

## Morphological Enhancement of Trans-Himalayan Trail through Central Village Town Model: A Case from Lukla Trail, Solukhumbu Nepal

Prasad Pokhrel K\*

Department of Geography Education, Faculty of Education, TU, Nepal.

### \*Corresponding Author:

Kabi Prasad Pokhrel PhD,  
 Professor, Department of Geography Education, Faculty of Education, TU, Nepal.  
 Email: drkabipokhrel@gmail.com

Received: January 23, 2020  
 Accepted: February 19, 2020  
 Published: February 26, 2020

**Copyright:** ©2020 Kabi Prasad Pokhrel. This is an Open Access article published and distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited.

### Abstract

This paper attempts to point out the initiations that have to be taken to enhance the morphological structure of Lukla Trans Himalaya Trails (LTHT) of Eastern Nepal. Both qualitative and quantitative approaches as well as expert judgment methods were applied to trace out the existing biophysical and socio-economic conditions of the Lukla Trail. Pointing out the environmentally sensitive areas, exploring the needs and resource base, and prioritizing the development activities that collected from local stakeholders, participatory techniques such as interactions, focus group discussion and interview portfolio were conducted with rural municipality authorities, elected members, community people, porters, tourists, and businessmen. The views and opinions given by stakeholders were analyzed in relation to how the morphological structure of the Trail could be strengthened and what type of initiation has to be taken by the governments to promote the present rural settlement structure into urban form. Review of available literature was to frame out the model for urban settlement development in mountain corridor. Tourism infrastructure, socio-economic conditions pattern of settlements, building materials, and transformation mode, biophysical, demographic and socio-cultural attributes, and regional connectivity network of local production and services were discussed in holistic way. The policy measures for land pooling, guided land development, land acquisition was also suggested to enhance the morphological structure of Lukla Trans-Himalaya Trail in order to upgrade the trail as urban center.

Findings of the study indicate that urban development in the mountain corridor is one of the emerging option that solves the local socio-economic problems in the context of remote mountain areas, satisfaction of human needs, diffusion of skills and technology by activating local politics and policy making for valorization of territorial specificity through democratic government and democratization of local development in the mode of people, public and private partnership (P4).

**Keywords:** Trans-Himalaya; Village Town Model; Mountain Corridor; Morphological Enhancement; Environment Sensitiveness.

## Introduction

The economic, spatial and mobility trends in Nepal point towards the inevitability of urban development in the country side with a view to materialize the social innovation and cultural practices in the sphere of arts and creativity [33]. The contextual scenario of mountain region of Nepal clearly indicates to address the local and territorial development initiations in the remote mountain areas for satisfaction of human needs, diffusion of skills and technology by activating local politics and policy making for valorization of territorial specificity through democratic governance and democratization of local development activities in order to promote the practice of self-determination economy as people transform their livelihoods and lives by enlarging the power and competence base of localities (Sen,2009). National Planning Commission of

Nepal has prioritized to promote the polycentric service centers as the engine of economic growth, social change, ecological stability and science and technology development in order to meet the sustainable goals in the Nepalese context (NPC, 2015). Regarding this, Ministry of Urban Development (MOUD) through national urban development strategy (NUDS, 2017) has initiated rural transformation in relation to build the socio-economic interrelationship between urban and rural areas for providing modern social infrastructure facilities by strengthening capacities of local communities and local governments in remote areas of the country. In the line with this, MOUD has focused to develop the urban settlement along Trans Himalaya Trails by identifying the possible Trails for urban development through urban infrastructure extension programs which can support sustainable, eco-friendly, local resource based and modern facilities available human settle-

ment development in the mountain areas. The Ministry has also initiated Trans-Himalaya Trails morphology strengthen aiming to upgrade as the urban center through enhancing available social services and physical infrastructure with due consideration of environmental sensitivity.

Great Himalaya Trail is one of the longest and highest footpaths on earth, and likely the most dramatic, traversing the entirety of Nepal from east to west in the shadows of the world's highest peaks. For those looking for the cutting edge of adventure trek, Nepal's Great Himalaya Trail (GHT) presents the opportunity of a lifetime. Winding beneath the world's highest peaks and visiting some of the most remote communities on earth, the Trail passes through lush green valleys, arid high plateaus and incredible landscapes in the Himalayas [5].

Spatial planners need to consider ecological niche as an important organism for the distribution of resources and competency of settlements, and how this pattern, in turn, alters the biotic and abiotic factors used for urban-rural spatial restructuring and land consolidation [42]. The human settlement also has a niche, which is affected by natural and socioeconomic conditions with regarding the urban-rural settlement as occupying a natural-socio-economic complex ecosystem niche [47]. The concept of land consolidation and urban-rural spatial restructuring from the perspectives of production, living, and ecological space, which are a new platform and major tool to implement new-type of urbanization strategies and the agricultural modernization [20-22]. Number of studies focus on one or two aspects of the natural, economic, or social conditions of urban-rural reconstruction, and it is challenging to reveal the holistic reality in a comprehensive manner [40, 45]. Zhao et al. (2013a) [47], Yao and Xie (2016) [44] suggested that ant colony optimization algorithms and scenario simulations could be a good way to support rural spatial restructuring.

It is still a big controversy which size of cities is best for human settlements from the economic and ecological perspectives. Some studies show that small towns (cities) play a positive role in rural transformation, and regard their roles as the urban functions in rural development [2]. Economists offered the criticism that small towns and cities do not comply with the law of economics and usually represent the inefficient use of resources, e.g., land use per person and energy consumption per capita. Some ecologists believe that small towns can achieve both environmental protection and meet human needs. Meanwhile, planners disagree and argue that urban dispersion and small-town construction could be a disaster for ecological conservation. Similarly, the collective land ownership system and the pressures of economic growth, the local authorities change the agricultural land to urban land use in small towns, resulting in large cultivated area being occupied, thereby causing the out-of-balance social-ecological system [7]. Moulart et al., (2016) and Koukofikis (2018) discussed the role of micro-enterprise and informal economic activities for urban development strategies. They viewed that urbanizing as a scientific debate that has till recently has been too confined to environmental macro-economic, political economy and environmental justice, with little attention given to spatial dynamics and local specificity.

Haining (2015) focused on the traditional settlements in the larger regional division and major cultural watershed, in terms of case analysis and theoretical discussion. Specifically, on natural conditions, rural settlement, single plane, building construction, decoration, and functions. Aryal (2015) [1] conducted a study in Nepal Himalayas using a system thinking approach and found that globalization; particularly tourism and labor migration, state conservation policies and practices, and climate change are the major drivers of change to the traditional social-ecological

system in mountain areas of Nepal with areal variations in site locations. The study revealed that tourism and labor migration created shortage of labor for transhumance systems and reduced local economic dependency on such systems and the trends of key climatic variables (temperature and precipitation) and perceived changes in different biophysical indicators the climate change has emerged as an additional threat and has the potential to impact different components of the system their functions and services. Huang (2017) [14] had analyzed historical urban growth trends in the mountainous region and stressed to understand the interaction between the spatial growth pattern and the mountainous topography including slope, accessibility, and land use type together create resistance to urban growth, while accessibility controls the sequence of urban development.

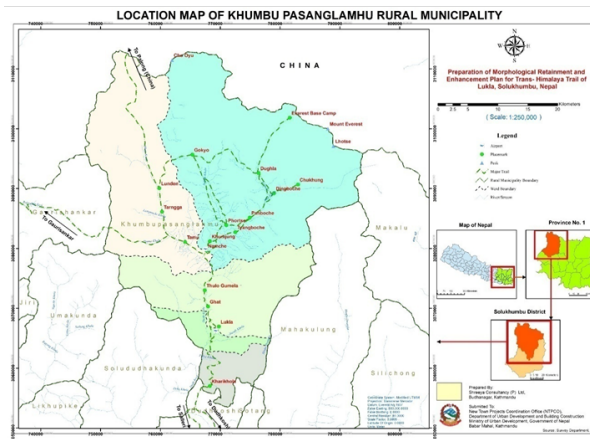
Keating (2018) [16] and Bolleyer (2018) [3] have shown how territorial politics shape institutional structures and public policies across developing and developed countries globally. Land governance is most apparent in political and economic zones and create regulations delineating how and by whom these areas can be used. So that state territorialization shapes state-society relations through the (re)configurations of power look at land use planning processes in relation to the state's territorialization attempts in land governance and contend that since the emergence of the sustainable development paradigm onward 1980s, and land use planning has become a key arena for political debates over society-environment interactions and, in practice, an important means for territorialization process. The spatial pattern of urban expansion in mountainous regions not only affects the surrounding landscape but also the overall ecologic system. Spatial patterns, with their associated processes, have long been a focus of urban geography. The spatial pattern is often analyzed and explained in the context of the urban social fabric, economic structures, and functions resulting in many spatial models. Some recent studies have shown that traditional urban-geographic models do not explain urban spatial expansion in mountain and Trans Himalayan's unique socioeconomic background, human settlement history, and rapid growth (Dorward, 1989; Romero & Ordenes, 2004; Petrișor, 2013; Schneider-Sliwa, 2015) [8].

In above back ground this study attempts to point out the existing biophysical scenario and initiations that have to be taken to enhance the morphological structure of Lukla Trans Himalaya Trails (LTHT) using participatory approaches and expert judgment method to suggest plan schemes for the different level governments in Nepal.

## Results

### Lukla Trans-Himalaya Trail

Lukla is a small town in the Khumbu Pasanglhamu Rural Municipality (KPLRM) of the Solukhumbu District of north-eastern Nepal. Lukla is situated at 2,860 meters (9,383 ft), it is a popular place for visitors to the Himalayas near Mount Everest to arrive. By the Nominee Culture believes Lukla means place with many goats and sheep which is covered by cloud near by Dudh Koshi River. Lukla and this region is served by a small airport, and a variety of shops and lodges catering to tourists and trekkers, providing western-style facilities. Right from Lukla, travelers take two days to reach the village Namche Bazaar, an altitude acclimatization stop for those continuing on. Lukla Trail lies in the heart of northern part of Solukhumbu district and serves as Iso serves as lifeline to upper settlements of Khumbu region. The major settlements of the routes are Ghat, Phakding, Toktok, Benkar, Manjo, Jorsale, Namche, Khumjung, Panboche and Dinboche. The trekking route and major settlements within trail are shown in the Figure-1.

**Figure 1. Trekking Route and Major settlement.**

### Geological structure and land forms

The Khumbu region lies in the Higher Himalayan Zone along with glaciers and mountain rivers and known as the home of natural hazards. The northern part is overlaid by the Tibetan Sedimentary Sequence which is characterized by a rugged terrain of high mountains, glaciers, deeply incised valleys and constricted (glacial-fluvial terraces). Landslides, mudslides, mass movement, and debris-flows observed throughout the trail due to weak geology, unstable geomorphic process, rugged topography and steep slopes, in combination with intense monsoon precipitation. Outcrops of the landslide deposits are rare, and the overall topography underlines the theory of a departed or polyphonic rockslide event while the deposited mass of Chaurikharka has surface topographic and sediment logic characteristics of a large rockslide with a heavily brecciated basal layer. The southern part shows similar features down in the DudhKoshi River gorge, but are there additionally topped by a boulder carapace forming a terrace-like deposit from Chaurikharka to Muse. Many sections of Lukla trail rockslide boulders on top of bedrock and moraine found, while Lukla itself is located on an alluvial and debris flow fan. South of Lukla bedrock geology is obscured by moraines from the Surke-Drangka Valley and rockslide material is missing (Fig-2).

### Drainage System

The periphery of Lukla Trails is a major source and origin point for major river system serving over a billion people. Snow and glacier are natural fresh water reservoir in solid form which are the important components of hydrological cycle in the trail. Mountainous topography is the main factor for perennial water flow in the Khumbu region. The Lukla Trail region consisting three major watersheds i.e.t BhotheKoshi, DudhKoshi, and Imja Khola which drain the region in the form of glacier and snowmelt as well as liquid precipitation. Its hydrology is heavily influenced by the monsoon and the temporal redistribution effects of glacier and snow melt. Major water bodies are: DudhKoshi, Imja River, Gokyo Lakes, Hongu river, NaktokKhola, HandiKhola, PaiyaKhola, BhotheKoshi, ThameKhola, and LangmucheKhola (Figure 3).

### Land Use

The Lukla Trans-Himalayan Trail lies in high mountain region and characterized high altitude, rugged terrain, barren lands and extreme climatic conditions so that most of the area of the trail and its allied area is not suitable for human activities like farming, physical infrastructure development and settlement development (Table-1).

It is evident from the table-1 that out of the total land area of the

Trail (KPLRM) more than 63 percent land area is covered by barren and rocky land followed by glaciers (15.49%), Grassland (7%), bushes (6.56%), forest (5%), and agriculture land (1.20%). The share of the human settlement, river and lake and physical infrastructure like route, footpath is very low. The land use pattern of the Trail clearly indicates that along the Trail it is difficult to construct and provide physical infrastructure facilities and very few lands particularly in river basin permits to extent human settlement in dense form i.e. urban form.

As regard the demographic information of the Trail area the total population of the rural municipality was 8989 having 4493 male and 4496 female population with 2433 households. Population and number of households are expected to have increased to certain extent in these eight years. Population distribution by ward is presented in table-2.

### Gap and trend analysis

Being the mountainous topography and lack of road transport facilities, the level of physical development in the Lukla Trail is very low and insufficient. There is huge gap in required infrastructure facilities and availability. Only 6.44 percent of trails are in all-weather condition and indicates the urgency to improve the Trail and road condition. Lack of sufficient information on drinking water supply in relation to demand and supply, it is difficult to point out the exact condition of the drinking water supply system along the Trail area. At present, the existing drinking water supply facility observed at the satisfactory level and almost households found to get drinking water facility in an unmanaged way. Available drinking water supply facility and sources seem to be insufficient and efforts needs to explore sources as well as better management as per equal opportunity to get water service easily. Most of the locals viewed that existing water supply system did not maintain equal opportunity and only the powerful people take more facility and powerless people get less and insufficient facility. It is therefore, existing situation indicates to make dramatic changes in drinking water management system as to take part by all of the community people. Somewhere few public taps found in the Trail route but the quality of water needs to be tested. The overall drinking water system of the Trail region is poor in quality and need to conduct scientific study on availability of water resources and development options of available resources in the Trail.

Regarding the sanitation condition, recently the trail area has declared as ODF area. However, during the field study period 15 percent households reported they have no their own toilet. Along the Trail right from Khari Khola to Khunjung Valley nowhere public toilet and trackers including tourists are facing the toilet problem.

Figure 2. Geological structure of Lukla trans Himalaya Trail.

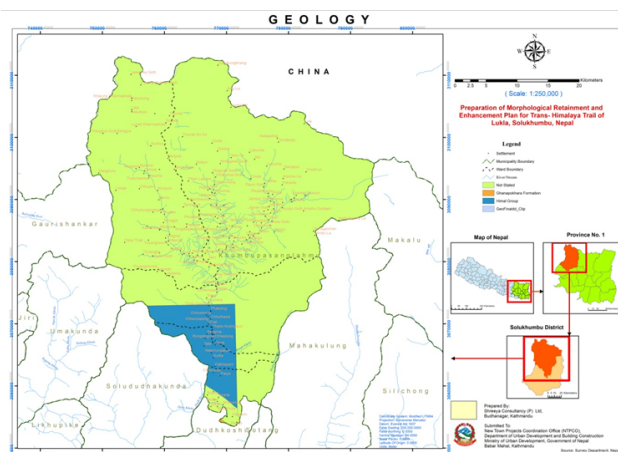


Figure 3. Drainage system of Lukla Trail.

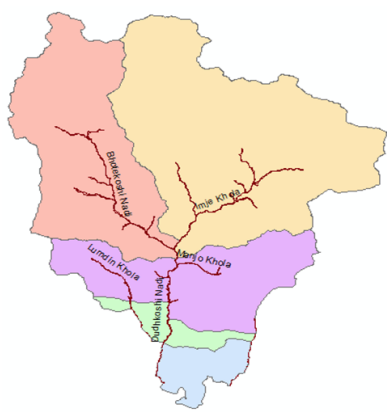


Table 1. Land use pattern of the Lukla Trail.

Land use	Area (in sq. km)	Percent
Barren Land	973.4	63.25%
Glaciers	238.35	15.49%
Grass	109	7.08%
Bush	100.91	6.56%
Forest	80.17	5.21%
Agricultural land (Cultivation)	18.5	1.20%
Pond or Lake	9.74	0.63%
Riverbed	8.52	0.55%
River/Waterbody	0.22	0.01%
Embankment	0.12	0.01%
Total	1,538.93	100.00%

Source: Satellite Image 2018 ; Field Study, 2019

Table 2. Population distribution by ward.

Ward No	Household	Male	Female	Total Population
1	434	901	927	1828
2	488	993	964	1957
3	480	879	873	1752
4	551	913	999	1912
5	480	807	733	1540
Total	2433	4493	4496	8989

Source: MOFAGD, 2019

There is a great challenge to manage sewer due to lack of public sewer line and sewer treatment plan. At present, this issue is not so serious but in future it could be the main problem when settlement would be dense.

The economic status of the people living has change in years after the economy is shifted to tourism enterprises, however, many social parameters are still very low and people are deprived from social services. Education, health, security, modern facilities like playgrounds, internet facilities, reliable energy source and sufficient portable water supply are still lacking, that has hindered social development of the Trail. The available market facility and social services as well as service delivery system of government organizations are also not at satisfactory level. Due to the remoteness and mountainous topography, people have difficulties to receive educational, health and governmental services. Culture, traditional values and beliefs also challenge to the social change on the one hand and immense adverse effects of outsiders on local harmony is another issue to sustain the Khumbu's originality in long run.

Human settlement patterns and structures in relation with its spatial features are in dynamic process and changes rapidly due to expansion of social and economic activities which reflected in response to the population growth, in-migration, local politics, economic development, local and regional connectivity), cultural and socio-ecological factors. Insights of the spatial pattern of human settlement growth and physical as well as social infrastructures condition indicate to extent basic physical and social infrastructures for enhancing the morphological structure of the trail which further demand effective sectoral development plan and programs. There are such settlements, market centers and tourist destination points which need to be upgraded through modern facilities with due considering environmental protection. Khari Khola, Surke, Muse, Lukla, Chaurikhark, Chhyaplung, Nyapchung, Jorsalle, Namche bazaar, ThameKhunjung Valley and Everest Base Camp are major location points that need to be equipped by modern social and physical infrastructures. Some scatter settlements which are in isolating form in the corridor of the Trail also need to be resettled in the Trail head area as compact settlement form where modern social and physical amenities could be provided in low cost of development and environment.

### Connectivity and regional linkages

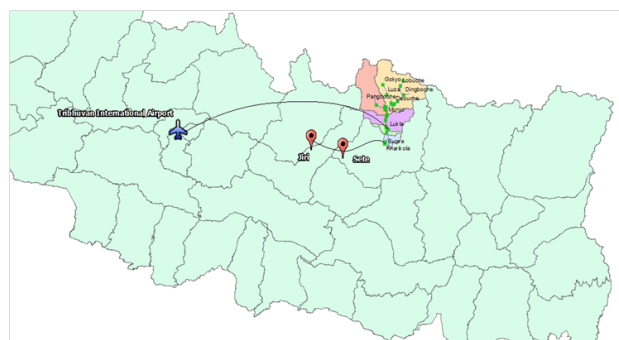
The ability to identify the local productive capacity and regional service providing network of the trail Lukla town undertook as the central nodes as to assume functional connectivity for multiple functions with respect to human, goods, technology and information flow from outsiders and insides of the trail. Using nodes that were located around the perimeter of the buffered area of the trail width was taken to remove the effects of node placement on current density by creating a map of connectivity in the north and

south parts of the Lukla as the center town village concept. The connectivity of the central nodes is more likely to cross paths and trails in areas of high flow of man and goods which provide efficient and cost effective method of predicting areas with relatively high landscape connectivity for multiple actions.

The connectivity linkage map (fig-4) shows the multiple connected from location-specific identity with linkage areas with significant increase in the surrounding area according to the effects of trail services to the community people.

Rural-urban interactions is an important aspect of livelihood strategies in the form of flows of people (migration), natural resources, products, goods and services, information and money, or in the form of income diversification such as urban agriculture and non-farm rural employment (Dems,2006) [6]. But in the Lukla trail rural and urban development is considered in isolation. Their inherent linkage with each other's development is less considered or reduced to only market linkages. Although market linkages play significant role, rural-urban linkage (RUL) is beyond this linear kind of assumption and it encompasses many complex interactions and processes. It is important to recognize the close relation between service center and rural systems because efforts and initiatives in one area, when properly conceived and planned, can have a positive spillover effect in the other. For example, changing food consumption patterns in urban centers as a result of rapid urbanization and income growth offer good opportunities for food producers in peri-urban and rural areas, with the possibility for food producers to focus on high value agricultural products and on contract farming schemes with supermarket chains. Understanding and capitalizing over such patterns of RUL is expected to help service center residents to satisfy their growing food demand and to improve the income and livelihood of rural food producers. If, however, the linkage between these two systems are not well understood and properly harnessed, the system can be threatened and doomed to failure. A good example in this case could be imbalance between the demand for natural resources, on the one hand, and their supply and management, on the other, that might lead to extreme poverty and degradation of natural resources at last. Unless its multi-faceted linkage with the rural economy is well managed, urbanization inflicts formidable pressure on natural resources and agricultural land. The poverty-land degradation-food insecurity nexus, heavily contributed by the poor. For instance, if we take only one component, i.e., energy, the growing service centers require huge amount of wood for fuel to meet their daily household energy demand. This often results in overexploitation of the forest resources of surrounding rural areas. In Lukla Trail the original forest around the central village has been cleared long ago to support the energy and construction demands of the growing settlement. Now part of the natural forest area has been degraded land and far reaching beyond imagination. Often, as observed in many sections of the Trails forest resources are getting scarce, and where reforestation efforts are

Figure 4. Connectivity and linkages.



minimal, with no widely disseminated alternative energy sources, shortage of fuel wood has been supplemented by alternative sources of energy like LPG Gas. Further, there is a heavy mining of soil fertility and deterioration of soil physical properties. Such chains of processes driven by the unplanned settlement grow in Trail area and lead to poor infiltration capacity of the soil, a phenomenon that reduces recharging effect of the aquifers and enhance high runoff, landslides, mudflow, debris flow and soil erosion rates. Again, this leads to reduce available natural resources like water and forest.

### Sectoral development strategies

The strengths of the Trans-Himalaya is a long history of cooperation between spaces that complement each other that can increase due to the on-going dynamism of the global community. Those timeless strengths need to be relativized the concerns on climate change disaster, equity and poverty, adoption of new technology that could be solved by the on-going economic dynamism and, once more, not foregoing the opportunities of Trans-Himalayan Trails. These possibilities can be achieved by addressing with common understanding for new development policy measures across the Himalayans as we need to enhance the morphological structure of Trans-Himalayan Trails, make policy measures to promote service center or create better job environment in terms of equity sustainable and inclusive growth, looking more carefully at health, education and social services with sufficient physical infrastructure support. New frontiers of economic development and new socio-cultural paradigms indicate that Trans-Himalayan Trails have crucial resources on sustainable development. Enhancement of Trans-Himalayan Trails morphological structure to better service (urban) center, and dense human settlement pattern could be a crucial contribution for peace, progress and prosperity of local communities and become gateway to prominent economic space of the Trail [7, 23]. Therefore, the small-scale spatial economy and small actors can enhance the sustainable livelihood and also promote people to people relations along with the improvement of Trail. This can also ensure the environment for implement stability and development in the Himalayan region in a collaboration of various stakeholders in order to bring about a lasting improvement in the economic, physical, social and environmental conditions of the Trail.

To achieve goals of sustainable development in the Trans-Himalayan Trails, it is necessary to frame the sectoral plan to mobilize the available resources and reinforce local self-initiations and general services to the public for creativity and innovation model work that should spatially compact, mixed-use, socially, culturally and ecologically integrating in the line with the national urban development strategy [27]. All these dimensions of sustainable development need to be taken into account at the same time and with the same weight including economic prosperity, social balance and a healthy environment. At the same time attention should be paid to cultural and health aspects.

## Discussion

### Central town-village model

The existing biophysical condition and socio-economic dynamism of Lukla Trail reveal that the villages in surrounding the Lukla Trail could play positive synergistic roles in densification of scatter settlements mountain region and the central town-village model could be the most useful to enhance the morphological structure of Trans-Himalayan Trails and urbanizing in mountainous areas. Therefore, in Lukla Trans-Himalayan Trail, government initiations have to focused in spatial restructuring based on biophysical capacity and ecological stability in the process of morphological

enhancement and urban development in such high altitude and mountainous topography in order to extend the understanding of central -town - village model and theory of regional planning. The proposed central town-village model is presented in figure -5 .

The proposed central town-village model in Nepalese context could be effective in upland and mountain regions for territorial politics which will be embodied in the state's political objective to extend its control over land and meet the strategies that cope the balanced development in the mountain region through scientific land use planning processes across scales.

The theoretical and empirical evidences also corroborate the model in terms of distribution and density of urban-rural settlements relative to geo-ecological, socio-economic, and cultural conditions are critical factors in the general urban-rural relationship. Regarding this, Forman, (2016) rightly noted that such settlements exert significant influence on regional development for macro scale role as well as growth and direction. The, urban-rural settlements have experienced significant changes across the world, especially in developing countries. Rapid urbanization, urban-rural social transformation, and declining employment opportunities in rural areas have been major driving forces behind changes in rural areas(UN,2006).

However, most of the area of Lukla Trail is not suitable for the urban-rural settlements construction. Very few suitable areas are distributed within the river sites in northeastern passes. Therefore, the urban-rural spatial restructuring should be based on the changing mode of rural settlements as central town-village, and city-oriented village. The central town-villages where the township government is located and landscapes change more significantly than general settlements. The central town-villages in Lukla Trans-Himalaya Trail would be key to sustainable development of the region and suit in line with the general law of development of mountainous urbanization (Zhang and Zhai, 2013). Thus, central town-village model can play a positive role in urban-rural transformation and ecological conservation, as well as improve production and living conditions, and coordinate urban-rural development. Therefore, the central town-villages and small markets could be the best means to unify human and nature as opposed to the situation characterized by high biodiversity, rich cultural value, and ecological sensitivity, and as such being much harder to recover than other regions [9, 31]. It is; therefore, scientists and policymakers have to pay more attention to evaluating environmental capacity and ecological thresholds in the process of urban-rural spatial restructuring and the enhancement of morphological structure of Trans-Himalayan Trails. This spatial development framework can also promote local governance arrangement and partnership development to identify the innovative clusters where the business community, scientific community and administration work together and developing the network of central town village through polycentric methods to serve as real service centers and mobilize their surrounding as a process to transform and develop the role of service centers [4]. Thus, the central town-village morphological enhancement model would be appropriate settlement strategy to ensures sectoral development initiations to address basic needs and requirements of population and housing ,economy and employment, social participation , education, health and environment to provide basic amenities to the local people (Fig-6).

Above mentioned facts and figures with Trans-Himalaya trails development paradigm Lukla Trans-Himalayan Trail region possesses an immense natural beauty and rich cultural diversity. Despite this rich diversity, many people in the Trail still are lacking in modern amenities and live in acute crisis. Taking into consideration the natural and socio-cultural enrich, the Trans-Himalayas

Trail presents great opportunities for developing local resources based economy like sustainable tourism (ST) that could not only generate high levels of employment and income for the local communities, but also enhance the lives of rural communities through infrastructure development, social mobilization, training and education, and institutional development. It is imperative to linkup the rural-urban function for livelihood transformation in relation to build the socio-economic interrelationship and provide modern social infrastructure services and ecological stability local environment through capacity building of local communities and governments. Three level government have to take initiations to enhance morphological structure of Trans Himalaya Trails by identifying the possible trails through physical infrastructure development programs which can support sustainable, eco-friendly, local resource based and modern facilities available human settlement development in the mountain areas [15, 18, 37].

## Recommendations

- The Khumbu region (KR) shared by large section of Himalaya and is a unique transnational ecotourism destination with rich natural and cultural diversity, so that government initiations is needed to promote ecotourism in the region.
- Within landscapes, limited economic opportunities and poor connectivity due to inaccessibility present multiple issues and challenges have to be addressed.
- The geographical, natural, cultural, economic, and political interdependency of destinations and communities within the KR highlight the need, scope, and opportunities for trans-Himalayan Trail morphological enhancement for ecotourism across the Lukla Trail.
- Lukla Trans-Himalayan Trail as envisaged by KPLRM can present opportunities for inclusive and responsible economic growth and promises achievement of the goals of protecting the environment, and sustainably empowering and creating employment for mountain communities must be prioritized.
- Regional cooperation on ecotourism provides opportunities for inclusive economic growth, connectivity, and mutual benefits that transcend areas by collaboratively harnessing the tangible and intangible natural and cultural attributes and values of the Trail in partnership with diverse stakeholders, therefore, need to be promoted.
- Interventions focusing on strengthening connectivity, branding and marketing, promoting niche segments, public-private partnerships, green infrastructure, and capacity building have to be promoted for Trans- Himalayan ecotourism across the landscape.
- Promotion of investment opportunities using innovative financial mechanisms for foreign direct investment, bankable projects, remittances, low-interest loans for entrepreneurship development need to be focused.
- Destination plans and management by mapping comprehensive inventory of existing and potential ecotourism products has to be prepared.
- Capacity building for quality hospitality and services with a special focus on women and marginalized communities can bring significant changes in tourism by establishing home stay along the Trail.
- Green and eco-friendly tourist infrastructure development (especially physical and communication) and promotion of services bust up the tourism in the Trail are prime requirements.

## Conclusions

The morphological structure of the Lukla trans- Himalayan Trail has been described by formal analysis of the physical historical fabric of the Lukla-Everest Base Camp alone. In the spatial analysis of the Trail, both physical features and political art and per-

formance were in sighted. The connectivity and movement of goods and human drew from social geography from the period that emphasized how the Trail known as the busiest tourist Trail in the world. This virtual realm has only multiplied exponentially in the wired situation of the current status. Technologically, morphological structure enhancement proposed socially networked space which provide new forms of collective human activities including all levels governments' initiations. Community sensing and mapping resources for change and sustainable progress of the Trail has been given top priority incorporating crowd source solutions and flash events in all points to an increasing demand for citizens everywhere to have a greater stake in participating in the journey of transformation. The morphological enhancement of Lukla Trail could justify the concept of urban development in mountain areas in Nepal and help to attract more trekking tourists to visit the Everest, as well as encourage the local communities to promote their services and also explore various development interventions in order to overcome the problem of remoteness, poverty, and low infrastructure services. Based on the study findings following suggestions are to be made for overall development of Lukla Trail region.

- The Khumbu region (KR) shared by large section of Himalaya and is a unique transnational ecotourism destination with rich natural and cultural diversity, so that government initiations is needed to promote ecotourism in the region.
- Within landscapes, limited economic opportunities and poor connectivity due to inaccessibility present multiple issues and challenges have to be addressed.
- The geographical, natural, cultural, economic, and political interdependency of destinations and communities within the KR highlight the need, scope, and opportunities for trans-Himalayan Trail morphological enhancement for ecotourism across the Lukla Trail.
- Lukla Trans-Himalayan Trail as envisaged by KPLRM can present opportunities for inclusive and responsible economic growth and promises achievement of the goals of protecting the environment, and sustainably empowering and creating employment for mountain communities must be prioritized.
- Regional cooperation on ecotourism provides opportunities for inclusive economic growth, connectivity, and mutual benefits that transcend areas by collaboratively harnessing the tangible and intangible natural and cultural attributes and values of the Trail in partnership with diverse stakeholders, therefore, need to be promoted.
- Interventions focusing on strengthening connectivity, branding and marketing, promoting niche segments, public-private partnerships, green infrastructure, and capacity building have to be promoted for Trans- Himalayan ecotourism across the landscape.
- Promotion of investment opportunities using innovative financial mechanisms for foreign direct investment, bankable projects, remittances, low-interest loans for entrepreneurship development need to be focused.
- Destination plans and management by mapping comprehensive inventory of existing and potential ecotourism products has to be prepared.
- Capacity building for quality hospitality and services with a special focus on women and marginalized communities can bring significant changes in tourism by establishing home stay along the Trail.
- Green and eco-friendly tourist infrastructure development (especially physical and communication) and promotion of services bust up the tourism in the Trail are prime requirements.

## References

- [1]. Aryal S. The socio-ecological impacts of structural changes in the transhumance system of the mountainous area of Nepal. (Doctoral

- dissertation). University of Southern Queensland; 2015; 1-247.
- [2]. Belsky ES, Karaska GJ. Approaches to locating urban functions in developing rural areas. *International Regional Science Review*. 1990 Dec;13(3):225-40.
  - [3]. Bolleyer N. Challenges of interdependence and coordination in federal systems. In *Handbook of Territorial Politics* 2018 Aug 31. Edward Elgar Publishing. pp. 45-60.
  - [4]. Chapin FS, Kaiser EJ. *Urban land use planning*. 3rd ed. Urbana, IL: University of Illinois press; 1995.
  - [5]. Choegyal L. The Great Himalaya trail: a new Nepal tourism product with both trek marketing and development rationale. *Nepal Tourism and Development Review*. 2011;1(1):71-6.
  - [6]. Chanyalew D. Rural-Urban Linkage and the Role of Small Urban Centers in Enhancing Economic Development in Ethiopia. In *Proceedings of a Planning Workshop on Thematic Research Area of the Global Mountain Program (GMP) Held in Addis Ababa, Ethiopia*. 2006 Aug 29.
  - [7]. Deng X, Huang J, Rozelle S, Zhang J, Li Z. Impact of urbanization on cultivated land changes in China. *Land use policy*. 2015 May 1;45:1-7.
  - [8]. Dorward, S. *Design for mountain communities: A landscape and architectural Guide*. 1st edn. New York, NY: Van Nostrand Reinhold. 1990 Oct 1.
  - [9]. Fan J, Wang Q, Zhou K, CHEN D. Preliminary research on spatial pattern of urbanization in mountainous areas of China. *City Planning Review*. 2013;5:9-15.
  - [10]. Faludi A, editor. *European spatial research and planning*. Cambridge, MA: Lincoln Institute of Land Policy; 2008.
  - [11]. Forman RT. Urban ecology principles: are urban ecology and natural area ecology really different?. *Landscape Ecology*. 2016 Oct 1;31(8):1653-62.
  - [12]. Haining T. Analyze of Traditional Settlement Patterns in the Southern Part of Shaanxi Province. *The Open Construction and Building Technology Journal*. 2015 Aug 19; 9(1).
  - [13]. Healey P, McDougall G, Thomas MJ, editors. *Planning Theory: prospects for the 1980s: selected papers from a conference held in Oxford, 2-4 April 1981*. Pergamon; 1982.
  - [14]. Huang G. Modeling Urban Spatial Growth in Mountainous Regions of Western China. *Mountain Research and Development*. 2017 Aug;37(3):367-76.
  - [15]. Joint Unesco-World Bank Seminar of the social and cultural impacts of tourism (1976: Wash.). *Tourism: Passport to Development?: Perspectives on the Social and Cultural Effects of Tourism in Developing Countries*. Oxford University Press; 1984.
  - [16]. Keating M. Rescaling the European state: A constructivist and political perspective. In *Handbook of Territorial Politics* 2018 Aug 31. Edward Elgar Publishing., pp. 17-29.
  - [17]. Koukofikis G. Post-growth society and the city; the role of micro-enterprise agency in urban-ecological transformation. PhD thesis, Gran Sasso Science Institute- Scauola Superiore Sant' Anna; 2018.
  - [18]. Lama AK, Kandel P, Chaudhary S, Dema K, Uprety Y, Gaira K, Pandey A, Dorji T, Chettri N. Transboundary ecotourism in the Kangchenjunga Landscape: Opportunities for sustainable development through regional cooperation. by International Centre for Integrated Mountain Development (ICIMOD) GPO Box 3226, Kathmandu, Nepal; 2019.
  - [19]. Li Y. Urban-rural interaction patterns and dynamic land use: implications for urban-rural integration in China. *Regional Environmental Change*. 2012 Dec 1;12(4):803-12.
  - [20]. Liu Y, Yang R, Li Y. Potential of land consolidation of hollowed villages under different urbanization scenarios in China. *Journal of Geographical Sciences*. 2013 Jun 1; 23(3):503-12.
  - [21]. Long H. Land consolidation: An indispensable way of spatial restructuring in rural China. *Journal of Geographical Sciences*. 2014 Apr 1;24(2):211-25.
  - [22]. Long HL, Liu YS. Rural restructuring in China. *J Rural Stud*. 2016; 47:387-391.
  - [23]. McGrath BP, Marshall V, Cadenasso ML, Grove JM, Pickett ST, Plunz R, Towers J. *Designing patch dynamics*. Columbia University Graduate School of Architecture. Preservation and Planning, New York. 2007.
  - [24]. McGrath B, Pickett ST. The metacity: A conceptual framework for integrating ecology and urban design. *Challenges*. 2011 Dec;2(4):55-72. doi: 10.3390/challe2040055
  - [25]. Ministry of Urban Development (MOUD). National urban development strategy (NUDS), 2017. Kathmandu: MOUD/Urban Development and Physical Planning Division, Government of Nepal. 2017.
  - [26]. Moulart F, Jessop B, Mehmood A. Agency, structure, institutions, discourse (ASID) in urban and regional development. *Int J Urban Sci*. 2016 May 3;20(2):167-87.
  - [27]. Ngah I. Urban planning: A conceptual framework. *Jurnal Alam Bina*. 1998;1(01):1-9.
  - [28]. Government of Nepal-Nepal Planning Commission. *Sustainable Development Goals 2016-2030: National (Preliminary) Report*. 2015.
  - [29]. Petrișor AI. The theory and practice of urban and spatial planning in Romania: Education, laws, actors, procedures, documents, plans, and spatial organization. A multiscale analysis. *Serbian Architectural Journal*. 2010;2(2):139-54.
  - [30]. Petrișor AI, Petrișor LE. The shifting relationship between urban and spatial planning and the protection of the environment: Romania as a case study. *Present Environment and Sustainable Development*. 2013 Jan 1;7(1):268-76.
  - [31]. Pôças I, Cunha M, Marcal AR, Pereira LS. An evaluation of changes in a mountainous rural landscape of Northeast Portugal using remotely sensed data. *Landscape and Urban Planning*. 2011 Jun 15;101(3):253-61.
  - [32]. Pokhrel KP, Ale G, Raut A. Polycentric settlement as a sustainable development strategy: A case of Baglung district, Nepal. *Geographical Journal of Nepal*. 2018 Apr 3;11:137-55.
  - [33]. Pokhrel KP, Mainalee PK. Environmental safeguards at urban municipality level under the urban infrastructure investment projects in Nepal: A conceptual clarity *Acta Scientific Agriculture*. 2019; 3(5):97-101.
  - [34]. Romero H, Ordenes F. Emerging urbanization in the Southern Andes. *Mountain Research and Development*. 2004 Aug;24(3):197-201.
  - [35]. Schneider A, Chang C, Paulsen K. The changing spatial form of cities in Western China. *Landscape and Urban Planning*. 2015 Mar 1;135:40-61.
  - [36]. Smelser NJ, Baltes PB, editors. *International encyclopedia of the social & behavioral sciences*. Amsterdam: Elsevier; 2001 Nov 1.
  - [37]. Selman P. *Planning Post-Rio*. PLANNER-LONDON-. 1993;79:17-19.
  - [38]. Sen AK. *The idea of justice*. Harvard University Press; 2009 Sep 30.
  - [39]. Suhardiman D, Keovilignavong O, Kenney-Lazar M. The territorial politics of land use planning in Laos. *Land use policy*. 2019 Apr 1;83:346-56.
  - [40]. Tan M, Li X. The changing settlements in rural areas under urban pressure in China: Patterns, driving forces and policy implications. *Landscape and Urban Planning*. 2013 Dec 1;120:170-7.
  - [41]. United Nations (UN). *Urbanization: Mega & megacities, new city states; UN-HABITAT: The stat of the world's cities*. New York: United Nations: 2006.
  - [42]. Webber, B. L.; Le Maitre, D. C. & Kriticos, D. J. Comment on climatic niche shifts is rare among terrestrial plant invaders. *Science*. 2012 Oct 12;338(6104):193; author reply 193. doi:10.1126/science.1225980. PMID:23066061.
  - [43]. Yu Z, Xiao L, Chen X, He Z, Guo Q, Vejre H. Spatial restructuring and land consolidation of urban-rural settlement in mountainous areas based on ecological niche perspective. *Journal of Geographical Sciences*. 2018 Feb 1;28(2):131-51.
  - [44]. Yao G, Xie H. Rural spatial restructuring in ecologically fragile mountainous areas of southern China: A case study of Changgang Town, Jiangxi Province. *Journal of Rural Studies*. 2016 Oct 1;47:435-48.
  - [45]. Zhang R, Jiang G, Wang M, Ma W, He X. Layout classification of rural settlement based on combination of multi-dimensional characteristics. *Transactions of the Chinese Society of Agricultural Engineering*. 2015 Jan 1;31(4):286-92.
  - [46]. Guo-fang ZX. Analysis of Growth Feature of Spatial Form for Mountainous Cities. *Modern Urban Research*. 2013(2):10.
  - [47]. Zhao J, Xu M, Lu SL, Cao CX. Human settlement evaluation in mountain areas based on remote sensing, GIS and ecological niche modeling. *Journal of Mountain Science*. 2013 Jun 1;10(3):378-87.

**Submit your manuscript at**

<https://www.enlivenarchive.org/online-submission.php>

**New initiative of Enliven Archive**

**Apart from providing HTML, PDF versions; we also provide video version and deposit the videos in about 15 freely accessible social network sites that promote videos which in turn will aid in rapid circulation of articles published with us.**