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Land Use/ Land use zoning Practice at Micro level in Nepal: An Assessment

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Abstract

The land use zoning is thought to be better for the sustainable use of land resources utilization in Nepal. Land use (LU) denotes the human activity associated with a specific piece of land and mainly refers to the use by human beings for specific purposes with some sorts of management practices (Khanal,2000). Specially, Land use is affecting by various factors like,physiographic,topographic,climatic,lithology,soil types, climate,rainfall pattern,cultural and traditional practices as well as socio economic factors etc. With varying physiography conditions around Punchapuri Municipality the land use zones have been found to be a varying shapes and thickness. With the growth of population Punchapuri has expanded the cultivable land of the town. The landuse in the Municipality is predominantly nonagricultural with forest,shrub,and grass,covering more than 77% of the total area. The Punchapuri Municipality which is located Surkhet district in province no.6 has been choosen as the study area. Land use map was prepared based on 0.5 m spatial resolution satellite imagery. Various other vector raster and imagery datasets were used ancillary data which enhanced interpretation and classification of land use classes.

Information on the losses, damage and its future risk were collected through focus group discussion, key informants, interview, observation and measurement. The paper further emphasizes on a detail study of land use pattern, land system, land forms type, land capability, geology and natural hazards in order to formulate a classification scheme for land use zoning. This study will certainly help the concerned authorities for the ongoing practices on the land, and land use zoning the finite resource of the country. It will further help to develop plan for the local areas and implement accordingly. Therefore, this study can be regarded as milestone for the planners and development working agencies within the area.

Key wards: *panchapuri municipality, landuse zonning,land capability,risk level and soil profile.*

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Introduction

Land Cover (LC) is defined as the observed bio/physical cover of the earth's surface (Gregorio & Jansen, 2005). It refers to the type of feature present in the land (but not limited to the land because, the dispute about whether it covers the water area or not is normalized by scientific community, who accept, in practice, water area also under land cover) (FAO, 2005). Land is the most important natural resources on the earth surface that support the life for food,fooder,fuel,timber and other biotic materials for human beings (FAO,1995). It also provides shelters filters and stores water and supplies space for urban and industrial development (Verhey, 2009); sources of nutrition,income and employment,and the basis for security,status,socialidentity and political relations (Veit,2011); integrating components of all livelihoods depanding on farm,forest,rangeland or water (rivers,lakes,coastal marine) habitats. The land is limited in extent and particularly the cultivable land is finite (Verheye,2009) therefore,there is an immediate need for the control and regulation in their land use pattern avoiding further misuse of the land and providing a future course of action programmes for healthy urban life.

Landuse is a dynamic phenomenon and hence there exists a need of an efficient landuse evaluation and monitoring system. The city is an organism in which land use patterns have arranged themselves accordingly to the economic and social demands of the people. Land use planning of these cities is essential, for this is basically concerned with the location. Intensity and amount of land development required for the various space using function of city life. Further land use pattern have been worked out after careful study of the present land condition, economic structure of cities and the livelihood break-of their population. The present high density in the old residential areas is one of the important problems. It is also felt that the undesirable mixing of land uses all over the Punchapuri Municipality should be urgently solved through this study. The growing direction of city either greater towards the east or least portion of the city extended to northern part because the northern part of city is not suitable for residential house due to the great barrier presence of physical features. The southern part or bank of the Karnali and Bheri River is not suitable for inhabitation due to water logging of Panchapuri Municipality. Therefore,the land use and land value are proportionately less. The green belt zone should be planned in such a manner that it would be beneficial to farmers as well as the municipality and periphery dwellers. In the northern part of the municipality should be devoted to horticulture.

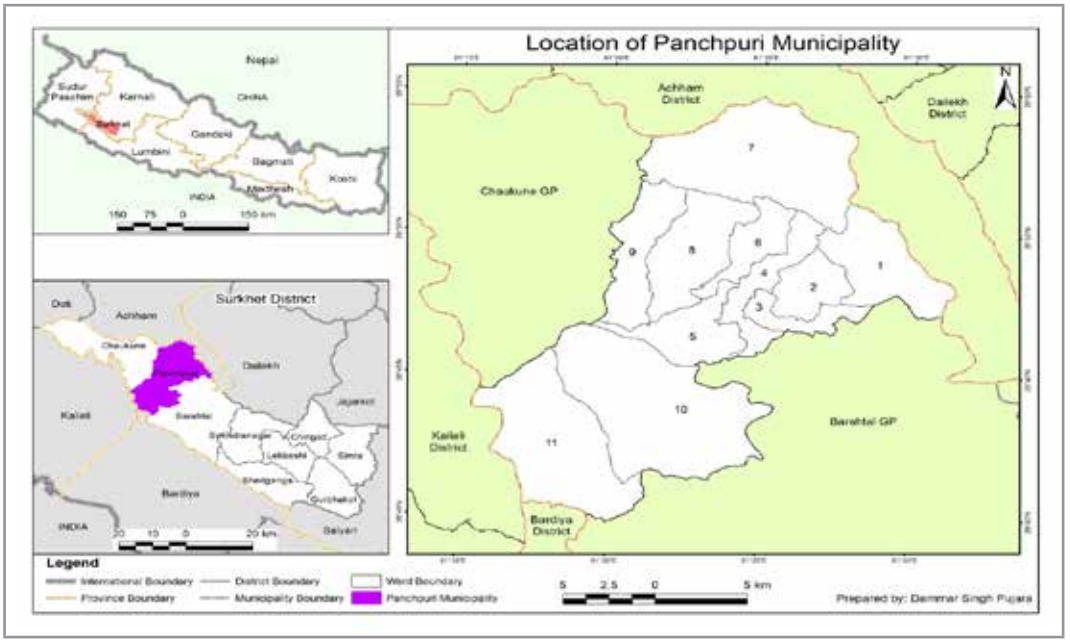
On the other hand, Land is not important resource but also a kind of goods. Under the condition of market economy, the regional differentiation of various and social activities within a municipality depends on their ability to pay rent. As regards the dwelling, land rents come from a part of the income of the residents. With regard to industrial activities, the extra value, which comes from economic activities, is the source of the rent. The type of economic activity decides the extra value per unit area. Even for the same economic activities, there are some differences in abilities due to the differences of location. For this reason, competition exists among various economic activities. Those who can afford higher rent will occupy more favorable space. In the study area,Babiyachour and Bidyapur are major trading centre. Usually,commercial and financial sectors are concentrated in the centre of the town and city, where the location is best and the rent is highest. At present, because the spatial structure of urban land utilization is closely connected to the long –term plan and administrative regulation, the real value of land cannot be reflected.

The Ninth and Tenth Five Year plans (2002/03-2006/07) of Nepal highlighted on the formulation and implementation of land use policy to discourage to use arable land for non-agricultural purposes. Comprehensive local level Nagarpalika level) land use planning has been felt necessary by the Government of Nepal to address the issues of food security, land degradation, forest and wild life protection, hazard mitigation, and physical development. In this scale of land use planning, basic information of the current land use, soil characteristics, land capability, land system, land use zoning, and cadastral maps as well as that of people and service is required.

Study Area

Panchapuri Nagarpalika is an important urban center in Surkhet district and it lies in 6th provinces in Nepal. Geographically, Panchapuri is located at 81° 15’ 11.89” to 81° 31’ 30.7” East, and 28° 39’ 47.29” to 28° 54’ 53.54” North latitude. Similarly, it lies on the southern gentle slope of the Mahabharat Lekh (Range). The total area of the Nagarpalika is 328.99 km². The total population of this Nagarpalika is 32231, of which male population accounts for 48.85 percent and female population is 52.15 percent (CBS 2011). Total number of household in the Nagarpalika is 6304. Similarly,in 2021 Census the total population is 35839. Out of 35839 populations the share of male population is 17230 and share of female population is 18609. The male population account for 48.0. The female population account for 51.9 percent. The sex ratio is 92.59 per 100 females. The annual percentage of population growth is 1.02, and density of population is 109 persons per square km. Similarly, the total literacy rate is 78.51. Male literacy accounts for 86.12 percent and female literacy

rate account for 71.60 percent respectively (CBS, 2021). The location of study area shown as (figure.1)



Data Sources and research Methodology

This paper covers the land use and zoning assessment in micro level of Nepal. The present study uses various datasets and documents. Available details on LULC datasets are also presented. These datasets have been obtained from sources such as web sites and academic and research institutions. Most of the scientific research documents have been obtained from web sites. Some were collected from the central library of Tribhuvan University, Nepal; the International Center for Integrated Mountain Development (ICIMOD), Nepal; and various governmental offices. National Land use Policy 2072 provides Land use classes. The level 1 land use categories are it also helped to know about land use class in the study area.

Interpretation of large scale aerial photograph and also has been used widely in the context of existing land use and land cover change in the study area.

Land use map was prepared based on 0.5 m spatial resolution satellite imagery. Various other vector raster and imagery datasets were used ancillary data which enhanced interpretation and classification of land use classes.

Both types of data, primary and secondary were used for the present land analysis. The secondary data was obtained maps of Land utilization, Land capability Land

system and topographical map prepared by survey department, Government of Nepal in different years. All data and information obtained from secondary sources related with study were verified during the field study. The GPS survey also used for dataset such as drainage network Nagarpalika/Gaunpalika boundary, location name and additional data for GIS based analysis. Digital Elevation Model This model was prepared from spot height and contour data of topographical map of study area prepared by survey department. The application of DEM to obtained information about the slope aspect, relief intensity surface etc. and performing different terrain analysis. The DEM was created in ARCGIS topo to roaster features tools.

Key Informants Interview: KII conducted interviewing selected individuals for their knowledge and experience in land use, forest (species and management) and cropping pattern and their related issues. Interviews were qualitative in depth and semi-structured. The interviews are guided by a checklist of topics/issues or open ended question.

Formal and informal discussion with Nagarpalaika members local stakeholders and people of different backgrounds and social identifies was conducted socio-economic, cultural and biophysical situation as well as optimum resource utilization and land use practice.

Observation was most important method to identify land use pattern and their practice. The Differential Global Positioning System (DGPS) survey was carried out for the collection of Ground control points (Gcps) Check points.

To identify and classification of land use and land cover used from the satellite imagery. Extensive field visit also needed with satellite imagery at 1:5000 scale where different ancillary layers as NDVI. Simple ratio were used in support while performing this task.

The minimum mapping unit for demarcation of land use zone was 0.25ha. However, important and essential features smaller than the MMU were also mapped. Many man-made and natural features on the ground have very unique shaped that can be reference in photo and image interpretation. For example School and colleges can be identified by their peculiar L shaped. Validation of classification of land use result with the application of the thematic map accuracy assessment.

The secondary information was collected from various sources such as published and unpublished reports, various maps and other sources the primary information of soil was collected using field sampling with strong support from GIS and RS analysis and other RS techniques. Soil unit can be classified based on both of the

physical and chemical properties of the soil unit. All data and information obtained from primary, secondary sources related to this study (land use) were verified during the field visit.

Soil Classification of the Panchapuri municipality were identified through soil profile depend on the soil types of USDA soil taxonomy system. Key information on interview was conducted with local farmers and other related stake holders who know the soil properties benefited to agriculture.

The land capability, its classification were identified based on the high resolution satellite images, soil map 1:100 scale land system map 1:100 were included on the other hand, other information was obtained relevant map of study area including LRMP maps, Topographical maps prepared by the survey department of Nepal. Evaluation of land capability of Panchapuri municipality based on the soil properties, terrain slope, erosion and drainage characteristic's.

We have also received the methods of risk assessment in the study area. This information such as type of flood, the flood extent water depth or water level was obtained through the Flood Hazard Map (FHM). Flow velocity and direction. Key informant survey focus group discussion was conducted, and the interview with the people, residing in flood prone area.

The field visits consists of three activities; confirmation of landslides map through observation, key informant survey, and measurement of length and width of landslides collection on information of the losses and damages future risk adaptation and mitigation activities of local people through focus group discussion. The collected data were analyzed, and the hazards maps were prepared in ArcGIS software.

Seismic risk data was obtained through the secondary data. The data has been produced by the maps of Epicenter of the earthquake in Nepal Himalaya, probabilistic seismic Hazard assessment map of the Nepal Himalaya (DMG,2001) and seismic risk zonation map of the Nepal Himalaya (BAJRACHARYA,1994). There is no industrial risk.

Result and Discussions

Physiographic region

This study area falls partly in the Middle mountain terrain in the northern side where the Eocene (Krol Group) rocks mainly limestone, sandstone and shale are found. In the southern side of the area, rocks of Lower Formation of the Siwalik

Sedimentary System can be seen. The area is so situated that the Bheri and Karnali river confluence is located at the southwestern central part.

Elevation

The elevation is an important topographic element affecting the soil formation. Elevation influences the soil formation by affecting the type of vegetation and soil type along with the climatic factors. The Elevation of the Panchapuri Nagarpalika ranges from 186.86 m. to 2003 m.

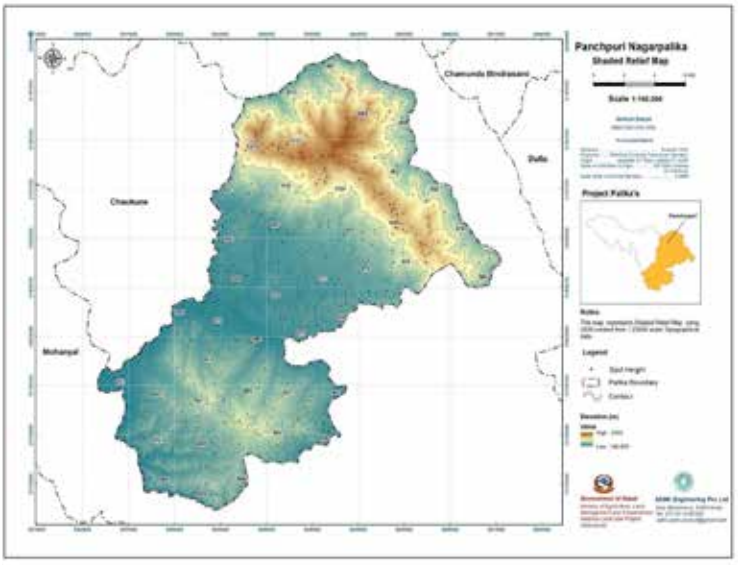


Figure 2.1 Elevation Map of Panchapuri Nagarpalika

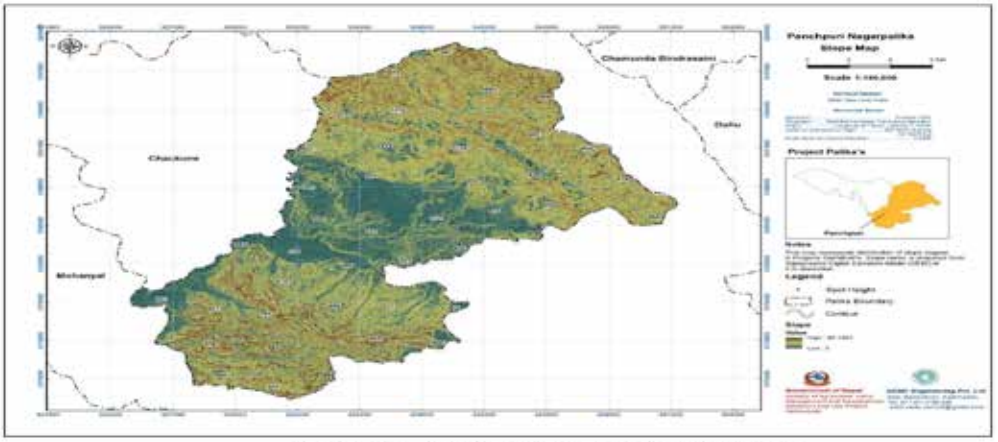


Figure 3.4: Slope map of Panchapuri Nagarpalika

Slope

Slope is influences the soil formation controlling soil erosion and water movement in the soil along with the other soil forming factors and affecting the soil characteristics. To delineate the soil boundary, slope is used as the physiographic variation. Besides this, slope of the project area was used as the basic tool for the demarcation of landform, land types and land units. The slope of this Nagarpalika ranges from 0º to 85.14.

Geology

The investigated area falls partly in the Middle mountain range which is basically a continuous single broad range with mature topography and ridge like looks. Its terrain presents an irregular assemblage of deeply dissected mountains and short ranges with diverse trends. Rocks of Eocene belt (4) occur to the north of Ranimatta thrust which again is bordered by Main Boundary Thrust (MBT) further north. Quaternary Deposits represent the Sub – Recent to Recent sediments deposited by the fluvial action. They are divisible into two types in an ascending order: Alluvium Deposits and Flood Plain Deposits (1a). Alluvium Deposits: This is distributed on both sides of the rivers and streams with low gradient and open valley. They are characterized by river terrace deposits and are of unsorted, rounded to sub rounded pebbly and gravely materials mixed together with fine sand, silt as well as clay giving rise to the development of the fertile top fine soil usable for the cultivation. Active Alluvial Fan (1b) is locally deposited debris as fan derived from landslides and brought down by tributaries to the main streams.

Flood Plain Deposits (River Bed Deposit)

It occurs along the riversides and on the flood plain (present river channel) itself which also contain the water during the winter season and cover the area as high as the water level rises during the heavy rainy season. In other words this is the area that is covered by the flooding river and left barren during the dry season after depositing the various materials carried at flood time. It has alluvial loose sediments consisting of boulders, cobbles, pebbles, coarse sand and gravels mainly of sandstone, siltstone and clay stone with silt. When mixed with clay it gives rise to the fertile top fine soil usable for the cultivation. The aggregates thus derived and deposited by the river often provide an excellent source of building and construction materials. During monsoon (rainy season), the water in the rivers, streams, kholas and nalas increases and runs above the river bed flooding the surrounding areas. The river bank scouring, side cutting and erosion is common feature often seen

in these river systems. Side cutting causes the gully erosion developing badland topography. In addition, inundation and flooding of relatively low – lying areas are commonly found in nearby areas of main rivers.

Flood Prone Areas: These are the low lands adjacent to the rivers and streams flowing in the area and are likely to be affected by floods. Hence, these lands are not suitable for human settlements but can be utilized for agriculture purposes. A risk of flash flood can always be a threat in these areas in the downstream in the future. Erosion and Flood Hazards: Most of the rivers except Bheri and Karnali in the area are originated in the Middle mountain and Siwaliks. These rivers carry little water during winter season. But in monsoon season when there is prolonged rain high intensity flash floods with deposition of huge amount of debris are possible to occur. River bank cutting and scouring in rivers and other streams and nalas is always a threat during monsoon season that needs to be taken care of. Low lands area adjacent to the present network of river plain are the potential flooding areas. This is the area that is inundated during the heavy rain (monsoon) and left barren during the dry season after depositing various materials carried at flood time. These areas are suitable for the Soil Report of Panchapuri Nagarpalika Final Report ADMC Engineering Pvt. Ltd. 8 cultivation (of both dry and wet) but not for the construction of buildings. Such areas are considered to have high ground water potential and are vulnerable to pollution also. Earthquake (Seismicity) and Liquefaction: Nepal has experienced several quakes of intensity 7 or more (in Richter scale) since 1833. Most of the time epicenters are found to confine or concentrate mainly in the Middle Mountains, that is, between north of Main Boundary Thrust (MBT) and further to its north the Main Central Thrust (MCT) and Ranimatta Thrust South of MBT) in the area. Normally earthquake commonly triggers landslides in the mountain region while in the flat land area liquefaction; subsidence as well as cracking effects is possible.

Bearing Capacity: The bearing capacity of soil layers depends on the degree of its compaction or relative density. Higher the value of relative density greater will be its bearing capacity. Generally the loose and soft top soil layers have low bearing capacity. The allowable bearing pressure of the structure built on such strata will be very low. In such areas deep foundation or the ground improvement works should be carried out to build heavy structures. In the flat ground (areas) the bearing capacity might be different and higher than in the slopes. Natural Resources: The area is blessed and surrounded by Karnali in the north, northeast, west and southwest and by Bheri in small southern part. Ground water, non – metallic minerals like river aggregates (sand, gravel, and pebbles) as well as natural forests and building stones

like slate, quartzite, and limestone are the prominent natural resources one can count in the area. The seasonal stream beds have enormous deposits of pebbles, gravels and sand as a good source of construction materials in the area. Proper management of these resources (cement industry and hydro power) for optimum utilization for the livelihood of people is necessary.

Streams and Canals

This Nagarpalika is endowed with rivers among which Karnali River is in the Northern side. Bheri river lies in the Eastern pheriphery as well as it divides ward number 10, 9, and 5 in Northen and southern part situated within this Nagarpalika. Bunggad Khola and also Karnali River situated in the southern most part. However, major Canal system is not available but many small local canal system (Kulo) exists. The major river basin in this Nagarpalika is Karnali River Basin and Bheri River Basin consist of different river system (Ghatte khola, kolte khola, kola khola, rujung khola, galawa khola and bunggad khola).

Climate

The Nagarpalika has primarily two types of climate. The river Valleys has tropical type of climate. The summer become very hot while winter is mild. The inner valley has lower temperate type of climate. Being the inner valley, it is hot in summer in the valley but remains pleasant in the upper slope land. Winter is cold. The Nagarpalika is represented by meteorological station at Pusma Camp. According to Pusma Camp station, the mean yearly minimum temperature is lowest (19.72ºC) in the month of January and it slowly rises from the month of Feb and attains highest (22.89ºC) in the month of March. Similarly, the mean yearly maximum temperature is the lowest (17.74ºC) in the month of January it slowly rises from the month of February and attains the highest (32.52ºC) in the month of May. The Maximum recorded temperature is 27.31°C and Minimum recorded temperature is 18.73°C in Pusma Camp.

land system, landform and land types

The major landform features are valley and tar in the low elevated part, undaluting hill slopes including a series of in the northern part, and hill ridges in the southern part. Physiography influences soil formation affecting the climate, vegetation of an area as if it is considered as passive factor of soil formation. Moreover, there is a close relationship between physiography and soil development which ultimately affects the availability of nutrients (Verma et al., 2005). The physiography has influential role in soil formation through slope and exposure. The flat topography

has more depth of soil as compared to the steep slopes because the steep slopes are more prone to the erosion (Sehgal, 2002). Soil properties like profile development, texture, structure, color, acidity, cation exchange capacity, base saturation etc. are related to land form. There is a close relationship between physiography and soils. The formation of the diverse group of soils can be attributed to the variation in topography causing erosion, leaching, sedimentation and other pedogenic processes modified by water table (Mini et al., 2006). Thus, physiographic influence of soil properties has been recognized which ultimately leads to evolution of the soil-landscape relationship. Topographic maps, aerial photographs stereo-capability and remote sensing data provide useful tool for geomorphic analysis of the region and help in soil survey and mapping. The present investigation is based on the physiographic-soil relationship approach assuming the physiographic controlled landform as the basic spatial and structural entities of forming soil mapping units.

Physiography in study area is further divided into land system according to recurrent pattern of landforms, geology and slope and arable agriculture limits and then land units based on map able land surface significantly from some user oriented point of view for delineation (LRMP 1986). Within the land units, land types were delineated based on position, slope, direction, drainage of landscape features which is especially important for local level project design (Carson 1985). The soil properties within the land types further subdivided based on the cropping pattern were determined by detailed field soil survey. These observations were further studied on Soil Association for classification. Digital Terrain Model (DTM) is employed for delineation of landform, land units and land types for detailed soil survey at local level planning.

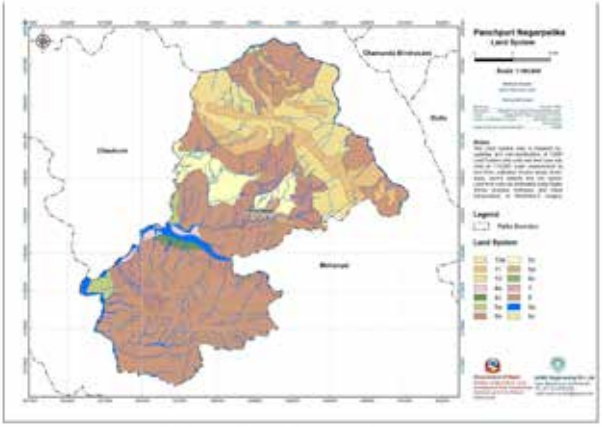


Figure 4.2: Spatial Distribution of Land Units

Land System

The study area lies in the Hilly physiographic region. It encompasses land system units of 1, 2, 3, 4, 5 and 6 basically differentiated based on geology and geomorphology. Physiography is further subdivided into landforms basically defined by the position of land surface in landscape and it is characterized by slope and its direction, elevation, rock exposure and soil type.

Land form

Landform is further subdivided into land units basically defined by the mapable size of land surface for demarcation in landscape by the user. And it is characterized by landscape features. The land units in the project area are shown as below: ● Intermediate position level. ● Depressions ● Khola, sandbar and flood plain Soil Report of Panchapuri Nagarpalika. Among the land units defined by LRMP Land System, land types are demarcated considering the local situation of land units representing micro-relief differences based on the local slope and elevation and its orientation. Landform affects soil formation and its profile development in association with the steepness of land and slope direction. The slope classes are required for land type classification. The land unit defined by LRMP is further subdivided based on local field variation associated with the different landuse practices. Altogether nine land units identified in the project areas associated with the micro relief variations. The spatial extent by the Nagarpalika area in presented in (table 1.1).

Table 1.1: Land System/Land type

Land system	Land form	Land units	Area (Ha)	Area %
1	Active and recent Alluvial plains	4a sand and gravel bars, 4c higher terrace undulating	278.89 210.41	0.8 0.6
2	Fans,aprons and ancient river terraces	5a very gentle slope,5b gentle slope 5c undulating,5d rolling	408.41 2587.28 2050.26 336.89	1.2 7.8 6.2 1.2
3	Steeply to very steeply Slopping hilly and mountainous terrain	8	17620.87	53.5

4 5	Alluvial Plains and fans (depositional)	9 a river channel 9c alluvial fans	1177.65 35.79	3.5 0.1
6	Moderately to steeply slopping mountainous terrain		3303.30	10.0
7	Steeply to very steeply slopping mountainous terrain			

Soil Profile

The noun soil is derived from through old French from the Latin 'Solum'which means floor or ground. In general, soil refers to the loose surface of the earth and distinguished from the solid rock. Defining the term precisely from the view point of pedology we can say that, the highly weathered decomposed upper layers of earth's crust which have been influenced by climate, plant growth and microorganisms, to support plant life can be termed as soil. To the soil scientists or pedologists, the word soil has a somewhat different meaning, but no generally accepted definition exists. Similarly, soil is the top covering of the Earth's surface. **A Dictionary of Geography-**"Soil is the loose materials which form the upper layer of the mantle rock, consisting mainly of very small particles. It is penetrated by the roots of plants,which drive from it both food and moisture,in fact,from the stand point of agriculture,soil constitutes only the few inches of the top layer of mantle rock in which cultivated plants are grown." The transformation of rock into soil is designated as soil formation. The rock may be of any kind, i.e.,gneiss,limestone,shale,sand or loose friable materials like loess,peat etc. The relationship between parent material or rock and soil formation is of basic importance so far as the anatomy of soil is concerned.

Weathering and other erosional agents break of the rocks and form the skeleton soil (regolith) for soil formation. The status of the soil system very with time that is,,they are not stable. We may consider a piece of granite that is brought to the surface of the earth for our convenience. In the interior of the earth the granite may have been in a state of equilibrium with its immediate surroundings,but now on the earth,s open surface,it is an entirely new environment,bringing from the rock system in a highly unstable condition.

Parent materials,climate and organism are commonly designated as soil formers or soil forming factors. Since soils change with time and undergo a process of evolution,the factors time also is frequently given the status of soil forming factors. Topography which modifies the water relationship in soils and to a considerable extent influences soil erosion,is usually treated as a soil former. We need it to grow crops. All this, however,is a very slow process.It takes thousands of years to form avery thin layer of soil.

On the basis of soil texture,geological structure and climate,the soil of study area can be broadly be categorizied mainly three types which are as follows.

Alluvial parent materials

Alluvial fine to medium textured soil mainly occurs in Terai region lies in the southern part of Nepal and interior river basin of the midland area. This type of soil is made by the deposition of the river. So it is mostly found in the river basin. As it is rich both in minerals and the humus and the good water holding capacity it is extremely fertile and suitable for all types of crops. It is fine,deep and is grey in colour. This type of soil is very fertile. It is formed from sediments brought down by rivers from mountains and deposited in plain. Therefore,its naturally fertility is renewed every year by floods during rainy season. The alluvial soils are formed by flooding and are normally considered fertile,but this is not always the case.

The amount and type of sediments brought by the rivers are affected by many human activities such as deforestation, various construction and agriculture activities. These human activities increase the pace of erosion and thus a large number of sediments are brought downstream. These eroded soils and nutrients sometimes can be good. But there are occasions when these floods –deposition brings contamination from the upland pollution. These are those deposited by moving water bodies such as rivers and streams. The texture of the deposit depends on the energy of the water body. Alluvial parent materials varies from coarse textured consisting a larger proportion of sands, gravels, cobbles and boulders to very fine textured silt and clay materials towards south as one moves from the Siwalik foothills. Alluvial type of parent material is associated with such landforms as piedmont, old streambeds, flood plains, fans, and levees.

Native bedrock: Native bedrock offers in-situ earth material on which soils are developed. These in-situ materials are direct product of the physical and chemical weathering of the rock. Soils formed in situ reflect the characteristics of the bedrock

on which they occur. Native bedrock comprises of the sandstone-mudstone or conglomerate sequence of sedimentary rock belonging to the Siwalik Formation The bedrock is gently to steeply dipping and consists of dense network of joints and fractures giving rise to dip and anti-dip slopes. These geological characteristics coupled with faults and thrusts have influenced to form scarp or cuesta or hogbacks which have a bearing on the geomorphic processes and in situ soil formation through action of solar insulation, physical and chemical action of water. Soils developed on such bedrock are loamy skeletal or coarse loams, less than 1 meter to bedrock. Texture variability reflects bedrock variability. Associated soil groups are typic, lithic, anthropic and dysctrocrepts and ustocrepts. Soils derived from the native bedrock are classed under land system unit 7 and 8 (LRMP, 1986).

Colluvial materials: It includes all those affected by gravity, which occur on the sloping land and on foot slope. Landslide and debris flow deposits are considered to be colluvial. Soils formed on colluviums tend to have a high proportion of angular stones of all sizes throughout the profile, the result of mixing during down slope movement. Soils developed on the colluviums belong to LRMP (1986)'s Land System Map unit 7 and 8. Well differentiated horizons are not found on these soils because of the great mixing that occurs with down slope movement. Lack of obvious soil horizons is a good indicator of a colluvial slope.

Risk Areas within the Study Area

It discusses the elements of risks, such as,hazard (mainly: flood,landslide,seismic,fire and industrial and vulnerability as guiding issues for formal landuse planning. Flood is a natural event of rising water level in a stream, lake,reservoir or coastal region (Frieseekee,2004). Flood is a too much water in the wrong place (Singh, N,2013). A flood is caused by heavy rainfall that causes/ river oceans to over flow. It can happen any time. Flood can happen very quickly when lots of heavy rainfall over a short period of time. Such type of flood is called flashflood which can occur with little or no warning. This can cause huge damage on human life than any other type of flooding. From the interview with local people,flood is uncertain in the study area. Bank cutting has been a serious problem in the area.

The result acquired through the analysis reveals the fact that the study area need immediate actions to take against flood such as river training or embankment or levee construction to protect the given area to flood. Settlement like Chamri, Bachhi, Salkot, Skulgada, Galawa, Tatopani, Tinkune Dugadi and surrounding areas are more prone to floods as revealed by the study.

The people in such area are at the risk of flood hazard so these people need to be shifted from those areas to the area free of flood and other risk.

Bheri and Karnali River cutting and flooding are the major environmental problems of this municipality. Bheri and Karnali rivers cut in its river occasionally according to the local senior person it have losses about 100 bigha of land of Punchapuri municipality. Fire risk Forest fire has been seen in the past in the study area and has done significant damage to the local ecosystem. Study from forest fire detection monitoring system from ICIMOD has been tracing forest from satellite data available from 2012. Major portion of the study area is covered with forest so there is a significant risk of forest fire. In addition, scattered bamboo plantation was seen in this package which is fire sensitive to since it produces large amount leaf litters.

Many studies suggest that fire occurring in chure and hilly region are due to the carelessness of human behavior. Poor handling of fire foe cooking and other purposes, electric short circuits, poor wiring, poor handling of gas cylinders, and stoves throwing cigarette butts carelessly human negligence and lack of adequate fire safety measures are the major factors contributing to the outbreak of fires. The settlement area of this package are particularly susceptible to fire hazards due to the heat, the house with thatch roofing and frequent lightning strikes and wind stroms. Most incidences of fire occurs in the day summer season,festival,crop harvesting and loadshedding.66%of the total area of Surkhet district falls under high risk of fire among all the districts of Nepal. (Matinetal,2017)

Though, there are landslides in this nagarpalika no significant landslide risk was observed in the study area that could damage settlement and agriculture land. Seismic RiskPanchapuri nagarpalika of surkhet district areas fall in seismic zone of 4,high seismic hazard area. Hence, the design horizontal seismic cofficent ranges from 0.089 to 0.1539 (calculated values). Industrial risk Panchapuri nagarpalika has no industry. There is no risk of industrial pollution. Other Risk No other risk in relation to land use done are seen in the study area.

Safe area for Settlement

The area has been under many potential threats. Mainly the agriculture and residential areas are under high threats from the flood and industries. Natural forest fires risk is seen in the dry season. There is potential risk of fire due to the thatch roofed houses which easily catches fires and the petrol pumps which need to be operated under the safety regulations. In case of seismic risk, no fault line passes

through the study areas. Some occurring of earthquakes as epicenter falling in the area has been seen. No landslides risk. Somewhere, sloppy terrain alongside road in monsoon season.

Landuse Zoning

Landuse zoning is the suitability classification of land for various landuse purposes. Based on the suitability of land for various landuse classes,landuse zones are classified into eight broad categories there are agriculture,commercial,residential,archiological and cultural, lake and riverine,public service and industrial etc. There has been existed unsystematic and unhealthy realestate business in the absence of effective landuse planning and zoning. The utility services are also very poor in the development areas due to lack of updated planning and monitoring.

The available land is not being used on its optimum level. Crop production is not according as the suitability and capability of the land. On the slope of the neighbouring hills, however,there are few quite a few quite disperse Pahadi settlement. The Pahadi settlements tend to be isolated and often such settlements are guided by the gradient of the hills and the availability of water. On the slope of the hills,where the hard rocks are exposed no agricultural crops are grown, but are grown for grazing purpose. The slope of the hills just north of Punchapuri Municipality is typical example of this case. Light forest on the higher slops are the main sources of fuel-wood and,such forests are also utilized for graging purpose. Out of the total land forest account 77.33% areas occupied are very quiet large among the various land use percent in study area. Agricultural land only occupied 17 % which belong to second position under the total area of the Municipality. Similarly,unplanned settlement and unhealthy habitat,lack of urban infrastructure,natural disaster and environmental degradation are other serious challenges to be faced in future. To cope with these challenges, available land should be managed appropriately. Land use planning is one of the tools for getting optimum benefit from scarce land resources. Sustainable socio-economic development of a country is highly dependent on the proper use and utilization of resources available.

Therefore, zoning is a device of land use planning used by mainly the local governments in most of the developing countries. The word derived from the practice of assigning permitted use of land based on mapped zones which separates one set of land uses from another.

Table 1.1: Land use Zoning Punchapuri Municipality

Zone Type	Area (Ha.)	Percentage (%)
Agricultural Zone	5698.47	17.32
Commercial zone	3.67	0.01
Cultural and Archeological	0.3	0.0001
Forest Zone	25441.78	77.33
Public Zone	395.04	1.20
Residential Zone	188.34	0.57
Riverine and Lake area	1172.49	3.56
Grand Tota	32899.84	100.00

Source: Field Survey 2018

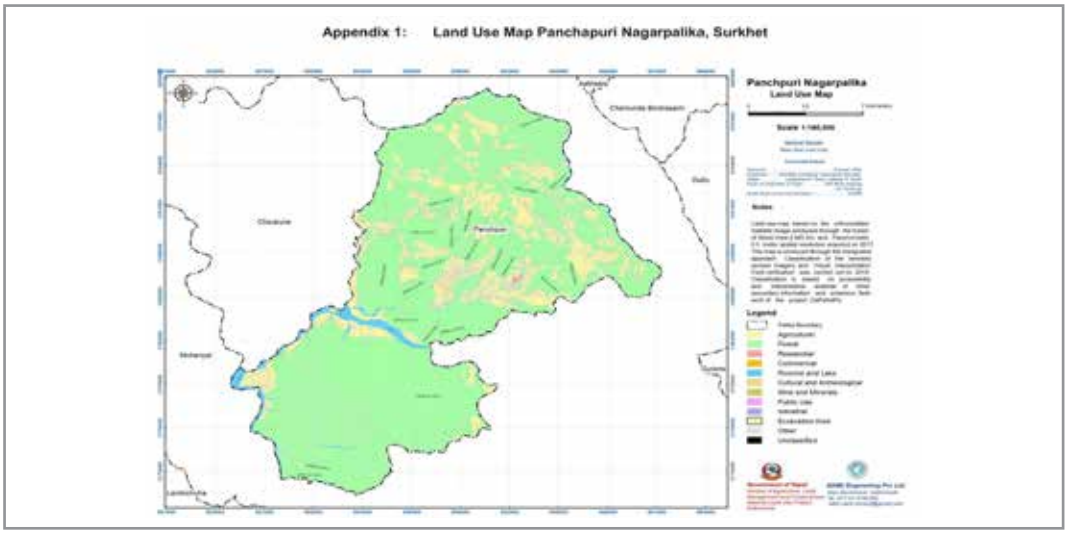
Land use Zone

Present landuse of the Panchapuri Nagarpalika at first hierarchical level of classification is provided in table 1.3 below. Out of total 32899.84 hectare land 77.65% area is covered by forest, 17.57 % area is covered by agriculture followed by Riverine and lake area which covers 3.58 % and commercial area covers 0.01% area of the Nagarpalika. Public services covers about 0.60% and residential covers 0.59% of the covered area. However,cultural and Archeological landuse area,mine and minerals,excavation area,industrial and covers less than 0.01%of the total area in this Nagarpalika.

Table.1.3 landuse Zone of Panchapuri Nagarpalika

S.No.	Landuse class	(Ha.)	Percent
1	Forest area	22545.35	77.65
2	Agricultural area	5780.54	17.57
3	Riverine and Lake area	1177.43	3.58
4	Public use	198.01	0.60
5	Residential area	195.61	0.59
6	Commercial area	2.86	0.01
7	Cultural and Archeological area	0.03	0.0001
8	Industrial Areas	0.00	0.00
9	Mind and minerals area	0.00	0.00

Source: Field Survey 2018



Conclusion

The present study is fruitful and it provide required maps data base on the theme, which will be fundamental technical reference for implementing land use plan at the local level. Such a data base will certainly help the concerned authorities to think of the ongoing practices on the lands the finite resource of the country. It will further help to develop plan for the local areas and implement accordingly. In this sense, the study can be regarded as milestone for the planners and authorities working within the study area. Being zoning criteria are subjective, it is necessary to adopts scientific guidelines to develop a micro zoning of the local government on the basis of this study. The land resources of the area are less deteriorated. Land use act is the most important tools to take this policy in action. Therefore it is essential to formulate land use act and enact in order to implement the scientific plan of land resources development. In conclusion, in the study area,for the overall urban plan of the new period,in order to save land resource and improve the efficiency of land use,the government should control such irrational phenomena as the small city occupying excessive land, and should encourage them to develop in a proper way. Land use planning is one of the tools for getting optimum benefit from scarce land resources. Sustainable socio-economic development of a country is highly dependent on the proper use and utilization of resources available. Present landuse of the Panchapuri Nagarpalika at first hierarchical level of classification is provided above study. Out of total 32899.84 hectare land 77.65% area is covered by forest, 17.57 % area is covered by agriculture followed by Riverine and lake area which covers 3.58 % and commercial area covers 0.01% area of the Nagarpalika.

Public services covers about 0.60% and residential covers 0.59% of the s area. However,cultural and Archeological landuse area,mine and minerals,excavation area,industrial and covers less than 0.01%of the total area in this Nagarpalika.

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