Land Use and Land Cover Change: A Study of Butwal Sub-Metropolitan City, Nepal

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Abstract

This thesis examines the changes in land use and land cover that have occurred in Butwal city, Nepal, from 1999 to 2021. To conduct this analysis remote sensing and GIS techniques were used. The study evaluates the spatial and temporal patterns of land use and land cover changes. Along with this, the thesis views factor such as migration and the role of remittance in land use and land cover. The thesis also investigates the impact of governance policies on land use and examines the strategies used to manage land use and land cover.

The research findings indicate that Butwal city has undergone significant land use and land cover changes over the past two decades, with a doubling of built-up areas within the valley. However, there has been a considerable loss of water bodies and barren land, while the vegetation area has seen only slight changes. The study also highlights that immigration has played a significant role in land use changes in the area. Interestingly, the findings suggest that remittances do not have a direct impact on land cover.

The study recommends the implementation of formulated plans to manage land use and land cover effectively. These findings provide valuable insights into land use and land cover dynamics in Nepal and the complex relationships between human activities and environmental change in rapidly urbanizing areas. Policymakers and planners can use these findings to develop sustainable land use and land cover management strategies for developing cities.

Keywords: Urbanizations, Migration, Remittance, Policies, Remote Sensing

Acronyms and abbreviations

AI	Artificial Intelligence
ARD	Analysis Ready Data
CBS	Central Bureau of Statistics
GDP	Gross Domestic Product
GIS	Geographic Information System
GoN	Government of Nepal
IOM	International Organization for Migration
KVDA	Kathmandu Valley Development Authority
LGOA	Local Government Operation Act
LLRs	land and land resources
LUIS	Land Use Information System
LULC	Land Use and Land Cover Change
LUP	Land Use Policy
LUPs	Land Use Plans
LUZs	Land Use Zones
MOCTCA	Ministry of Culture, Tourism, and Civil Aviation
MoF	Ministry of Forest

MOFE	Ministry of Forests and Environment
MoICS	Ministry of Industry, Commerce, and Supplies
MoLMPA	Ministry of Land Management, Cooperatives, and Poverty Alleviation
MoLRM	Ministry of Land Reform and Management
NLUP	National Land Use Policy
Q-GIS	Quantum Geographic Information System
SCP	Semi-Automatic Classification Plugin
SLUZs	Specific Land Use Zones
USGS	United States Geological Survey
VDCs	Village Development Committees

1 CHAPTER I: INTRODUCTION

1.1 Background

Land resources are defined as distinct properties with both physical and economic characteristics, ranging from geological resources to biodiversity. Land essentially has a spatial component that serves as a starting point for development planning that leads to regional and urban planning. Land use and land cover are closely related to the evolution of urban or urban-oriented regions'-built environments and growth centers in both the regional and urban planning paradigms (Chand, 2019). Land-cover change occurs when one cover type is replaced by another, such as in the extension for agriculture, urbanization, and deforestation. The reasons for which humans exploit land cover are termed land use. It encompasses both the method by which land's biophysical qualities are altered and the aim behind that modification (Lambin and Geist, 2006).

The land offers a variety of ecosystem services. Provisional services (shelter, food, etc.), regulating services (water purification), sustaining services (various carbon and nitrogen cycles), recreational value, and economic value are all provided by land (landscape and its beauty) (Paudel et al., 2016). As a result of urbanization, natural land covers are being replaced by urban materials (Fu and Weng, 2016). Demands for urban commodities, particularly the impact of quickly increasing cities, have resulted in significant land-use/cover change (Lambin and Geist, 2006). In the scenario of developing countries, they have undergone considerable urban expansion during the last two decades (Wandera, 2014).

Although urbanization is a global phenomenon, the rate of urbanization in developing countries is more rapid. Local governments and urban planners can benefit greatly from information on urban growth, land use, and land cover change studies to improve plans for the city's sustainable development. Rapid changes in land use and cover, particularly in developing countries, are often characterized by uncontrolled urban expansion, land degradation, or the transformation of agricultural land, as well as deforestation, which has tremendous environmental costs. This type of shift has a significant impact on the local and/or regional environment, which in turn has an impact on the global environment (Hegazy and Kaloop, 2015).

Many of the observed phenomena that are responsible for changes like landscape changes, landscape fragmentation, changes in ecosystems, climatic changes, urbanization, and LULC changes, based on sustainable development, require Land Use and Land Cover Change (LULC) research. The phrase 'LULC change' refers to the alteration of the terrestrial environment by humans (Nath et al., 2018).

1.2 Rationale

Nepal's key land-related concerns include increasing population, unmanaged settlements, land encroachment, conversion of cultivable lands into residential areas, and land conflicts (Shrestha, 2020). Land use and land cover change are considered one of the important components in contemporary strategies for managing natural resources and monitoring environmental changes in this setting of expanding urbanization (Hegazy and Kaloop, 2015).

Monitoring of land use change is critical because it aids the understanding of the relationships between human and natural events, leading to better natural resource management and usage (Pasha et al., 2012). Land use rules and standards are critical criteria in the implementation of any project, whether it is a small-scale project of rural infrastructure development in small towns or a new town development project targeted at urban land development. In the foundations of planning practice, development planning is supposed to guide acceptable land use patterns and vice versa (Chand, 2019).

In Nepal, the legislative practice of land use and zoning restrictions has not been strictly followed, resulting in difficulty in land management (Chand, 2019). One of the general examples of ineffective land management practice is the invasion of public open spaces, in addition to the deterioration of local authorities' administration and public land. Some of the squatters, who have been affected by natural calamities like landslides and floods, have taken over protected places owned by different religious trusts, including national parks, grasslands, and community woods (Chand, 2019). Similarly, migration from rural to urban areas for various reasons, as well as extraordinary investment in urban real estate, has created a severe regional imbalance in Nepal's

economy, putting land use rules and regional and urban development strategies to the test (Chand, 2019).

Only through a modern Land Use Policy (LUP) can the country achieve food security, environmentally friendly development projects, secure human settlement, and planned urbanization, as well as a sustained and inclusive economic boost. Land use policy refers to the limitations and preservation of land and land resources (LLRs), as well as their optimum use and effective management. This Policy governs the legal and institutional administration of Lands and Land Resources (LLRs), as well as their protection, use, and management (GoN, 2015).

In the context of Nepal, land use policy aims for different policies for the management of cultivated land, forestry, protection of the habitat of wild creatures, management of urbanization, and other aspects of the land. In 2015, a new Land Use Policy was enacted. Encroachment on the agricultural lands, forests, government, and public lands, and various natural resources is rampant these days in Nepal, owing to rapid population growth, internal migration, and unmanaged and rapid urbanization, among other factors, and the protection of these resources has become a challenge (Chand, 2019).

Most of the research on land use and land cover due to urbanization is carried out in Kathmandu, for instance, Shrestha and Acharya (2021) studied historical and future land-use and land cover changes in Kathmandu valley. Similarly, (Wang et al., 2020) did research on land use and land cover change detection and prediction in the Kathmandu valley. There should be detailed research on how land is being used and its pattern of change in developing urban cities like Butwal. People might not be aware of the upcoming consequences of land changes and in most cases, they are solely concerned with maximizing the land's utility (Paudel et al., 2016). There should be an in-depth study on the factor that results in land use and land cover change such as the role of internal migration and remittance can be investigated. In general, research on land use and land cover change is necessary for efficient land use planning, development of policies, and sustainable resource management.

1.3 Objective

The broad objective of the study is to analyze the land use and land cover change of Butwal Sub-Metropolitan city, Nepal.

The specific objective of the study is as follows:

- To examine land use and land cover change by examining the geo- spatial data of two periods (2000 and 2020).
- To examine factors resulting in land use and land cover change.
- To analyze the source of income and land ownership in Butwal sub-metropolitan
- To investigate the roles and responsibilities of current land use policies and plans.

1.4 Research questions

- What is the current state of land use and land cover change?
- What is the condition of migration in the study area?
- What is the role of remittance on land use change in Butwal Sub-metropolitan city?
- What are the land use-related policies and plans?

1.5 Limitations of the study

Access to data: It was difficult to get precise and trustworthy information on migration and remittance revenue for a city. In many cases, the data that was provided was focused on broader administrative areas, such as districts, which made it challenging to understand the details of migration and remittance trends within a particular city.

Spatial resolution: Due to the low spatial resolution and a high percentage of cloud coverage, it was challenging to get precise remote sensing data. As a result, it was difficult to identify tiny changes in land use and land cover. For instance, in the remote sensing data of 1999, there was no availability of band 6.

Multiple causes: A variety of social, economic, and environmental factors have an impact on how land use and land cover vary. Here, a particular reason is researched. Comprehensive research on other factors influencing changes in land use and land cover is yet to be studied.

2 CHAPTER II: LITERATURE REVIEW

2.1 Concept of land use and land cover change

Land encompasses all aspects of a natural occurrence including landforms and soils, as well as climate and vegetation, as well as existing forest production methods and practices in the crop, livestock, forestry, and fisheries sectors. The phrase 'land' cover refers to the physical qualities of the land's surface that can be seen directly. Land use, on the other hand, refers to the economic and social uses of land, as well as how humans exploit land cover (Khatiwada, 2019).

The natural land covers have been influenced and modified by rising anthropogenic demand on the ecosystem, leading to the alternation, deterioration, and fragmentation of habitat (Pasha et al., 2012). Changes in land use can have a significant impact on ecosystem services. Conversion of native grasslands, forests, and wetlands into croplands, tree plantations, and developed regions has resulted in massive increases in food, fuel, housing, and other commodity production, but at the expense of numerous ecosystem services and biodiversity (Lawler et al., 2014).

Conversion of valuable agricultural land and semi-natural ecosystems to built-up areas, results in negative ecological consequences such as habitat degradation and fragmentation. The significant consequences of rapidly shifting spending habits in accommodation, transportation, and leisure have intensified, amplifying harmful environmental trends. The landscape is a highly dynamic system, with natural and socially integrated processes being greatly influenced by change (Izakovičová et al., 2017).

2.2 Land cover change and land use policy in Nepal

Land Use Policy (LUP) is a multidisciplinary policy statement that addresses social, economic, political, and legal as well as the planning issues in the developmental phase. Through land classification, correct usage, and effective management, the policy intends to maximize the utilization of land resources and long-term benefits of Land and Land Resources (Shrestha, 2020).

In a study of land management problems in Nepal by Chand (2019), it was described that in Nepal's rural and urban regions, problems with land management have unexpectedly become a particular difficulty in spatial planning. Chand (2019) has explained this has in turn, led to new problems with land governance, so a dialectical approach is required to identify and remove the unwelcome barrier that stands in the way of sustainable land management and sustainable urban growth (Chand, 2019).

Only through a modern Land Use Policy (LUP) can the country achieve food security, environmentally friendly developmental projects, provides secure human settlement, and organized urbanization, as well as bring sustainable and inclusive benefit to the economy (GoN, 2015). In Nepal, land and land resources have been exploited due to unmanaged settlements, overcrowding, croplands for residential use, deforestation, and other factors. Land Use laws have been created by Nepal's Ministry of Land Management, Cooperatives, and Poverty Alleviation as a necessity to eliminate such land risks and initiate a systematic approach to land. The current policy focuses on the development of land use systems through land use plans, and it has divided the land into eleven zones for better management and understanding (Shrestha, 2020).

Although Nepal's traditional land management system dated to the 1870s, the Land Survey and Measuring Act, which was passed in 1962, was the first legislative tool to be used for contemporary land management in Nepal. Eighth Five Year Plan (1992/93-96/97), which designated the land use plan as a long-term foundation program to address the issues in land management, marked a significant turning point in land use planning in Nepal (Chand, 2019). Ever since these efforts for planned development started, the urban sector has received considerable emphasis from Nepalese policymakers. The "Planned development" strategy is crucial because the urban sector has a great contribution to the GDP, which is approximately around 60 percent. Also, the average income in cities is 4.5 times higher than in rural areas (Karki, 2004). In addition, cities have served as centers of excellence for education, health care, innovation, entrepreneurship, business, commerce, industry, culture, and social services, as well as large markets for a variety of goods and services and nodes for transportation (Mandal, 2014).

2.3 Existing knowledge in land use change due to urbanization

Urban populations worldwide expanded from just 751 million in 1950 to 4.2 billion in 2018, accounting for 55% of the world's population. In the case of Nepal, during 1952/1954, 2.9% of Nepal's population lived in urban areas, and by 2017, that number had risen to more than 50%. Among three geographical regions, high population densities were found to be in Terai (Rijal et al., 2020). In a study carried out by Rijal et al. (2020), it was observed that urban area is expanding and around 93% of new urban area are formed on a cultivable area. Rijal et al. (2020) discussed how socioeconomic factors, particularly migration-driven population increase, and the economic opportunities provided by urban regions, were thought to have contributed most to urbanization (62%) and were followed by political factors (14.5%), physical factors (12%), and planning and policy factors (12%) (Rijal et al., 2020).

The pattern of historical urban expansion along with future urban expansion was studied by Rimal et al. (2020) and through LULC simulation it was revealed that two significant land-change transitions that are unique to western Nepal, namely fast urban growth and decline of the agricultural land. Rimal et al. (2020) claimed that urban growth does not appear to be effectively designated and governed at the local level, according to the spatial patterns of dispersed, small-scale urban expansion and linear urbanization along the sides of roads. Also, they mentioned that the frequently noted incapability of local government to create and enforce land-use zones and plans undoubtedly contributed to the chaotic pattern of regional urban growth and is expected to continue in the future (Rimal et al., 2020).

In a report prepared by the government for a conference on housing and sustainable urban development it was mentioned that for the past few decades, Nepal has been experiencing a rapid pace of urbanization, driven primarily by the rural-to-urban migration of the people in search of better livelihoods and economic opportunities. Urban growth in Nepal has mostly been unplanned and uncoordinated. It has become a common practice to construct buildings even where basic urban infrastructure is non-existent or severely inadequate. Likewise, the poor land subdivision has made it difficult to provide urban infrastructure and services effectively and efficiently.

Kathmandu Valley and the Terai area are stark examples of how agricultural lands are prematurely falling prey to urbanization (MoUD, 2016).

Understanding land use and land cover changes has become a necessity in managing and monitoring natural resources and development, especially in urban planning. Remote sensing and geographical information systems are proven tools for assessing land use and land cover changes that help planners to advance sustainability. Wang et al. (2020) detected and predicted land use and land cover shifts in Kathmandu using remote sensing and geographic information systems. According to Wang et al. (2020), the Kathmandu district lost 9.28% of its forests, 9.80% of its agricultural land, and 77% of its water bodies between 1990 and 2010. The pattern of land class changes revealed by a trend analysis of changes in land use and land cover classes identified that the increased built-up region whereas, the coverage of both forests and agriculture decreased (Wang et al., 2020).

According to a study on land use and land cover in the Churia region, cultivated land and forest are the most common land use and land cover types, followed by shrub and riverbed. Agricultural land increased in all physiographic regions in the last two decades, from 1990/91 to 2010, with a disproportionately low rise in the hills and Duns and a disproportionately high increase in Bhabhar and Terai (Ghimire, 2017). The Dun valleys, also referred to as the Inner Terai or Vitri Madhesh, are expansive valleys characterized by gentle slopes. These valleys possess highly fertile soil and abundant water resources, making them ideal for intensive cultivation (Flora of Nepal, n.d.). About 8.4% of Nepal's overall land area is made up of dunes and, there is Bhawar which makes up roughly 14.9% of Nepal's overall land area (Ghimire, 2017). The Bhabar region, known as Char Kose Jhadi locally, is a narrow but continuous forest belt measuring 8-12 km in width. It is formed by the accumulation of gravel, boulders, and alluvium carried down from the foothills. This area remains arid for most of the year, with the exception of the monsoon season when substantial seasonal streams transport surface runoff into the plains (Flora of Nepal, n.d.). The three regions Duns, Bhawar, and Terai are Nepal's breadbasket (Ghimire, 2017).

The way cities are being developed in the Kathmandu Valley is not sustainable for the environment. The urban growth is unplanned and there is poor enforcement of regulations, leading

to uncontrolled expansion of the city and dramatic changes in its layout. If development continues in this manner, there will be immense pressure on land resources. Moreover, unplanned growth has resulted in poor quality, inaccessible housing, and increased susceptibility to disasters (Muzzini and Aparicio, 2012). Likewise, Bhattarai and Conway (2010) study on urban vulnerabilities in the Kathmandu Valley found similar results. Uncontrolled and excessive urban growth has various impacts and vulnerabilities on the urban environment. Overpopulation due to immigration has created major challenges such as unplanned housing schemes leading to the deterioration of land resources. Weak institutional arrangements have encouraged unplanned urban development, leading to uncontrolled urban sprawl and significant changes in the urban landscape (Bhattarai and Conway, 2010).

2.4 History of migration in Terai

The Terai was, and still is, regarded as a frontier region for prospective agricultural livelihood potential inside the nation. As a result, migration from the hills to the Terai became a significant demographic, sociopolitical, and economic issue. The push factors were the uneven topography, lack of arable and fertile land, and the terrible existence in the hills, while the pull factors were the fertile land, plain topography, easy access, and better infrastructure (Hom Nath and Anke, 2013).

Most of the emigration to the Terai was forced up to the end of the nineteenth century. The Nepalese government even promoted immigration from India in the early 20th century as a way to improve the Terai, which up until that point had remained mainly underdeveloped (Hom Nath and Anke, 2013). To stimulate habitation in this plain, several actions were done, including, a reduction in land taxes, land reforms, and road building (Aubriot, 2010). The Terai did not, however, draw any Nepali hill people. Due to cultural similarities, they selected the northern and north-eastern regions of India. Either migration from plain to plain or from hill to hill was the norm. When Nepalese hill people moved to the Indian highlands, Indians from the plains came to live in the lowland Terai (Hom Nath and Anke, 2013).

Nonetheless, migration to the Terai intensified from the mid of 20th century i.e., around the 1950s owing to population pressure and the scarcity of land resources in the hills. Along with this, there

was the elimination of malaria, and the execution of land resettlement schemes in the Terai, and eventually, immigrants found the Terai to be appealing. From 1952/54 and 1981, the country's average annual population growth rate was 2.2%, ranging from 1.2% in the highlands and hills to 3.3% in the Terai. The percentage of the overall population residing in the Terai climbed from 34.7 to 48.7 percent within the same time frame. Likewise, the population of the Terai increased by 2.5 times and net migration by 6.4 times between 1961 and 1981. However, there was less population increase and negative net migration in the hill region (Hom Nath and Anke, 2013). Also, according to a study on migration in Nepal by the International Organization for Migration (IOM), internal migration in Nepal has similarly evolved into a means of subsistence. The majority of internal migrants come from the hills and mountains and move to the Terai, with some districts experiencing an exodus of more than 50% of their population. (IOM, 2019).

3 CHAPTER III: MATERIALS AND METHODS

3.1 Study area

The Butwal sub-metropolitan city has a maximum east-west distance of around 12 km and a maximum north-south length of about 11 km. Its total area is 6822.81 ha. Butwal was formerly known as Batauli and became a municipality in 1959 AD. Based on specialization in the non-agricultural sector, it is placed tenth (Mandal, 2014).

It is situated at the intersection of two important national highways, the Mahindra Highway and the Siddhartha Highway, which are connected to the northern hills and mountains (Mandal and Kumari, 2020). The municipality's functional foundation is becoming more diverse, including manufacturing, banking, insurance, education, and catering services. Tourism is also growing. The notable aspect of Butwal is its expanding squatter settlement, which accounts for around one-third of all households, and 805 of those who are economically active are involved in secondary production works (Mandal, 2014).

The study concentrates on the Butwal Sub-Metropolitan of Rupandehi District, Nepal, which is the largest city in the Lumbini province and has a population of over 130 000. Butwal is close to Belhaiya, which is Nepal's border with India. One of Nepal's busiest borders with India is Belhaiya, where a significant percentage of imports come from. Belhaiya border contributed 16.92% of imports and 3.95% of exports in the fiscal year 2019–20, according to MoF, Department of Customs, 2020. As a result, this city plays host to a major amount of business activity in western Nepal (Rajendra and Christian, 2021).

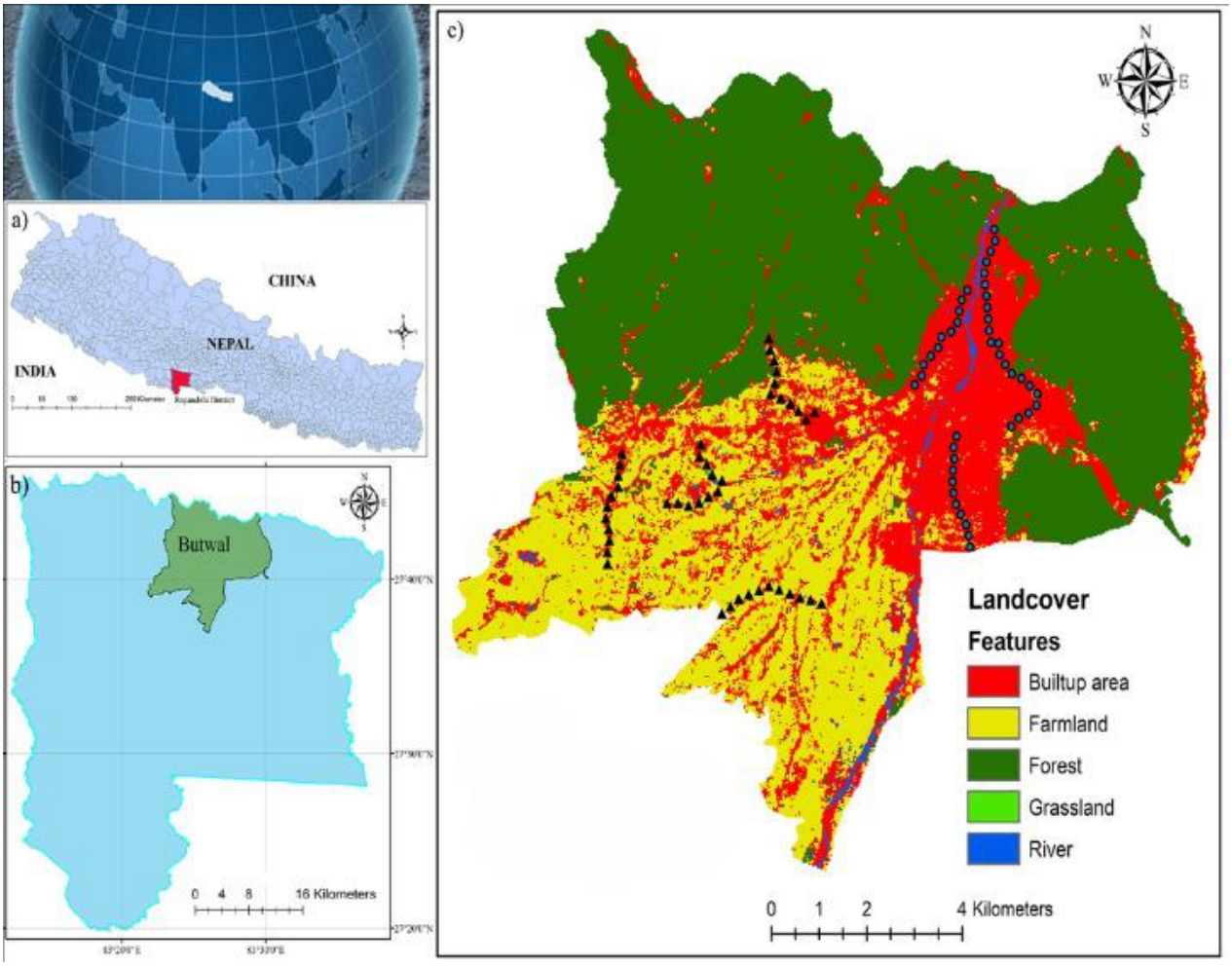

Figure 1: Map illustrating the study area. (a) Map of Nepal presenting Rupandehi District; (b) Map showing Butwal Sub-Metropolitan City in Rupandehi District; and, (c) Map of Butwal Sub-Metropolitan City with land use and land cover (Aryal et al., 2021) .

3.2 Research design

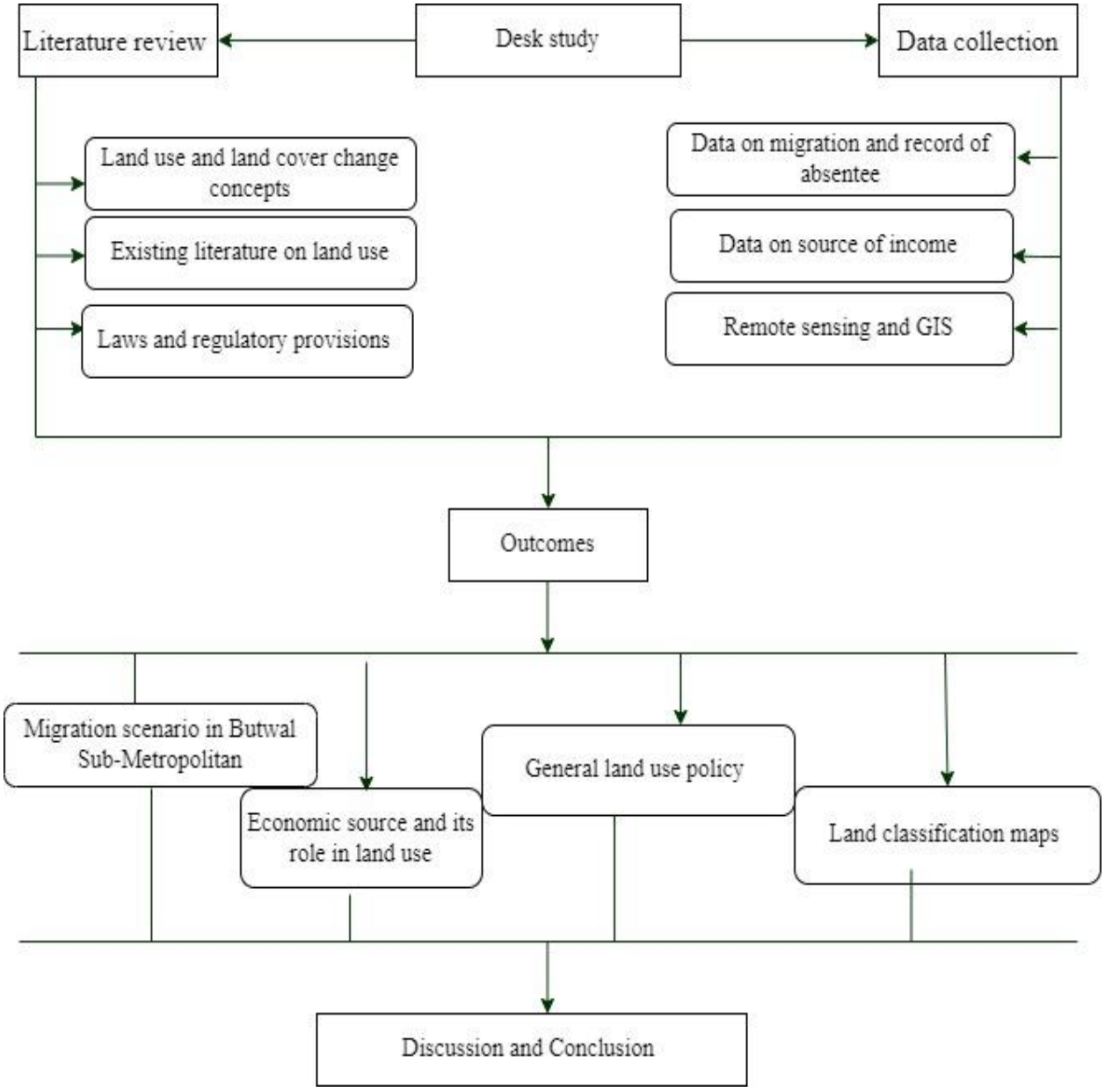

Figure 2: Schematic diagram illustrating the research design (Nepal et al., 2020)

3.3 Materials and methods

3.3.1 Desk Study

Literature Review

Literature was searched on land use and land cover change in Nepal. The study was focused on policies of land use but besides this content related to land use and land cover change was studied. To analyze a different study that was carried out on land use and land cover change, various research papers, articles, and journals are studied. Whereas data about population related to migration, source of income, land ownership, and other required information will be obtained from the Central Bureau of Statistics (CBS), Ministry of Land Reform and Management (MoLRM), and other various sources.

Secondary data

The data on different characteristics of a population are mentioned in the report such as migration, source of income, literacy number, and other essential aspects. These data were mostly obtained from the Butwal sub-metropolitan city official website. Butwal sub-metropolitan city has uploaded details on different population characteristics on its official website under the title “City Profile”.

Along with this, the Central Bureau of Statistics which is responsible for conducting of population survey has officially uploaded the macro data of the survey on its website. Similarly, the Ministry of Land Reform and Management (MoLRM) has enlisted various land-related information including land use plan and policy that has been formulated in different years. Alongside this, essential information and data that were available in different literature were also mentioned in the data collection.

Remote Sensing and Geographic Information System (GIS)

Assessing changes in land use and land cover using remote sensing and geographic information systems is a well-established method of advancing sustainability in planning (Wang et al., 2020). GIS will be used for image processing such as geo-referencing, and digitalization of the imaging

object (Ghimire, 2017). Here, land use and land cover changes in the Butwal sub-metropolitan city are detected using remote sensing and geographic information systems.

Exploring data

The first step of remote sensing and Geographic information system is to collect data on the study area. Here, the image was extracted from the United States Geological Survey (USGS) Earth Explorer. The imagery of 1999 and 2021 was downloaded with the sensors Landsat with cloud coverage of less than 15 percent. The satellite image of 1999 has sensors Landsat 4 and 5 whereas, for the satellite image of 2021, the sensor was Landsat 7.

Q-GIS (Quantum Geographic Information System)

After downloading the image, the software called Q-GIS was used for further processing. Q-GIS has many additional possibilities for processing than those installed by default. These are so-called plugins. Semi-Automatic Classification Plugin (SCP) is the plugin that was used to do satellite imagery processing, those relevant for classification (Robson, 2022).

To display color composites of the imagery, the individual bands are combined into one unit. Then the image was pre-processed. Preprocessing is needed to make your imagery ready for further analyses - often referred to as Analysis Ready Data (ARD) (Robson, 2022). After pre-processing, the classification of an image into different land classes was started. The classification is done in SCP Dock by selecting the imagery for the classification and selecting training shape files (for the areas of interest).

Here, the image is classified into four different regions of interest namely, Water bodies, Vegetation, Built-up, and Barren land. After completing the classification of an image, the post-processing steps were followed. Post-processing gives a classification report of the SCP Main Interface.

Land classification produced by AI (Artificial Intelligence)

The land classification models of artificial intelligence (AI) were improved by utilizing a vast training dataset of human-labeled image pixels in the billions. These models were used on all Sentinel-2 scene collections for every year from 2017 to 2022. The result produced a map with 9 classes that describe the land surface, including vegetation, bare land, water, cropland, and built-up areas. These maps are accessible through ArcGIS Living Atlas of the World. With the help of these visualizations, planners worldwide can gain a better understanding of the terrain around them, and how it has transformed over time, and use the latest information available to make well-informed decisions (Esri, n.d).

4 CHAPTER IV: RESULTS

4.1 Evolution of land use policies and plan

Throughout its history, Nepal has attempted to address the problems with land management by implementing several policy initiatives. Since land scarcity was not a concern and the land was primarily used as a resource to generate food in the early periods, the governing bodies did not need strict regulatory policies to manage the land (Shrestha et al., 2020). The introduction of legislation requiring the recording of land ownership records during the Lichhabi dynasty in 300 AD. marked the beginning of governmental land policies in Nepal, but they were not yet comprehensive. Since then, the state has increased land taxes and enacted land regulations that primarily govern the use of agricultural and residential property. Before the advent of the present system, land administration in Nepal was extremely complicated, with numerous categories and subcategories of ownership and other land tenure rules (Shrestha et al., 2020). Up to 1950, the country's land use was governed by occasional royal commands. Government land use laws and policies had three main objectives: (a) raising government revenue; (b) utilizing unpaid labor for public projects like building palaces and irrigation canals, transporting public goods, and taking part in wars; and (c) winning the favor of state officials in decision-making. The privatization of public land, the expansion of agricultural land into existing forest, and the reclamation of waste land through the adoption of various land ownership rights, a transfer system for those rights, and taxation were the three main avenues of land use change during that time (Nepal et al., 2020).

The land was used by people in the form of usufructuary rights such as Birta, Guthi, Jagir, Rakam, and Raikar (Nepal et al., 2020). Guthi is land designated for the use of benevolent, religious, or philanthropic institutions, whereas Birta is land given by the state to people so they can support themselves. Kipat is a type of community tenure that is only given to people from specific ethnic groups. Raikar is a land that the government retains control of while charging users of it a fee (Nepal et al., 2020). Jagir is the land that is given to government workers as a perk of employment. Similar to this, Rakam is the land given as payment for performing particular tasks. The land was granted for specific use and administration at the individual and communal levels (Nepal et al., 2020). The old system of land tenure was altered and replaced once democracy was established in

1951. The Jagir system, Birta system, Rakam system, and Kipat system were all discontinued in 1951, 1959, 1963, and 1968, respectively (Nepal et al., 2020).

In 1963, the first coordinated and more scholarly land management policy was published. The Land (Measurement) Act of 1963 established the term "land data" and named the Survey Office as the agency in charge of gathering information about land parcels, including their ownership status, quality, and measurement, as well as creating ownership records and delivering them to the Land Revenue Office. The Survey Department currently has cadastral data for the entire country, which is one of this Act's great accomplishments (Shrestha et al., 2020). The Land Acts (1964) were put into effect to modernize the usage of land resources after the Land (Measurement) Acts. For the first time, it attempted to put the use of land resources in context and acknowledged the need to shift idle land capital to other areas of the national economy.

Land use policy was first implemented in the nation with the Fifth Development Plan (1975–1980). By creating grazing space and protecting wildlife, it supported the expansion of tourism in the high mountain regions and the production of livestock (Nepal et al., 2020). The Land Policy of Nepal fixed the upper ceiling of land holdings, established and maintained tenancy rights, and limited the amount of land a tenant household may rent for agriculture (Shrestha et al., 2020). There was a Zamindari system where landholders used to control the access to the land and collect tax amounts from the user (Alden Wily et al., 2008). This system was also abolished by the land policy under the Fifth Development Plan (Shrestha et al., 2020).

The turning point in land use planning in Nepal is considered to be the eighth five-year plan which addressed the issues in land management. The eighth five-year plan was designated for the period 1992/93-96/97. The succeeding Ninth Five-Year Plan, which ran from 1997–1998 to 2001–2002, placed a strong emphasis on sustainable development for the extension and protection of the ecological sectors of mountains, hills, and lowlands by utilizing land and natural resources (Chand, 2019). They also included activities such as: (a) implementing a land use policy through zoning plans, (b) educating people about the function and significance of a land use plan in agricultural production, environmental protection, and other developments, (c) enhancing technical and institutional capacity, and (d) discouraging the practice of leaving land fallow, it aimed to achieve

its goal of sustainable land use. Additionally, it included guidelines for creating land use plans that adhered to integrated land use principles to protect the land from degradation (Nepal et al., 2020).

The National Land Use Project was founded in 2000 to remember the implementation of land use policies in Nepal. One of the main goals of the project was to identify and zone land for housing, urbanization, industrialization, and other non-agricultural processes in the existing municipalities and rural areas with an urban focus, as well as to maintain the system's environmental balance by preserving and developing water, forests, and living treasure. After it, the Tenth Five Year Plan (2002/03 - 2006/07) was implemented, with the land use sector's goals being to construct a service-oriented and educational land administration through the development of sustainable land use management for raising land productivity. The plans' main goals were identifying and classifying land for agriculture, forestry, industrialization, and the expansion of urban settlements as well as implementing land use planning based on maps created at various scales. The five-year plans included the creation of the National Geographic Information System, formulation of land use policy, and discouragement of using fertile land for non-agricultural or unproductive enterprises (Chand, 2019).

The Ministry of Land Management, Cooperatives, and Poverty Alleviation (MoLMPA) has played a role in land use zoning and the development of guidelines and codes. However, other ministries are also involved in land use planning within their sectors. For instance, the Ministry of Forests and Environment (MOFE) is responsible for managing forests, parks, and protected areas, which also include wetlands. The Ministry of Culture, Tourism, and Civil Aviation (MOCTCA), and the Ministry of Energy, Water Resources, and Irrigation are also involved in the management of wetlands. Additionally, the Local Government Operation Act (LGOA) and Building Act have provisions for land use zoning and management, which are under the responsibility of two separate institutions. Despite this, these government bodies operate independently of each other and without strong coordination (Nepal et al., 2020).

The National Land Policy is crucial for ensuring sustainable development, effective government, human welfare, and economic opportunity. It comprises a vast array of socioeconomic and legal guidelines that specify how the land and its benefits are to be distributed (Shrestha et al., 2020).

To promote sustainable socio-economic and environmental development through the wise use of land and its resources, the government developed and implemented the National Land Use Policy (NLUP) in 2013. The land was divided into seven separate zones under this policy: agricultural, residential, commercial, industrial, forest, public utility, and others as necessary (Nepal et al., 2020).

After reviewing the land use policy from 2013 A.D., the Land Use Policy, 2015 was created to handle all current issues on a long-term basis. There were seven separate zones in Land Use Policy, 2013 which were increased to eleven in 2015 policy: Agricultural Zone, Residential Zone, Commercial Zone, Industrial Zone, Mines and Minerals Zone Cultural and Archaeological Zone River and Lake-Reservoir Zones, Forest Zones Public Use and Open Space Zone and Building Materials (Stone, Sands, Concrete) Excavation Zone and Other Zones as specified as per necessity (MoLRM, 2015).

In addition to these laws and ordinances policy, the five-year periodic plans and other development master plans also include policies for land management (Shrestha et al., 2020). The recommended institutional organization from the province to the municipal level is another benefit of these measures. The system by which coordination can take place with the other important ministries and agencies, such as those responsible for agriculture, forests, national parks, and wildlife protection, is not explicitly covered under the NLUP 2015, though. According to Nepal et al. (2020) the role of land users, their experiences, knowledge, and capacity for adaptation are not sufficiently taken into account in government policies on land use and management because they are still mostly technical. Nepal et al. (2020) also mention that adaptive and sustainable land use planning and management, calls for more locally driven, discoursed, and participatory techniques while taking into account the variations in biophysical and socioeconomic variables by physiographic units (Nepal et al., 2020).

Due to a lack of appropriate laws, the 2013 National Land Use Policy had not been put into effect so, on March 10, 2019, the Nepalese federal parliament approved the Land Use Act in response to comments from many stakeholders for the management of land sustainably. This law regulates land management and ensures the sustainable use of land resources. To accomplish a national goal,

this Land Act includes a long-term vision for utilizing most of the land resources available through various land classifications, their proper use, and management (Shrestha et al., 2020). This act forbids the construction of new homes or other infrastructure on agricultural land, aside from the already-existing structures. This act makes it abundantly apparent that purchasing and dividing any agricultural land without first receiving consent from the local land use authority is completely forbidden (Shrestha et al., 2020). The safeguarding of arable lands was given top priority in the National Land Use Policy of 2013 AD to ensure food security. An overall strategy or vision for national land use policy to achieve sustainable social, economic, and ecological advancements and the prosperity of the nation, in 2015 was to make the best use possible of the Land and Land Resources (LLRs) that were at hand. Its mission/goal was to create a specified land use system through land use plans to manage lands sustainably. Ministry of Land Management, Cooperatives and Poverty Alleviation (MoLRM) has uploaded Land Use Policy policies and their strategies on their webpage which are as follows (MoLRM, 2015):

Policy 1: Entire lands of the country shall be classified into Land Use Zones (LUZs). Those zones could be sub-classified into Land Use Sub-Zones as per necessity.

Strategy 1: Land use zoning involves several bases, including the composition, capability, and appropriateness of the land. Land composition, which refers to the geographical and geological aspects of the land, along with its capability and appropriateness, are considered the primary factors for land use zoning. Additionally, in specific locations, the existing land use and its composition, capability, and appropriateness should be taken into account as the main bases for land use zoning. If the state determines that land use is necessary for public interests or physical infrastructure development, it may designate the land for a different purpose than its specific land use category.

Strategy 2: Involves the determination of sub-classifications through micro-zoning in urban areas, taking into account their comparative sensitivity.

Policy 2: According to a federal structure, level-wise (Federal, Provincial, and Local Levels) Land Use Plans (LUPs) shall be devised and executed.

Strategy 1: Involves the preparation of the Federal Land Use Map based on national priority and policy.

Strategy 2: The Federal land use plan is considered as general directives before devising Provincial/Regional and zone-wise plans.

Strategy 3: Outlines the objectives to be considered in the devising of Land Use Plans (LUPs), which includes the consolidation of lands for the protection of the Agricultural Zone, ensuring well-facilitated and safe human settlements, maintaining a balance between physical infrastructure development and the environment, conserving historical, religious, cultural and tourist hubs, identifying vulnerable zones based on a geographical and geological study, utilizing non-use land and under-use land, protecting and promoting biodiversity, mitigating the impact of climate change, controlling unmanaged development and, extension of industrial, commercialized or business zones, developing green belts, open spaces, and areas for gardening, playgrounds and entertainment venues in both urban and rural areas, and developing green belts and open spaces along with rivers, roads, and both sides of canals.

Strategy 4: Lower-level Land Use Plans (LUPs) should conform to the upper-level plans when creating level-wise plans.

Strategy 5: Rural and urban Land Use Plans (LUPs) should be created separately in an extended form at the local level before implementation.

Strategy 6: Coordination with the Kathmandu Valley Development Authority (KVDA) should be done when creating and implementing Land Use Plans (LUPs) in the Kathmandu Valley and with other stakeholder agencies in other areas implementing town development plans.

Strategy 7: Stakeholder participation, including gender and inclusiveness, should be sought when creating and implementing Land Use Plans (LUPs). Local community involvement should be ensured when creating LUPs at the local level.

Strategy 8: The Central Agency should provide directions, technology, and technical assistance as required when creating Provincial/Regional and local level Land Use Plans (LUPs).

Policy 3: The use of Land and Land Resources (LLRs) shall be ensured based on Specific Land Use Zones (SLUZs) and Land Use Plans (LUPs).

Strategy 1: Specific Land Use Zones (SLUZs) and Land Use Plans (LUPs) will be used as the basis for ensuring proper land use.

Strategy 2: Discourage land use that is different from the Specific Land Use Zones (SLUZs) or changes in land use without approval from the relevant authority. Unauthorized land use changes will be revoked.

Strategy 3: Specific Land Use Zones (SLUZs) and Land Use Plans (LUPs) will be used to ensure the safety of humans, increase land productivity, protect biodiversity, and maintain ecological balance. If there is a valid reason for changing the land use, the Government of Nepal (GoN) Council of Ministers may make the decision based on the recommendation of the relevant experts.

Policy 4: Level-wise Land Use Plans (LUPs) compatible with physical infrastructure development projects shall be devised and implemented.

Strategy 1: Plans for a hygienic, attractive, well-equipped, and safe human settlement, as well as planned and sustainable urbanization and physical infrastructure of the country, will be created and executed based on Land Use Plans (LUPs) of the relevant zones.

Strategy 2: Plans for a hygienic, beautiful, well-facilitated, and safe human settlement, as well as planned and sustainable urbanization and physical infrastructure of the country, will be created and executed based on Land Use Plans (LUPs) of the relevant zones and geological studies.

Strategy 3: Private and cooperative sectors will be encouraged to operate physical infrastructure development, industrial development, and land development programs.

Policy 5: Optimum use and protection of arable lands shall be ensured upon discouraging non-agricultural use of arable lands and the trend of keeping land fallow and rampant fragmentation.

Strategy 1: Non-agricultural use of arable lands will be discouraged, and grants, subsidies, and compensation will be provided to protect and promote the agricultural sector.

Strategy 2: High lands of mountainous regions that are classified under the agricultural zone will be developed into valuable zones for herbals, fruits, animal husbandry, and pasture.

Strategy 3: Lands under the irrigation facility and within the command area of a planned irrigation project will be classified into agricultural zones, and irrigation facilities will be ensured.

Strategy 4: Fragmentation of land into smaller pieces will not be allowed once a minimum area of the land plot is specified based on Specific Land Use Zones (SLUZs).

Strategy 5: Criteria for Land Consolidation will be established and implemented to encourage commercial agricultural/business farming in a classified agricultural zone.

Strategy 6: No one will be allowed to leave agricultural lands fallow in a classified agricultural zone without believable reasons for three consecutive years.

Strategy 7: Grants, subsidies, and assistance may be reduced, and additional tax may be imposed on landlords not engaging in agriculture in a classified agricultural zone.

Policy 6: A hygienic, beautiful, well-facilitated, and safe human settlement, as well as a planned and sustainable urbanization of the country, shall be ensured.

Strategy 1: Safe and suitable places with low slopes shall be identified at the provincial, regional, and local levels, and safe human settlements shall be developed there.

Strategy 2: Private sector involvement shall be encouraged for developing planned and sustainable human settlements in proposed new towns and residential areas.

Strategy 3: The minimum and maximum area of a housing unit in new town development areas and other town-oriented zones shall be regulated.

Strategy 4: Guidelines for human settlement, urbanization plans, and building construction in classified urban and rural settlement lands, along with standards for basic infrastructure, greenery, and open spaces, shall be set according to building codes and standards.

Strategy 5: Vulnerable and insecure human settlements shall be relocated to safe places with appropriate infrastructure and livelihood opportunities after natural disasters.

Strategy 6: The government shall collaborate with stakeholders to promote integrated human settlements with basic infrastructure.

Strategy 7: The trend of unmanaged settlement shall be controlled to encourage planned and sustainable human settlements with infrastructure following building guides, codes, and standards.

Strategy 8: Capacity building at local levels shall be enhanced to enforce prescribed building guides, codes, and standards.

Strategy 9: Public-private partnerships and public cooperatives shall be encouraged to provide secure and low-cost housing for landless and low-income people in residential zones following prescribed building guides, codes, and standards.

Policy 7: Conservation and optimum use of forests and other natural heritages shall be ensured.

Strategy 1: The priority will be to create green certificates by using maps, surveys, and demarcation to identify forests and reserve areas.

Strategy 2: When forest areas are used for National Priority Projects, an equivalent amount of afforestation will be done to compensate for the loss.

Strategy 3: Forest management and afforestation will be encouraged in areas of forests that have been damaged.

Strategy 4: A special plan will be created and implemented to conserve the Churia and Bhabhar hill areas.

Strategy 5: To protect the Churia and Bhabhar hill areas, vulnerable human settlements in sensitive parts of those areas will be relocated to the development of basic infrastructure integrated human settlement programs.

Strategy 6: Special measures will be taken to conserve water shed areas, wetland areas, reserves, intermediary areas, national parks, wildlife reserves, and pasture areas.

Strategy 7: Forest areas with potential for biodiversity will be developed into reserved forests, and forest areas, grassy fields, and wildlife habitats will be protected.

Strategy 8: Efforts to conserve, promote, and utilize damaged areas of forests and natural heritage sites (such as lakes, reservoirs, ponds, rivers, wetlands, etc.) will be initiated to improve their conditions.

Strategy 9: Lands with low productivity in mountainous and hill areas that have human settlements between forest zones will be relocated to appropriate areas and encouraged to develop forests in those areas.

Policy 8: Incentive-oriented programs shall be operated to motivate people the use Land and Land Resources (LLRs) under Land Use Zones (LUZs) or Land Use Plans (LUPs).

Strategy 1: The government will provide extra support to industry, housing companies, the private sector, the cooperative sector, and others who show interest in developing agriculture according to land use plans and policies.

Strategy 2: The private sector will be incentivized to develop unused land within Specific Land Use Zones (SLUZs) and Land Use Zones (LUZs) for purposes such as commercial farming, tourist destinations, research centers, scientific laboratories, entertainment venues, and sports facilities.

Strategy 3: Individuals or organizations that provide secure buildings or housing under a managed housing project meeting the state's standards will be eligible for additional subsidies and facilities.

Strategy 4: To promote eco-friendliness in mountainous settlements, tunnelways or ropeways will be encouraged as a suitable mode of transportation.

Policy 9: Keeping lands under conditions of 'non-use' or 'under-use', 'misuse, and 'excessive use' shall be discouraged.

Strategy 1: Any actions that disrupt the natural flow of rivers, boundaries, or prescribed standards will be prohibited.

Strategy 2: The boundaries of natural features like lake reservoirs, bio-tracks, public ponds, wetlands, and pasture lands must not be encroached upon, and they should be used for tourism purposes while preserving their natural features.

Strategy 3: Soil protection through maintaining its natural core will be encouraged, and any activities that cause changes to the natural features due to poor land use standards will be discouraged.

Strategy 4: Any activities that result in the degradation of arable land or create vulnerabilities for nearby local settlements due to facilitating land soil or constructing roads will be discouraged.

Strategy 5: Programs to develop and bring underused or low-graded government or public lands into Specific Land Use Zones (SLUZs) will be encouraged.

Policy 10: To keep a balance between development and environment for the mitigation of natural and human created-hazards, vulnerable zones shall be identified, and the provision thereof shall be made to ensure of operation of certain activities only in those zones.

Strategy 1: Only certain activities will be allowed in areas identified as highly hazardous zones for natural disasters.

Strategy 2: Protective programs will be permitted to operate to safeguard sensitive areas from natural disasters.

Strategy 3: The principle of sustainable development will be adopted in construction and development activities to maintain a balance between land, environment, and development, taking into account the impact of climate change.

Strategy 4: Government lands that are secured and sustainable embankments for maintaining the natural flow of rivers shall be used for appropriate purposes such as agriculture, forestry, roads, green belts, and open areas/zones.

Policy 11: Protection and optimum use of natural heritages, tourist hubs, and historical, cultural and religious, archaeological zones including lands belonging to Government, the public, and trust shall be ensured.

Strategy 1: Identify historical, cultural, religious, and archaeological sites and potential tourist hubs and use and protect them without affecting their originality according to their objectives.

Strategy 2: Prohibit the use of heritages listed in world heritages and prohibit changes in Land Use Zones (LUZs) that could affect them.

Strategy 3: Protect strategic, environmental, and sensitive zones, including biodiverse and highly important zones, through No GO Zones and prohibit other uses.

Strategy 4: Utilize natural resources, such as minerals, oil, and gas, according to the Specific Land Use Zone classification in the zones they are found.

Strategy 5: Manage government, public, or trust lands that are not being used appropriately and use them according to Specific Land Use Zones (SLUZs) purposes.

Strategy 6: Establish a permanent mechanism with functions, duties, powers, and responsibilities for the necessary protection and maintenance of records of government and public lands.

Policy 12: Minimum valuation and land tax system shall be developed as per plot-based land records upon referring Land Use Zones (LUZs) based on specific land use.

Strategy 1: A comprehensive land record system based on plot survey design and mapping shall be created to classify land use zones (LUZs) for unsurveyed lands.

Strategy 2: Property valuation and taxation shall be based on specific land use zones (SLUZs) and a progressive tax system.

Strategy 3: A progressive tax system shall be applied to all properties except for residential houses built collectively or jointly by business companies, or institutions in residential zones. The tax will be based on a minimum land area requirement of one house per family.

Strategy 4: Tax exemptions shall be given for agricultural lands, and all other lands, taxes will be assessed based on usage and benefits.

Policy 13: An information system on Land Use Plans (LUPs) shall be developed.

Strategy 1: To create effective Land Use Plans (LUPs), essential maps and databases, such as Land Use/Land Resources Maps, Land Capability Map, Land Use Zoning Map, and Hazard Map shall be prepared.

Strategy 2: A modern information system based on Land Use Plans (LUPs) shall be developed, and stakeholders shall have easy access to the updated system and its distribution.

Strategy 3: The updated Land Use Information System (LUIS) shall serve as the base for various purposes, including infrastructure development, establishment and operation of industrial enterprises, human settlement, urbanization, and planning at various levels of the state structure.

Policy 14: Institutional structure shall be established in the course of the execution of land use policy, plans, and programs thereto.

Strategy 1: An institutional structure or mechanism will be set up to implement the Land Use Policy (LUP), plans, and programs related to it.

Strategy 2: To effectively implement the Land Use Policy (LUP), appropriate Acts, Rules, Regulations, and Directives will be created or established.

Strategy 3: To execute the Land Use Policy (LUP), efficient coordination between various stakeholder agencies will be arranged.

Policy 15: Public awareness shall be enhanced on land use and long-term impact thereto

Strategy 1: To increase knowledge and awareness of the best use of land and land resources, the educational curriculum at various levels will include information related to land use.

Strategy 2: Audio and video materials related to land use will be produced and broadcast based on the classification of Land Use Zones (LUZs).

Strategy 3: The government agencies will improve their capabilities and awareness in Specific Land Use Zones (SLUZs) based on land use plans (LUPs), to align programs with them (MoLRM, 2015).

4.2 Annual population change

Table 1: Annual Population of Butwal Sub-metropolitan City in different years (GoN, 2019)

Year	Population	Population Growth Rate (per decade)
2001	75384	70%
2011	138742	84.04%
2021	195054	40.58%

The population of Butwal has been increasing continuously. The population of Butwal in the census 2001 was 75384. Within 10 years period, in the census 2011, the population was 138742 with a population growth rate of 84.04%. In the 2021 census, the population of the Butwal Sub-Metropolitan was 195054 and the growth rate is 40.58%.

4.3 Records of Absentee, 2019

4.3.1 Absent population

Table 2: Record of the absentee population (GoN, 2019)

Total Population	156572
Absent Population	14394
Male absentees	10896
Female absentees	3497
Other absentees	1

If a population in a household is gone for more than six months for whatever reason—work, school, business, another job, medication, etc.—it is said to be an absentee population in Nepal. As a result, since this population is not present in the original population, it is referred to as an absent population in statistics (GoN, 2019). Butwal had a population of 156576 residents in 2019 and had a record of 14349 absentees. In a total of 14394 absent residents, 10896 were males and 3497 females, and 1 other person.

Table 3: Record of absentees based on age group (GoN, 2019)

Absentee by age group	
Age group	Population
0-9 yrs.	1120
10-19yrs	2254
20-29yrs	6832
30-39yrs	2858
40-49yrs	928
50yrs or more	402
Total	14394

The data above represents that among absentees, the people of age group 20-29 years were found to be high i.e., 6832 out of 14394 absentee populations. After that, 2858 population of the age group 30-39yrs and 2254 population of the age group 10-19yrs was recorded as absentee population. It is noted that most, active populations are leaving the sub-metropolitan and along with these dependent age groups are also leaving as a dependent case or for further study.

4.3.1.1 Absentee educational qualifications

Table 4: Educational qualification of absentees while absent (GoN, 2019)

While the absent passed level	
Pre-elementary	80
Class 1-5	893
Class 6-8	1253
Class 9-10	1967
S.L.C\ SEE	2041
Class 12th	3608
Graduate	1969
Postgraduate or above	945
Literate	407
Vocational education	23
Other	81
Unknown	319

Among the 14394 people who are not present in the sub-metropolitan city, 80 have completed pre-primary education, 893 have studied grades 1 through 5, 1967 have studied grades 9–10, and 1969 have earned a diploma or an equivalent. It was discovered that many absentees had completed their secondary education in the sub-metropolitan city. It can be presumed through the data that those who completed their secondary school might have been moved from Butwal in the pursuit of a job and higher education in other regions.

4.3.2 Reason for absentee

Table 5: Details on the reason for absenteeism (GoN, 2019)

Reason for absent	Total	Percent
Job search	4610	32
Education	3579	24.9
Private job	3147	21.9
Government job	1042	7.2
Dependent	967	6.7
Others	572	4
Trade	288	2
Cause unknown	177	1.2

Political conflict	12	0.1
Total	14394	100

Out of the 14394 missing residents in the sub-metropolitan city, 572 said that their absence was due to something other than school, work, business, or a political issue. However, 177 people declined to explain their absence. 4610 people, or 32%, stated that their absence was due to job searching. 3147, or 21.9%, are absent for a private job, while 3579, or 24.9%, are missing for study. Given the lack of educational and employment prospects in the sub-metropolitan city, it is clear why the population is absent: they left the area in quest of better opportunities.

Most immigrants travel away from their home countries in pursuit of employment, education, and job, and they are often accompanied by their families, particularly if they have school-age children.

4.3.3 Current residency of absentee

Table 6: Detail on the current residency of absenteeism (GoN, 2019)

The current address of absentee		
The current address of absentee	Population	Percent
Elsewhere in the district (same district)	119	0.83
Other districts of Nepal	2761	19.18
Abroad	11013	76.51
Unknown	54	0.38
Not mentioned	447	3.11
Total	14394	100

Out of the 14394 absent residents in the sub-metropolitan city, 11013 (or 76.51%) are outside of Nepal, while 2761 (or 19.18% of the population) are in different districts of the country. The examination of the statistics reveals that a significant portion of the absentee population has left the country, with most of them leaving for employment in other Asian nations. On the other hand, individuals are migrating to other cities with opportunities in other urban regions of the country.

Table 7: Current location of absentee (GoN, 2019)

Details of the place where the absentee population is currently living		
Current location	Population	Percent
Another district of Nepal	2886	20.1
Same municipality different location	404	2.8
Asian Country	7498	52.1
Australia\New Zealand	1280	8.9
European	980	6.8
North America	836	5.8
South America	41	0.3
African	29	0.2
Unknown	440	3.1
Total	14394	100

A maximum of 7498 people, or 52.1% of the sub-metropolitan city's 14394 absent residents, are from Asian countries. Second, 2886 people, or 20.1% of the absent population, live in other Nepalese districts. Since Nepali have easy access to India, some 2398 people, or 22.49 % of the population, are found to have moved to that country from Butwal Sub-Metropolitan City. Aside from this, very few individuals travel to Australia, the Americas, or other European nations. 1280 people, or 8.9% of the population, traveled to Australia or New Zealand. 3.1% of the population, or 440 people, still do not know where they live. It is anticipated that a significant portion of the population is in other urban areas of the nation looking for more employment and opportunities.

Table 8: Details on the country where the absentee population is residing (GoN, 2019)

Description of the country where the absentee is living		
Country name	Population	Percent
India	2398	22.49
Australia	1252	11.74
Gulf countries (Qatar, UAE, and Saudi Arabia)	2371	22.23
America	708	6.64
Japan	663	6.22
Other Asian countries	443	4.15
Other	2829	26.53
Total	10664	100

India and Golf country is the prime destination of most of the absentee. A movement to India is easier because of easy access to an open border system. 22.49% of absentees are in India whereas 22.23% of absentees are in Gulf countries. After this Australia has been a destination for absentees with 11.24% of the population solely migrating from Butwal sub-metropolitan city.

4.4 Migration in Terai

Table 9: Net migration in different regions of Nepal in three decades (KC, 2003)

Region	1981	1991	2001
	Net- Migration	Net- Migration	Net-Migration
Mountain			
Eastern	-212080	-82129	-114489
Central	-11311	-41227	-69154
Western	-37139	-2556	-1261
Mid-Western	1418	-7780	-20429
Far Western	-2355	-27963	-49770
Hill			
Eastern	-233937	-275233	-333050
Central	-47402	2137	185654
Western	-87532	-276369	-416552
Mid-Western	-23028	-101683	-102272
Far Western	-32812	-102775	-164539
Terai			
Eastern	261880	287847	295119
Central	185420	163677	148237
Western	106763	182705	256236
Mid-Western	41126	100081	120172
Far-Western	90989	181268	266098

Net migration is the difference between in-migration and out-migration. In the above data, the net migration of mountains and hills in 1981, 1991, and 2001 are in negative value. This represents that the number of out-migrants is more than the number of in-migrants. Whereas the net migration of Terai has a positive value which means that the in-migration is higher than the out-migration. This can outline that migration is a factor in the increasing population in the Terai region.

Table 10: In and out-migration in different regions of Nepal (KC, 2003)

Region	1981		1991		2001	
	In-Migrants	Out-Migrants	In-Migrants	Out-Migrants	In-Migrants	Out-Migrants
Mountain						
Eastern	23907	235987	12439	94568	15957	130446
Central	10425	21736	11333	52560	11991	81145
Western	1080	38219	2584	5140	3716	4977
Mid-Western	7330	5912	4931	12711	2710	23139
Far Western	10886	13241	8464	36427	8353	58123
Hill	1981		1991		2001	
	In-Migrants	Out-Migrants	In-Migrants	Out-Migrants	In-Migrants	Out-Migrants
Eastern	31423	265360	40433	315666	70330	403380
Central	71873	119275	157435	155298	362536	176882
Western	62572	150104	30452	306821	54442	470994
Mid-Western	31500	54528	22447	124130	34711	136983
Far Western	14559	47371	16349	119124	18394	182933
Terai	1981		1991		2001	
	In-Migrants	Out-Migrants	In-Migrants	Out-Migrants	In-Migrants	Out-Migrants
Eastern	300835	38955	362486	74639	435659	140540
Central	214473	29053	235313	71636	291068	142831
Western	111435	4672	197915	15210	293812	37576
Mid-Western	54364	13238	128232	28151	164289	44117
Far Western	92200	1211	187393	6125	279382	13284

The in-migration and out-migration data of different regions of Nepal in different periods make a clear vision of where the population is increasing and decreasing. The above data clearly illustrates that the in-migration in Terai has been rising. Butwal lies in the western region of Terai and the western region there has been more in-migration than out-migration.

4.5 Migration to Butwal sub-metropolitan city

In addition to fertility and mortality rates, migration is the primary factor that affects population changes in a particular area as well as how resources are distributed there. It influences practically every aspect of life, including social, economic, demographic, political, and environmental. In Nepal, poverty, unequal resource distribution and allocation, and regional variations in labor demand are the key driving forces behind migration (Pull and push factors). In-migration in Terai is not a recent occurrence. A major demographic, socioeconomic, and political issue in Nepal leads to the movement from the hills to the Terai (Baral, 2021).

KC (2015) carried out a study to understand how internal migration has altered land use and land cover (LULC) over the past 25 years and how these changes in human settlements have affected the surrounding landscapes in Nepal's middle mountains. According to KC (2015), the push factors included repeated crop failure because of erratic rainfall and landslides, declining farm productivity, water stress, a labor shortage in agriculture, and high labor costs in the uplands. While better services and income opportunities as well as fertile land with irrigation facilities were reported as the main draw factors for internal migration towards lowlands, i.e. close to road heads and valley floors (KC, 2015).

Census is the main source of data on migration. Nepal's first census was in 1911. The censuses of 1952 and 1954 have information about migration only based on the absent population. In the census 1971, data on migration were gathered by the de-jure technique, where people were enumerated wherever they were found regardless of their regular or legal residency, hence there was no information on the population that was not present. From the 2001 census, information on migration was gathered from both the comprehensive count and the sample enumeration (Baral, 2021).

The Terai area contains 150 urban cities, or 51.2 %, of the country's total 293 urban centers. Population growth in the Terai region has been rapid, with a 0.04 million population in 1952/1954, 0.1 million in 1961, and 9.31 million in 2017 (Rijal et al., 2020).

Migration is regarded as one of the main factors in population change in any given area. It appears that residents of this Butwal sub-metropolitan city also move there from nearby rural municipalities and districts. But the tendency to move from one place to another within or outside the country, either permanently or temporarily, is progressively growing as people look for other chances and jobs.

Table 11: Population by place of birth, 2001 (KC, 2003).

In the year 2001	Total Population	Same District (i.e., Rupandehi)	Other Districts of Nepal		Foreign Born
			VDC	Municipality	
	75384	35532	32602	1548	5702
Percent	100	47.134	43.24	2.05	7.56

Based on the data in the table above, it was determined that, during 2001, out of 75384 persons living in the Butwal sub-metropolitan city, 35532 persons were born within the Rupandehi district. 32602 and 1548 people out of a total population of 75384 were born in other Village Development Committees (VDCs) and Municipalities. There were also 5702 i.e., 7.56 % of foreign-born residents.

Table 12: Population by place of birth, 2019 (GoN, 2019)

Population	In Butwal	Same District (i.e., Rupandehi)	Another district of Nepal	Abroad	Not mentioned
Total	38934	26854	84978	5793	17
Percent	24.86	17.1	54.27	3.69	0.01

Based on the data in the table above, it was determined that of the 156576 persons living in the Butwal sub-metropolitan city in 2019, there were 84978 born outside of the sub-metropolitan area and 38934 were born within it. 26854 persons now reside in the Butwal sub-metropolitan city but were born in different locations within the Rupandehi district. Even people who were born overseas live in the sub-metropolitan areas of Butwal. 5793 persons currently reside in the Butwal sub-metropolitan area but were born overseas. 17 people have no birthplaces mentioned.

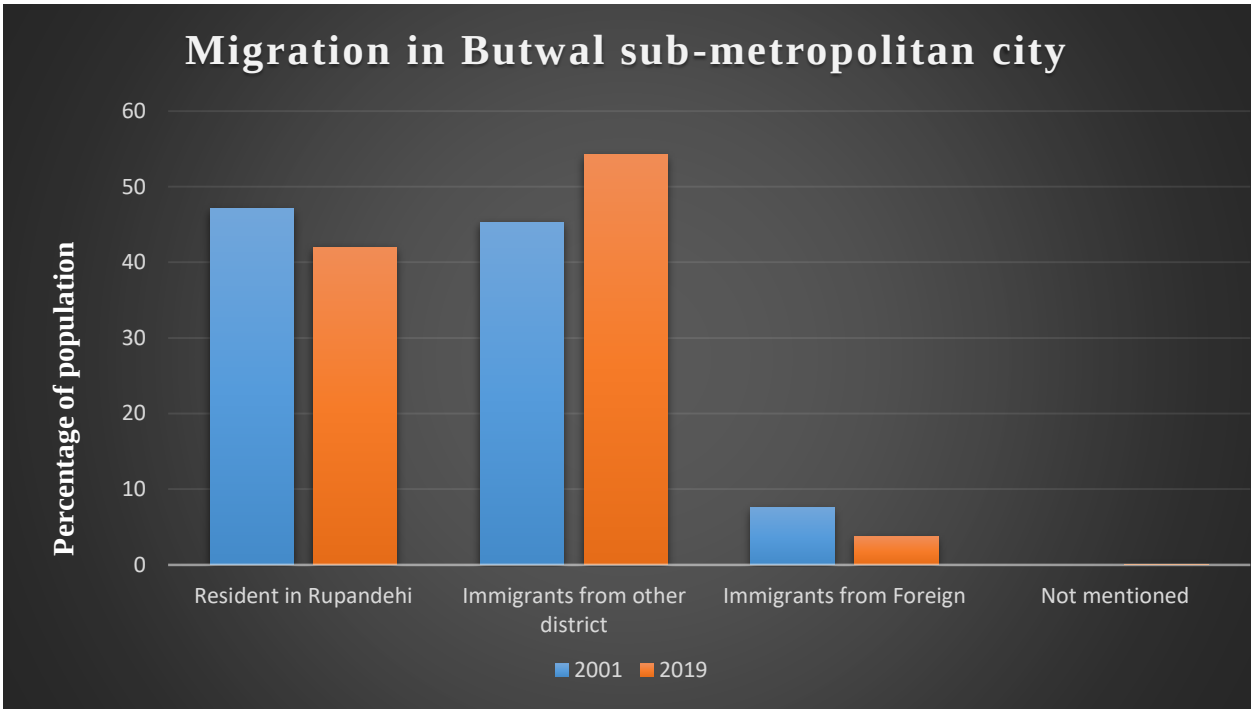

Figure 3: Chart illustrating migration in Butwal during 2001 and 2019 ((KC, 2003) : (GoN, 2019))

It appears that more people will move to the sub-metropolitan city from other municipalities, rural municipalities, or districts as the economic, physical, social, and other aspects of the city develop.

4.6 Source of Income in Butwal sub-metropolitan city

Based on the average annual amount obtained by dividing the amount of income received from various sources of income from the sub-metropolitan city or outside the sub-metropolitan city by the number of households involved in that source of income, information was obtained about major economic activities taking place in the sub-metropolitan city. Looking at the statics, 12022 households said that their income comes from employment, 9380 households said that they got

their income from business and thirdly, 7731 households said they got their income from foreign remittances. After that, the fourth and fifth respectively include income from land rent and daily wages.

Table 13: Details on the annual source of income (GoN, 2019)

Annual source of income			
Source of income	Family number	Gross income	Average income
Animal husbandry and beekeeping	2137	144970000	67838
Industry	545	458208000	840748
Business	9380	4384752000	467457
Employment	12022	4230980400	351936
Pension	3972	1236609600	311331
Lease of house and land	5326	729654000	136998
Vehicles and Machinery	750	235509600	314012
Interest and Dividend	194	40941600	211039
Daily from wage labor	5182	1278068400	246636
Annual income from foreign remittance	7731	2640866000	341594
Internal annual income from remittance income	2684	720511000	268447
Other annual income	1444	292761600	202743

4.6.1 Details of areas where remittance proceeds will be spent in Butwal sub-metropolitan

A survey was conducted by the Butwal sub-metropolitan among the recipients of remittances. When asked which sector they would prioritize spending the money from remittances in the families of those who received internal or external foreign remittance while being absent from the

sub-metropolitan city, 33.7% of the households said that they would spend it on household consumption, followed by 24.6% on education, and 16.3% said they didn't know their priority. On the second priority, 27.5% chose medical care (GoN, 2019).

Table 14: Primary area where the remittance is spent (GoN, 2019)

The first area where remittance is spent	Total Family	Percent
Household consumption	3063	33.70%
Spent on Education	2236	24.60%
Unknown	1480	16.30%
In health treatment	575	6.30%
Debt paid	550	6.00%
Construction of house	458	5.00%
Miscellaneous spending	263	2.90%
Other	259	2.80%
Purchase of land	78	0.90%
Festival and other rituals	53	0.60%
Give loans to others	32	0.40%
Saving	23	0.30%
Business/Saving	17	0.20%
Animal husbandry	10	0.10%
Brought jewelry	2	0.00%
Total	9099	100.00%

4.7 Land use

4.7.1 Agricultural land ownership

Table 15: Ownership of land used for agriculture *(GoN, 2019)*

	Total households
Use Own land for agriculture	2904
Use other's land for agriculture	947
Rent land to others for agriculture	541

According to statistics, a significant portion of the sub-metropolitan city's population does not work in agriculture. 2904 households in the sub-metropolitan city own their land for agriculture,

947 families own other people's property for agriculture, and 514 households allow other people to use their land for agricultural work.

4.7.2 House ownership used by families

Table 16: Ownership of house used by the family (GoN, 2019)

Ownership of house used by family		
	Number	Percent
Personal	26743	65.42
On rent	13997	34.24
Institutional	38	0.09
Other	96	0.23
Not mentioned	2	0.005
Total	40876	100

Out of the 40876 households in the Butwal sub-metropolitan city, 65.42 %, or 26743 families, own their own homes; 34.24 %, or 13997 households, rent; 0.09 %, or 38 homes are used for institutions; and 0.23 %, or 96 homes, were used for other purposes.

4.7.3 Land ownership to build houses.

Table 17: Details on land ownership to build houses (GoN, 2019)

Household based on the ownership of the land where the family is living		
	household number	Percent
Private	20487	76.34
Guthi	84	0.31
Squatter	6207	23.13
Other	59	0.22
Total	26837	100

In the sub-metropolitan city of Butwal, there are 26837 houses, of which 20487, or 76.34%, are built on private land, and 6207, or 23.13%, are built on public land by squatters. Similarly, it was discovered that 59 households (or 0.22% of the households) lived in other people's homes while 84 households (or 0.31% of the households) built their homes on Guthi property. Since 23.13% of inhabitants in this sub-metropolitan city use public property, it appears that the land use plan and policy should pay attention to this issue (GoN, 2019).

4.7.4 Industrial developments

Due to several factors, including its flat terrain spread across a sizable area, its proximity to India's border, and the availability of agricultural and forestry raw materials, there have been industrial activities in Butwal (GoN, 2019).

The Ministry of Industry, Commerce, and Supplies (MoICS) is responsible for executing the appropriate policies and programs for the industry, commerce, and supply sectors. It also works with other government agencies, the business sector, and the dairy industry to execute and evaluate the programs. The Ministry has contributed significantly to the growth and promotion of the supply, trade, and industrial sectors (GoN).

Figure 4:Map illustrating different industrial estates in Nepal (GoN)

There are 10 industrial districts throughout the country under the Ministry of Industry, Commerce, and Supplies, and Butwal is one of the industrial districts. There are 74 industries and offices in the industrial estate of Butwal. It occupies 237657.08 sq. areas (GoN).

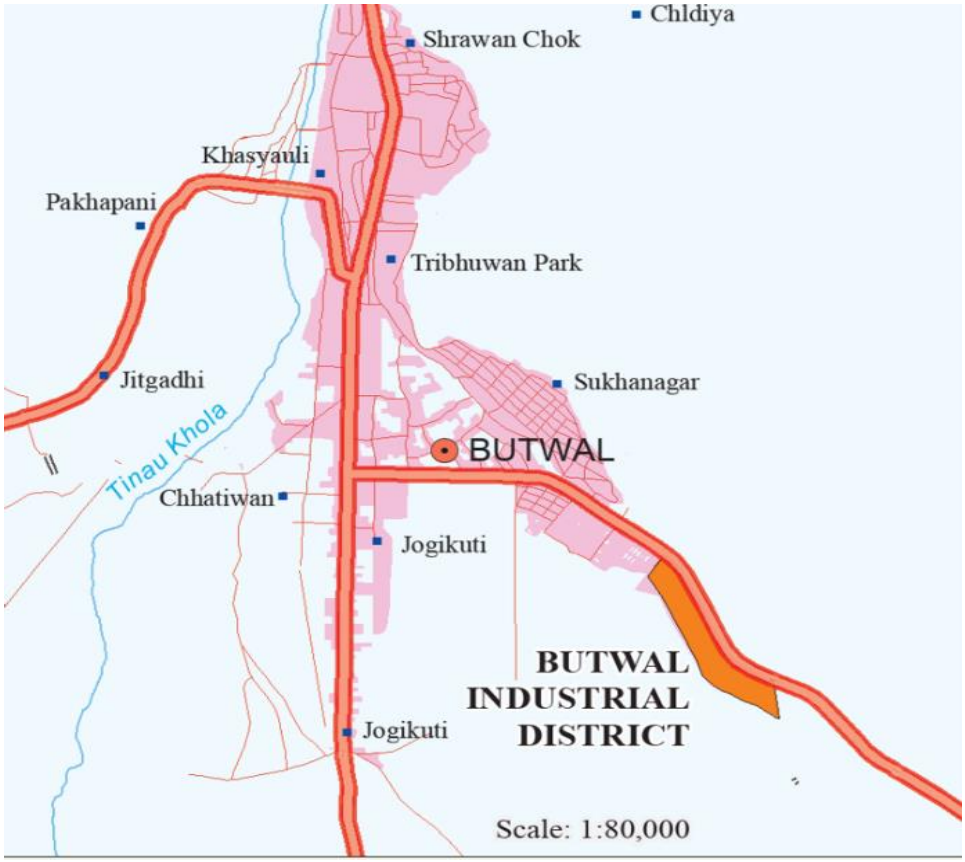

Figure 5: Map showing industrial estate in Butwal Sub-Metropolitan (GoN)

Butwal sub-metropolitan municipalities have developed their internal transportation systems and have constructed their marketplaces in public spaces and small business hubs (GoN, 2019).

4.8 The outcome from Remote sensing and Q-GIS analyses

Following are the maps obtained as a result of image classification in Q-GIS. There is a representation of four features in the land classification which are: Water bodies, Vegetation, Built-in, and Barren lands.

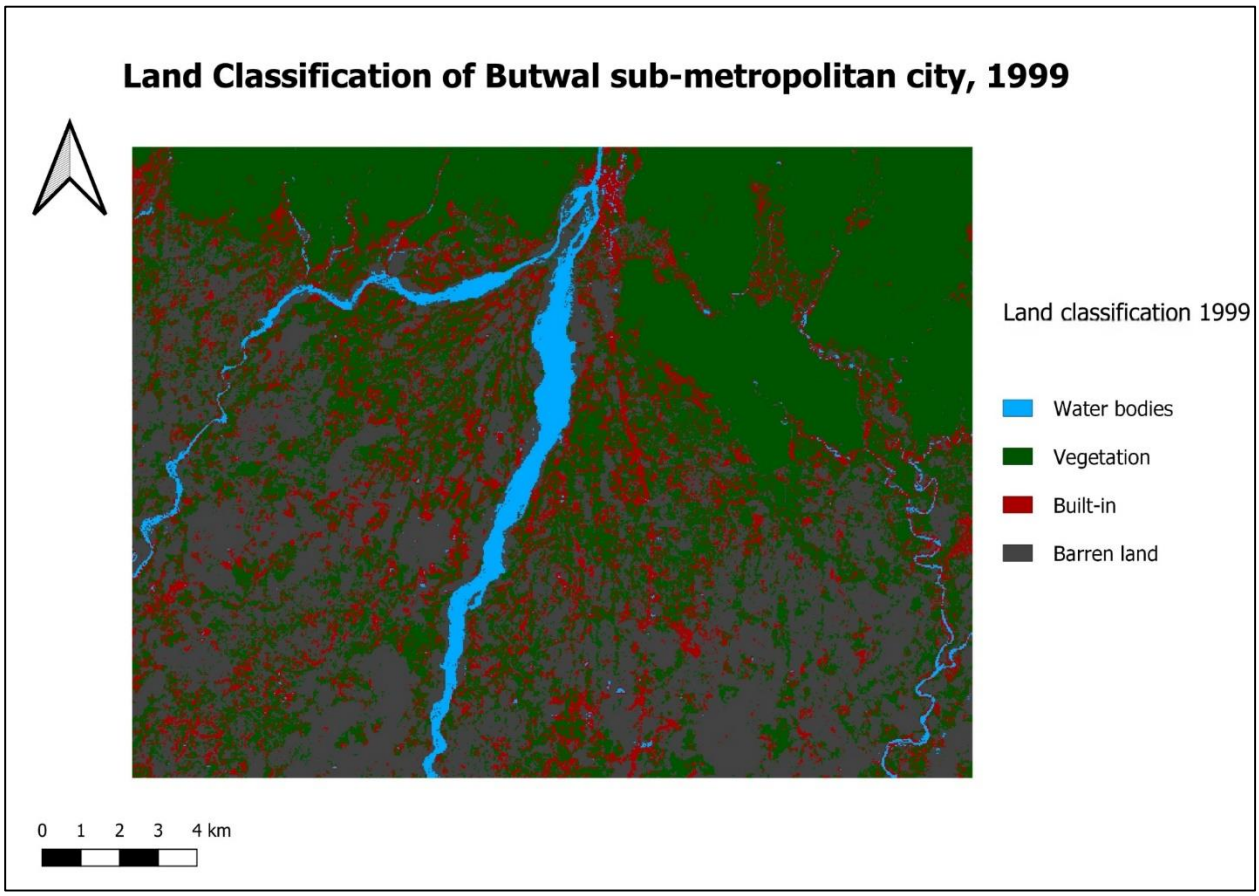

Figure 6: Map illustrating land classification of Butwal Sub-Metropolitan City, 1999

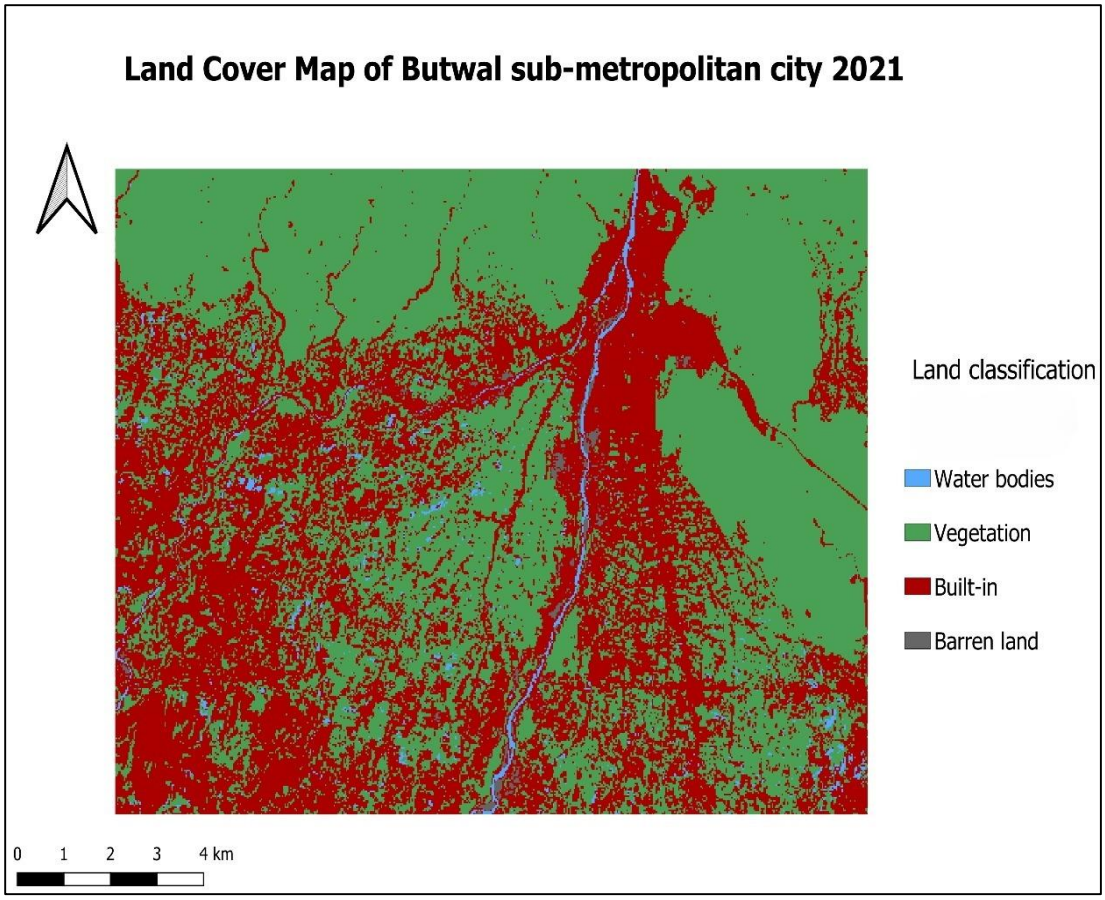

Figure 7: Map illustrating Land classification of Butwal Sub-Metropolitan City, 2021

4.8.1 Classification report

After completing the classification of a map, in the band classification, the calculation was done based on maximum likelihood. Following is the classification report obtained for both 1999 and 2021.

Table 18: Description of land classification 1999

Land classification 1999		
Class	Percentage	Area(m^2)
Water bodies	6.3	3050361450
Vegetation	65.9	31937270175
Built-in	17.38	8411930775
Barren land	10.42	5054359500

Table 19: Description of land classification 2021

Land classification 2021		
Class	Percentage	Area(m^2)
Water bodies	3.8	295113600
Vegetation	60.43	4784213700
Built-in	35.51	2813169600
Barren land	0.29	23419800

Land coverage report of Butwal sub-metropolitan from 1999-2021

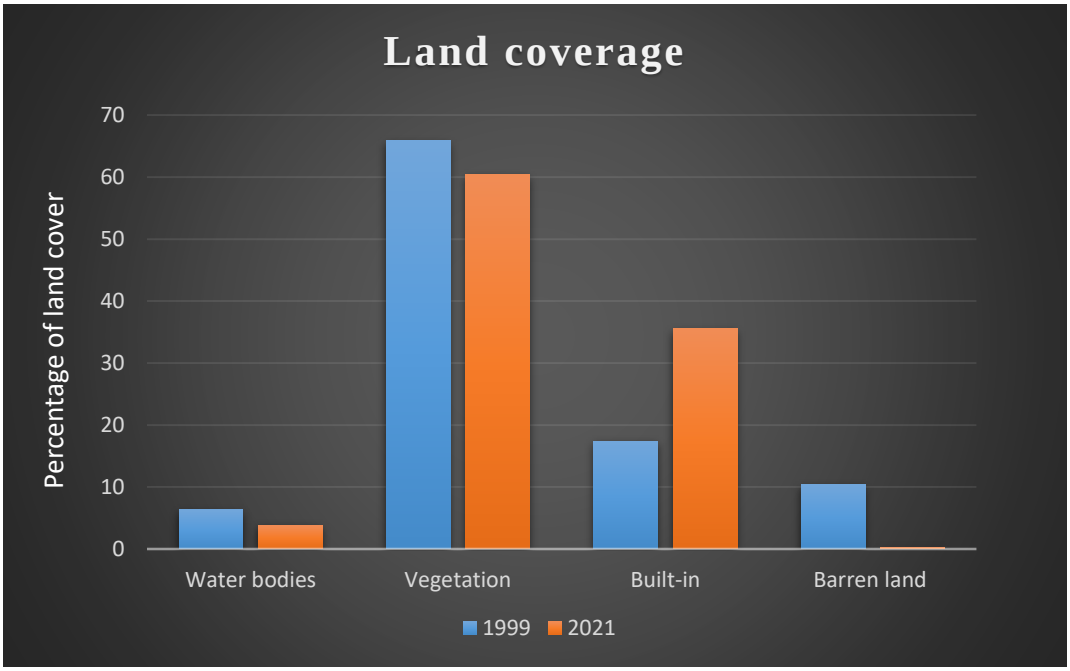

Figure 8: Chart illustrating the land cover of Butwal from 1999 to 2021

4.8.2 Land cover change analysis by Esri

In terms of mapping, location intelligence, and geographic information system (GIS) software, Esri dominates the world market (Esri, n.d.). Esri launched the first artificial intelligence (AI)-generated global 10-meter LULC map derived from European Space Agency (ESA) Sentinel-2 images in 2021 in collaboration with Impact Observatory and Microsoft. The Sentinel-2 10m Land Use/Land Cover Time Series covers worldwide coverage from 2017 through 2022. The yearly updates identify changes in vegetation and crops, woods, barren ground, and urban areas from year to year. Together with the maps, statistical coverage charts are also presented. Following are the land classification image of Butwal, Nepal produced by Impact Observatory and Microsoft, and Esri (Waterman, 2023).

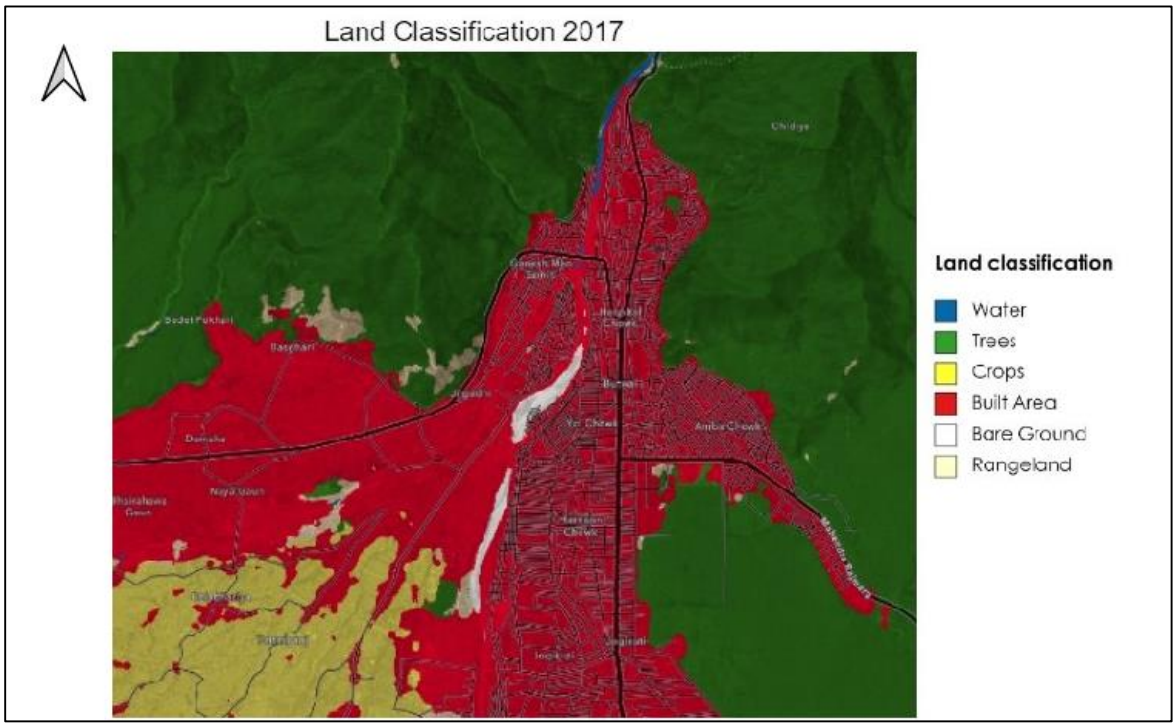

Figure 9: Map Sentinel-2 10m land use and land cover data 2017 (Esri, 2023)

Figure 10: Sentinel-2 10m land use and land cover data 2022 (Esri, 2023)

Land coverage report of Butwal sub-metropolitan by Esri from 2017-2022

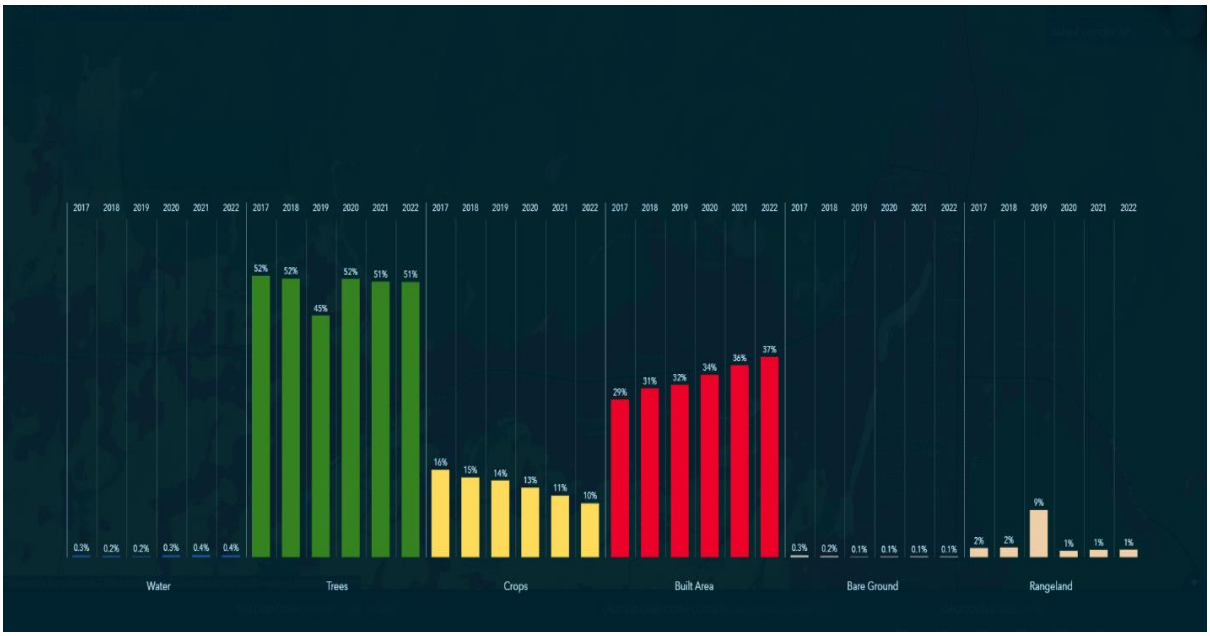

Figure 11: Chart illustrating the land cover of Butwal from 2017 to 2022 (Esri, 2023)

5 CHAPTER V: DISCUSSION

The Terai region of Nepal is known as the country's "food bowl," and here the urban areas have grown at an average annual rate of 12% for the 30 years since 1988/1989. The identification of the primary elements impacting LULC is necessary for sustainable urban growth and effective environmental planning. Planners and developers can use it as a benchmark when creating municipal plans, land management strategies, environmental protection plans, and sustainable urban planning plans (Rijal et al., 2020)

5.1 Progressive plans and policy yet ineffective implementation

The land use planning is very specific to each location. Therefore, it is necessary to enhance the capacity of local communities and institutions to develop and implement comprehensive land use policies at the local level. When local communities and institutions can create and enforce land use plans, governance will be strengthened (Nepal et al., 2020).

Land use policy 2015, has ensured under Policy 6 that there will be a well-planned and sustainable urbanization. But as the land policy are formulated recently, it has not yet reached into action. Therefore, even though it is illegal to build physical construction on public land without consultation with the concerned authority, there should also be plans and policies for the squatter population who has already been settled in the area before the formulation of the policy (MoLRM, 2015).

Marasini and Chidi (2021) conducted research in Sundernagar, one of the Butwal squatter settlements for the assessment of vulnerability, in 2015. Marasini and Chidi (2021) found out that Sundernagar was settled in 2004 during the period of Maoist insurgency (Marasini and Chidi, 2021). In a recent data collection by the Butwal Sub-Metropolitan, it was found that 23.13 percent of houses are made by illegal encroachment of land without official land ownership certificates (GoN, 2019).

Nepal et al. (2020) examined the government's policies, laws, and institutions related to land use and land cover resources, and identified areas for improvement due to gaps and constraints. Based

on the Nepal et al. (2020) assessment of legislative and policy documents, it was concluded that the Land Use Policy of 2015 and the Fifth and sixth amendments to the Land Act of 1964 are significant milestones in Nepal's history of land management. One of the key aspects of these policies is the emphasis placed on creating a digital database of land resources for scientific land use zoning. Another strength is the recommendation for an institutional organization at various levels, from provincial to local. However, the authors note that the 2015 National Land Use Policy does not provide a clear mechanism for coordinating with other important ministries and departments, such as those responsible for agriculture, forestry, national parks, and wildlife conservation (Nepal et al., 2020).

It was also mentioned in the paper of Nepal et al. (2020), that currently, the Ministry of Land Management, Cooperatives and Poverty Alleviation (MoLMPA) bears the primary responsibility for implementing land management activities, while other ministries such as the Ministry of Forests, Ministry of Irrigation, and Ministry of Urban Development have a more passive role. This lack of coordination can lead to conflicts between different departments (Nepal et al., 2020).

Although the land use policy has emphasized the need to discourage the abandonment of agricultural land and recognize the importance of developing and implementing land use plans at various political and administrative levels, the acts, regulations, and codes necessary for implementation have not been developed or endorsed yet. There is a need to either endorse new acts or revise existing ones following the spirit of the new constitution. Additionally, while the government at the local level has recently been established and given responsibility for formulating and implementing land use plans, their technical capacity for doing so is currently insufficient (Nepal et al., 2020).

5.2 The role of migration in LULC

Globally, urban centers are the destinations for most internal migration. In each region of Nepal, there are urban centers such as: in the central region, Kathmandu Valley, Bharatpur, and Birjung are the urban centers, while in the Eastern region, Biratnagar, Itahari, Dharan, and Damak are the urban centers. Whereas, in the western part of Nepal Pokhara, Butwal and Bhairahawa are the

urban centers. In these three urban centers of the western region, there are 42% of inhabitants. This shows that just under half of the country's residents are living in the Western region (Bell et al., 2020). Similarly, the study of internal migration in Nepal (KC, 2003) also highlighted migration and urbanization in Nepal. In the study, he mentioned that the Terai region experienced a net positive migration, with out-migrants from both the mountain and hill regions (KC, 2003).

Migration is at its peak among young adults and decreases sharply among teenagers and older individuals, with a smaller increase among young children migrating with their parents. Marriage is the primary reason for females leaving their district of birth, accounting for 44% of lifetime migration. Whereas, men mostly move for employment, study, or agricultural purposes (Bell et al., 2020).

In the case of Butwal, more than half of Butwal inhabitants were immigrants in 2001 (GoN, 2019). So, with the increase in the number of immigrants, there will be direct and indirect utilization of land resources. Let's see an example of Kathmandu Valley. The Kathmandu Valley is experiencing rapid growth and is currently one of the fastest-growing metropolitan areas in South Asia. It comprises approximately one-third of Nepal's urban population and is growing at a rate of about 4.3% annually. However, urban land patterns are changing rapidly, and the pace of population growth is outpacing the ability of institutions to manage urbanization in the area. As a result, urban settlements are experiencing uncontrolled and haphazard growth in built-up areas (Muzzini and Aparicio, 2012).

5.3 Role of remittances on land use and land cover change

The study shows that the number of absentees in the age range of 20-29 years was discovered to be particularly high. The majority of the absentees had finished their secondary education in the Butwal sub-metropolitan city, which was also examined in the research. The reason for absence was found to be work and study (GoN, 2019). In addition to these, other reasons for absence included commerce, political unrest, and migration with family. For these kinds of different reasons, they are found to be migrating in the same district or other districts of Nepal and also abroad.

On examining the areas of expenditure of remittance amount it was observed that most of the remittance spending went toward meeting basic human needs, including domestic consumption, education, medical care, and other purposes like investing in jewellery, savings, animal husbandry, and various other activities with only a small percentage used for land acquisition and home construction. There was significantly less number of households using their remittance revenue to purchase land and in the construction of homes *(GoN, 2019)*. Spending the remittance income on buying land and building houses and construction work is minimal. This suggests that despite the significant remittance income received by households in the area, investment in real estate development is limited. A similar result was obtained in research conducted by Thapa and Acharya (2017) on Remittances and Household Expenditure in Nepal. It was observed that households that receive remittances tend to spend a larger portion of their income on items other than food. These items may include things like clothing, personal care products, and expenses related to religious and social events. Additionally, these households invest in health, education, and durable goods such as kitchen appliances, jewelry, furniture, motorcycles, cars, and electronics (Thapa and Acharya, 2017). Byanjanakar and Shakha (2021) studied the Impact of Remittances on Rural Poverty in Nepal has yielded comparable results. Their research indicates that Nepalese households typically use remittances for spending on goods and services rather than for savings or investment purposes (Byanjanakar and Shakha, 2021).

Lamichhane (2018) conducted a thesis study on the Labor Migration and Remittance Economy of Nepal, where he analyzed the usage of remittance income. He found that in Nepal, a significant portion of remittance income is used to repay loans taken for migration until they are fully paid off. In comparison to loan repayment and consumption, only a small fraction of remittance income is utilized for saving and investment purposes (Lamichhane, 2018). On the other hand, research by Pant (2017) conducted in 2017 yielded different results. Pant (2017) researched determinants of remittances and the effect of remittance on expenditure behavior and child welfare in the households of Nepal. According to the study, households that receive remittance tend to allocate a higher proportion of their income towards education and health services, while spending and investment on housing and land were less (Pant, 2017).

5.4 Land cover change analysis through remote sensing and GIS

Rimal et al. (2020) studied the pattern of historical and future urban expansion, and the changes in land use in the western Terai region between 1989 and 2016 were analyzed. The findings of the study revealed that during this period, there was a significant increase in urban areas at the expense of cultivated land. Projections for urban expansion up to 2026 and 2036 suggest that this trend will continue, despite a projected decline in the rate of urban expansion. The study also indicated that there are two major land-use transformations taking place in western Nepal, including rapid urban expansion and the loss of agricultural land. Large portions of agricultural land in Kailali, Banke, Dang, Rupandehi, and Chitwan were transformed into urban areas. This change wasn't limited to just the southern regions undergoing urbanization but also occurred in the rich river valleys in the highlands. Urbanization is predominantly occurring in areas that are easily accessible from the mid-hill districts and the East-West highway, including major urban centers such as Butwal (Rimal et al., 2020).

5.4.1 Image classification in QGIS

The analysis of land use and land cover change in the Butwal Sub-metropolitan area shows significant changes in the landscape over the past 20 years. In summary, the analysis of land-use changes over the past two decades reveals significant shifts in the distribution of different land cover types. There has been a substantial reduction of barren land and on the other hand, there has been a surge of built-in space over the same period, with a corresponding increase in urbanization and infrastructure development.

There is a notable change in the water bodies and human activities are the primary cause of it due to encroachment for the settlement as well as the extraction of riverbed materials. Research conducted by (Dahal, 2015) investigated the economic activities related to the extraction of riverbed materials from the Tinau River in Butwal. According to the study, external influences have been degrading the Tinau River over an extended period. Alongside the quick rise in economic activity, this deterioration is getting worse. The negative consequences include a decline in water quality, uncontrolled extraction of riverbed materials, improper dumping of garbage in

floodplain areas, unregulated disposal of untreated waste into rivers, and encroachment on floodplain areas (Dahal, 2015).

Despite these significant shifts, the percentage of vegetation has remained relatively stable over the years, with a slight decline from 65.9% in 1999 to 60.43% in 2021. While this decline may seem modest, it is a cause for concern, given the critical role of vegetation in maintaining ecological balance and providing essential ecosystem services.

Overall, the changes in land-use patterns over the past two decades highlight the complex and dynamic interactions between human activities and natural systems. While some changes, such as the reduction in barren land and increased urbanization, may be seen as positive from a development perspective, they also raise environmental and social concerns. At the same time, the reduction in water bodies and vegetation cover underscores the urgent need for more sustainable land-use practices.

5.4.2 Esri Sentinel-2 land cover explorer

The land coverage analysis conducted by Esri has also revealed significant changes in land use and land cover over the past five years in Butwal. The most notable change is the substantial increase in the built area, indicating that urbanization has intensified in the region. This trend is a cause for concern, given the potential negative impacts of urbanization on natural habitats and ecosystems.

On the other hand, the analysis indicates that there has not been much change in the forest area, suggesting that the forest area has remained stable. This finding is positive, given the critical role that forests play in sequestering carbon, regulating the water cycle, and supporting biodiversity.

However, the area under crops has decreased indicating that agricultural land has been converted to other uses. Also, the reduction in bare land and water coverage areas suggests that these areas have been converted to other land uses. It underscores the need for sustainable land-use practices that balance the competing demands of different land uses.

The findings underscore the urgent need for more sustainable land-use practices that balance economic development, social equity, and environmental conservation. It also highlights the need for more comprehensive monitoring and evaluation of land use changes to understand their impacts and develop effective strategies to manage land sustainably.

6 CHAPTER VI: CONCLUSION AND RECOMMENDATIONS

Previously, there has not been much investigation on land use and land cover change in a developing urban city like Butwal. It was unfeasible to conduct a comparative analysis without access to prior research and data. However, this research has created a baseline, and it is anticipated that these findings will assist policymakers and relevant stakeholders in realizing the necessity of land use and land cover mapping to aid in making a favorable plan for sustainable urbanization (Thapa and Poudel, 2018).

6.1 Recognize the existing drivers of land use and land cover change

Immigration has been examined in the research as one of the factors influencing changes in land use and land cover. It is important to examine the root causes of their unauthorized homes. Additionally, it's important to determine what kind of land they have been using as residences—whether they are clearing the forest and building communities or just taking over the arid areas. Finding out if construction is destroying the vegetation and bank of the river as well as it is crucial to discover the negative effect of these actions on the environment and what difficulty it might cause in future planning. Therefore, understanding the underlying reasons for the population flow is essential.

6.2 Questioning the policy and its implementation

The land use policy has just been formulated a few years ago. Upcoming developmental activities can be carried out based on this new Land Use Policy but for the constructions and settlements that have already been done, there should be appropriate regulations and mitigation measures to manage it.

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