see that most of the residents in this area works in different sectors ranging from government, private sector and remittances".

Similarly, some of the households during key informant interviews expressed that;

"As a result of growing population, the demand for land for commercial activities and residential buildings has grown exponentially, which has affected not only the income sources on which people used to depend but also the LULC pattern in our locality".

3.6. Shocks Experienced by Communities

The findings show that more than 50% of the households in rural areas lost their livelihood and experienced marked decrease in their income. Fig. 6 presents the shocks experienced by respondents in past three decades. About 24.6% respondents stated low rainfall a major shock they experienced in this period. While 16.5% viewed decrease in crop productivity was the major shock suffered by them. In a same way, 17.1% respondents attributed major shocks to water issues and 15.5% to loss of livelihood activities. Land degradation and over exploitation were cited by 10.2% and 7.6% respondents, respectively. While 8.0% viewed deforestation and 0.5% respondents said that earthquake of 2005 was the major shock which affected their livelihood. The study area experienced several shocks during the last three decades. Household's interviews revealed that the earthquake of 2005 was the most catastrophic shock followed by LULC pattern change, low rainfall, decreases crop production, water problem, land degradation, over exploitation, deforestation, and land price hike. These shocks resulted in the loss of livelihood and a significant reduction in income earning opportunities particularly among the rural households in the study area.
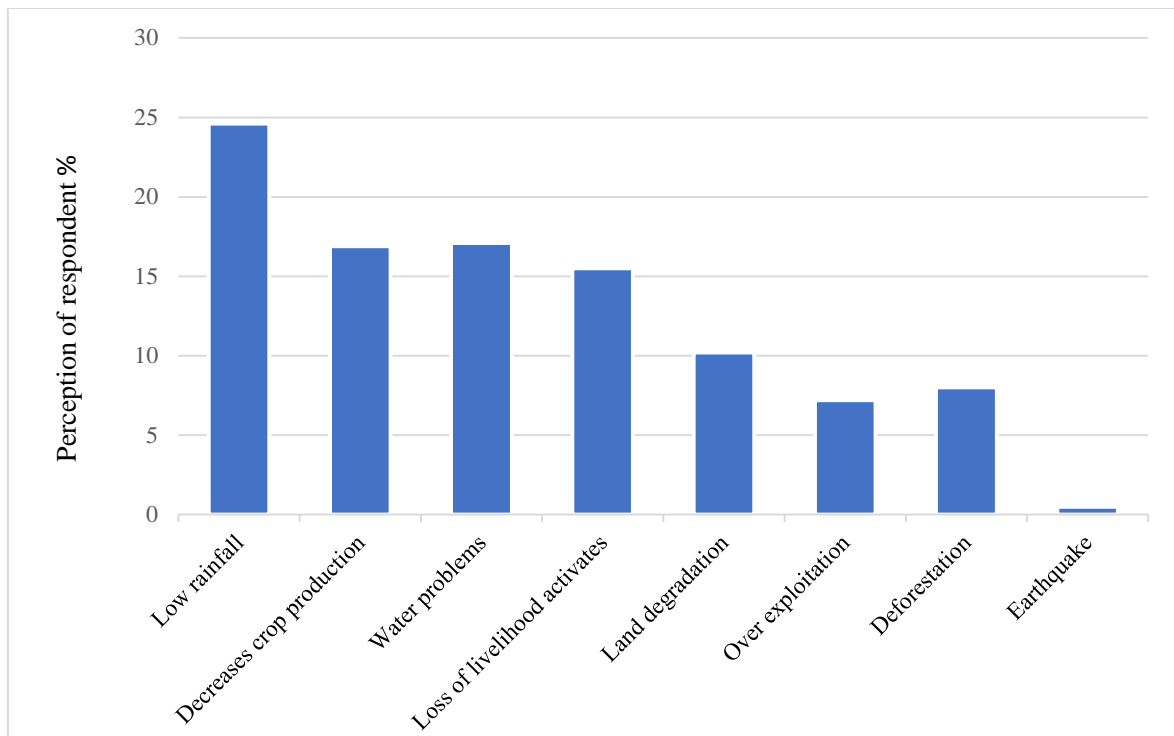
Fig 6. Major shocks experienced by respondent in past three decades

3.7. Coping Strategies Used to Counter Shocks Experienced by Communities

Fig. 7 shows the major livelihood coping strategies adopted by households in the study area during the last three decades. It shows that 37.2% households adopted migration to diversify their livelihood. 19.2% sold agricultural land they owned to increase their livelihood resilience. Similarly, 8.3% respondents sold their livestock. On the other hand, 18.6% households entirely shifted their livelihood mechanism from one source to another as a coping strategy. While 0.7% relied on the government's aid to build their livelihood resilience and 1.5% households actually reduced their expenditures. Lastly, 14.5% households depended upon their existing assets to cope and recover from the shocks they suffered. The predominant livelihood coping strategies to counter the LULC related shocks which have been adopted by the residents of District Abbottabad. It was found during the interviews that most of the respondents relied on own assets in the study area sold their agricultural land, crop, livestock, and conversion of agricultural land into commercial land to counter the shocks they experienced.
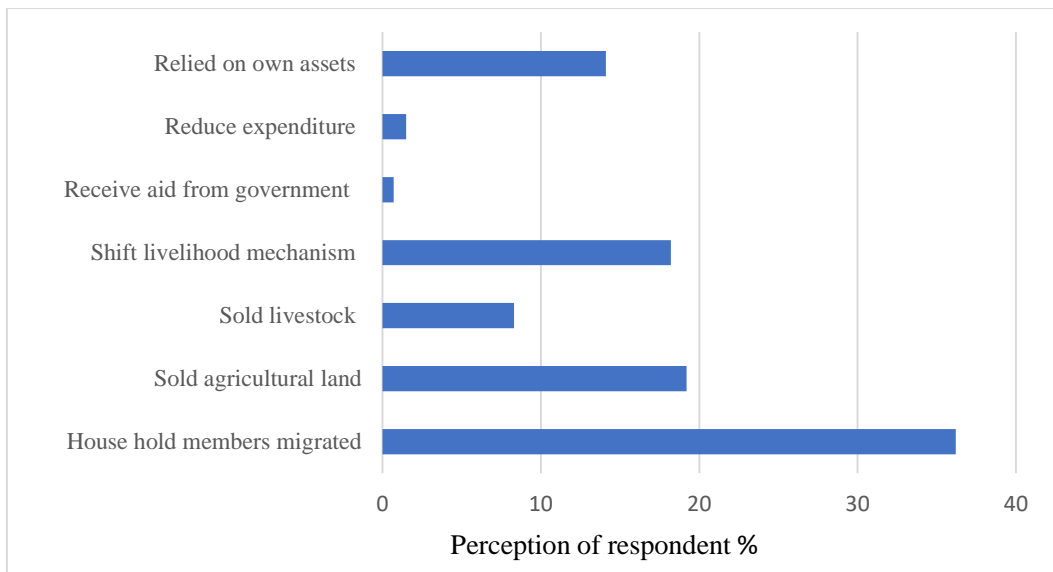
Fig 7. Household livelihood coping strategies

During interviews with households, various coping strategies adopted by the inhabitants of District Abbottabad were revealed in order to counter short and long-term shocks. The inhabitants of the valley resorted to a diverse range of coping mechanisms which include migration, shift in livelihood sources, reduction in expenditures, selling of agricultural land and livestock and government aid. Most of the households maintained that;

> *"Agriculture and livestock rearing remained to be major source of our livelihood, but its significance has declined rapidly as we cannot depend entirely on this sector. Therefore, most of inhabitants have sold their lands and livestock to start either businesses or build residential buildings for self or rental purposes".*

In the same way, some of the households also stated they had reduced their expenditures due to the associated shocks and financial crises. Migration was the important coping strategy adopted by majority of the households to recover from the shocks they had experienced as result of LULC changes. This included both internal (within district/country) and external (Outside country) migration in search of livelihood. According to respondents from rural area;

> *"Majority of the households in our area migrated to urban areas of the district in search of livelihood and are now engaged in various off-farm activities. Most of the individuals from our community also emigrated to overseas especially Gulf states and are now supporting their families back home by sending remittances".*

Likewise, there were still households who depended on their own assets such as land, residential buildings for rentals purposes and businesses to cope and recover from shocks.

3.8. Correlation analysis between LULC change variables

The correlation analysis shows negative relationship between population and natural resource with shifting of livelihood mechanism significant at 1% and positive while relationship with urban expansion and land use change pattern are positively significant at 5%, because rapid increase in population has direct impact on available resources. Consequently, resources versus needs create an imbalance, thus taxing the existing system which paves the way for alternate arrangements. This phenomenon leads to internal displacement of rural population to urban areas. Moreover, age old means of earning livelihood through agriculture is the primary activity coupled with other means adopted to meet essential requirements of households. The results reveal that the relationship between land use change patterns with shift of livelihood is positively significant at 1% and negatively significant with Highland prices at 5%. The major reason is the abrupt land use changes in the study area.

Agriculture is negatively significant at 1% which shows the strong relationship with urban expansion. Most of the agricultural lands are being converted into built-up areas with new roads and tracks which has adversely affected agriculture practices. The shrinking of agricultural land both in rural and urban areas have led to considerable reduction in agriculture production.

Rent out land is negatively significant at 10% and shows the weak relationship but positive and significant relationship with shift of livelihood activities at 5% due to increase in population and urbanization has exacerbated the cost of living in the study area. Agriculture land is increasingly being converted into residential areas and new buildings to accommodate more influx, thus forcing the people to search for other means of livelihood.

Table 5. Correlation analysis between LULC change variables

	1	2	3	4	5	6	7	8	9	10	11	12
1. Population	1											
2. Natural conditions	-.753**	1										

3. Urban expansion	.424**	-.181*	1								
4. Changes land use patterns	.578*	.027	.199*	1							
5. Shift livelihood mechanism	.614**	-.047	.121	.847**	1						
6. High Land price	.017	.111	-.019	-.481*	-.042	1					
7. Agriculture decline	.075	.042	-.004	.110	.075	-.125	1				
8. Trade	.039	.067	.061	.098	.022	-.014	.033	1			
9. Agriculture	-.061	.042	-.618*	-.017	-.001	.127	-.029	-.067	1		
10. Remittances	-.147	-.107	-.172	.112	-.014	-.201*	-.109	-.057	-.119	1	
11. Rentals	.509**	.025	.157	.158	.209*	.210*	.036	.063	-.076	-.124	1
12. Self-employment	-.013	-.027	.146	-.724*	-.089	-.167	.053	-.055	-.258**	-.406*	-.037	1

Self-employment is negatively significant with land use change pattern at 1% which shows the strong relationship while positive least significant at 10% and negatively significant with remittances at 5% which shows the weak relationship. Initially people's domestic earning through self-employment was not sufficient to meet livelihood requirements thus forcing people to search for other means. Furthermore, natural conditions have negative relationship at 10% but significant urban expansion has negative relationship with land use pattern at 10% showing the weak relationship as some of the locals have adopted small businesses of their own by selling their share of land and resorted to self-employment as a source of livelihood. Urban expansion triggered several social issues besides taxing available resources and amenities. It totally changed the natural environment by reducing green areas and cutting trees. Resultantly, unplanned urban expansion and lack of town planning not only led to critical environmental challenges but also unprecedented spike in prices of land which compelled the people to sell their land for good money.

5. Conclusions

Land use and land cover change and its related effects are an extensively debated issue among researchers and development practitioners. This issue has attracted the attention of academia and policymakers particularly in the rapidly urbanizing countries like Pakistan, because of its wide-ranging impacts on environment and livelihoods. The study focused on monitoring the changes in LULC for three decades from 1989 to 2019 using satellite images. Results of spatial analysis data show past three decades is indicative of reduction in

agriculture land and increase in built up areas with infrastructure development surrounding urban areas of district Abbottabad. Consequently, all the urban areas and the suburbs are witnessing shrinking agricultural land due to new settlements and infrastructure development. This fast shrinking of land is resulting in depletion of agro production, which will have serious impacts on livelihood activities.

The analysis of primary data showed that farming was the principal source of livelihood for majority of the inhabitants with high coupled with high influx of migrants who quest for land property and agriculture. The study revealed that Local population was somehow forced to convert agriculture land into building structures for living and commercial purposes. This change was triggered due to enormous increase in population which needed additional shelters and price hike in real estate motivated the marginalized households to sell their land for earning better livelihood. At the same time, earning livelihood emerged as a serious challenge for many low-income large families. Thus, LULC change had serious implications for livelihood generation to many households mainly, due to decrease of agriculture land coupled with low yield production. Previously, food requirements of most of the population was met from agriculture farms and additional family support needs were met by selling the livestock which had affected local population during the period of study. Moreover, livelihood earning was taxed due to lack of resources as feeding animals became a grave issue due to bear animal's pasture lands which had shrunk with the passage of time. Resultantly, majority of the people migrated to urban regions of the district to find better means of earning livelihood.

Reduction of agriculture land forced people to look for diverse means of non-farm livelihood activities like small businesses, government jobs, rent out their houses and rely on remittances. Overall, these changes resulted in different socioeconomic activities in district Abbottabad. District Abbottabad experienced number of jolting shocks affecting livelihoods of area. The major LULC changes occurred due to devastating earthquake of 2005 coupled with other changes including low rainfall, low yield from different crops, water shortage, land degradation, over exploitation of forest land and price increase of land triggering livelihood earning issues. Furthermore, existing livelihood earning opportunities were taxed by the new influx of migrants. Study of the area suggests serious changes to mitigate livelihood challenge besides fast moving LULC changes due to weak law enforcement, lack of planning for urban expansion. Policy makers must undertake serious efforts to meet the challenges surfacing due speedy LULC changes. Urban expansion must be checked through rules and

regulations. New strategy must be worked out to create different livelihood earning opportunities. Future researchers must focus on social issues emerging due to these changes.

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