

SPATIAL AND FUNCTIONAL DIVERSITY OF MOUNTAIN SETTLEMENTS: A CASE STUDY OF HAR KI DUN

D. K. Shahi

Associate Professor, DAV PG College, Dehradun, Uttarakhand

DOI: 10.46609/IJSSER.2021.v06i12.020 URL: <https://doi.org/10.46609/IJSSER.2021.v06i12.020>

Received: 20 Dec. 2021 / Accepted: 30 Dec. 2021 / Published: 31 Dec. 2021

ABSTRACT

Mountains have the most varied landscapes. There are deep valleys, densely wooded scarps and rolling pastureland (bugyals). The 'geodiversity' of the mountainous areas has given rise to a diversity of cultural landscapes. This diversity has also given rise to a diversity of settlements. Similar to the other mountainous areas the heterogeneous landscape of the high Himalayan region presents distinct types of settlements. These settlements are scattered, fragmented and vertically distributed. There is marked spatial and functional diversity in these settlements. This spatial and functional diversity of settlements is due to the diversity of the natural landscape. It is due to the diversity of terrain, climatic conditions and nature (or fertility) of the soil. The functional diversity of settlements is due to the differences in the suitability of the landscape for distinct land use. It is also due to the diversity of the socioeconomic factors; such as connectivity of the region. Furthermore, these spatially fragmented and functionally distinct parts of settlements present an integrated land use (functionally integrated land use), especially within a heterogeneous landscape.

The aim of this research, therefore, is to define and describe the different types of landscapes that occur in the high Himalayan region. These landscapes sustain different (human) activities. It is an attempt to identify the functions of spatially distinct landscapes (i.e., production areas) of mountain settlements. The aim of this research is to explain how these landscapes are used differently.

Another theme of this research is the spatial interdependence of settlements. It evaluates the relationship between landscape diversity and the land suitability for crop production or animal husbandry and other land use of these spatially distinct and different areas of mountain settlements. It evaluates the functionality (and functional relationship) of these settled spaces.

simultaneously it evaluates the spatial interdependence of different scattered parts of the settlements.

The present research is an empirical investigation. It is conducted in and around the Har ki Dun area of the high Himalayan region. It presents a distinct spatial pattern of dispersed settlements. It also presents a distinct spatial pattern of land use in this area. This research includes the evaluation of the spatial and functional diversity of these mountain settlements.

The study reveals the traditional method of land organization. It is an integrated land use (functionally integrated land use) in spatial and functional fragments of village settlements.

Key Words: Landscape Diversity, Spatial Diversity, Functional Diversity, Mountain Settlements, Har ki Dun

Introduction

Mountains have the most varied landscapes. There are deep valleys, densely wooded scarps and rolling pastureland (bugyals). The 'geodiversity' of the mountainous areas has given rise to a diversity of cultural landscapes. This diversity has also given rise to a diversity of settlements. Similar to the other mountainous areas the heterogeneous landscape of the high Himalayan region presents distinct types of settlements. These settlements are scattered, fragmented and vertically distributed. Thus, there are different types of landscapes that occur in the high Himalayan region. These landscapes sustain different (human) activities. There is a close relationship between landscape diversity and the land suitability for crop production or animal husbandry and other land use of these spatially distinct and different areas of mountain settlements. Thus, these settlements have different functionality.

Naturally, there is marked spatial and functional diversity in these settlements. This spatial and functional diversity of settlements is due to the diversity of the natural landscape. It is due to the diversity of terrain, climatic conditions and nature (or fertility) of the soil. The functional diversity of settlements is due to the differences in the suitability of the landscape for distinct land use. It is also due to the diversity of the socioeconomic factors; such as connectivity of the region. Furthermore, these settlements have a spatial interdependence (and functional relationship) between these settled spaces. In fact, these spatially fragmented and functionally distinct parts of settlements present an integrated land use (functionally integrated land use), especially within a heterogeneous landscape.

The present research is an empirical investigation. It is conducted in and around the Har ki Dun area of the high Himalayan region. The nature of settlements in this region presents a distinct spatial pattern of dispersed settlements. The settlements also present a distinct spatial pattern of land use. This research presents the spatial and functional diversity of these mountain settlements. The traditional method of land organization serves to integrate the land use (functionally integrated land use) in spatial and functional fragments of village settlements.

(Re)defining Diversity

The word diversity embraces many definitions with different meanings and thus, it is not easy to define it. The closest synonym of diversity is heterogeneity. Dictionaries defined diversity as the condition of having many different elements or having different characteristics. Besides heterogeneity other less frequently used term includes multiplicity. Variety or variability is also a widely used term in the literature. Variety or variability also describes diversity. Beyond ambiguity diversity simply states plurality; e.g. The differences in individuals (entities) lead to diversity.

Geographical diversity is differences in geographical features. These are the features on which geographical entities are differentiated from one another. The term geographical diversity also refers to the differences in places or spaces. It is considered as spatial diversity. Simultaneously, geographical diversity also refers to the difference in geographical entities. Accordingly, geographical diversity can be conceptualized as a multitude of individual differences of physical, human and cultural characteristics that exist among geocultural entities. Thus, there is geodiversity, biodiversity, cultural diversity.

Inevitably, in the geographical realm, the geographical diversity is expressed in the various physical characteristics of a place or space, such as existing types of relief and landscape, climate and vegetation, among others. In addition to these differences, geographical diversity is also expressed in spatial heterogeneity, in the human or cultural characteristics of the inhabitants of a particular region (difference in land use, ethnicity, language, etc.).

A more holistic conceptualization of geographical diversity comes from landscape diversity. Any landscape in itself is a manifestation of geographical diversity (Madel Carmen Minguéz Garcia, 2009). The study of diversity means to understand the natural and cultural (human) dimensions of landscape and to recognize differences.

Geographers and landscape ecologists have differing views on landscape and its diversity. It is often described as the diversity of geographical spaces and their environmental systems (Leser

and Schaub,1995). The landscape diversity is best expressed in settlement and land use. At the same time, the landscape diversity shapes settlement heterogeneity. Therefore, settlement diversity is driven by landscape diversity. Settlement diversity is commonly understood to include the variety and variability of settlements. Settlement diversity also includes differences within settlements.

Settlement Diversity

Human settlement is defined as a human habitat. Settlement is in fact the place of human existence and space for human survival. It refers to the totality of the human community with all the physical, social and cultural elements that sustain it. Any form of human dwelling, from the smallest house to a large cluster of houses, where people reside and pursue their life goals, can be understood as settlement. Human settlements come in many forms and can be permanent and temporary, mobile and sedentary, disseminated and agglomerated (Zivkovic J., 2019).

Settlement diversity refers to variety or variation in settlements. It refers to anything and everything that sets one settlement apart from another. It encompasses many different characteristics; physical forms and different dimensions of settlement, area and spatial features or morphological characteristics of settlements. The settlement diversity is also defined by differences in land use (Hannes Palang, 1998). It includes, in particular, the differences in human geography (demographic and economic characteristics) of settlements. It also includes social and cultural diversity (differences in ethnicity, language, religion). These factors shape the geographical patterns of settlement diversity. The diversity is also created by the function of settlements (the primary function of human habitat).

Settlements are scattered throughout available spaces. These scattered settlements have many different characteristics.

Natural Diversity - Settlements have geographical diversity. This diversity is due to the diversity of the landscape. The diversity of settlements is created by the differences in elevation and the configuration of landform. The diversity of settlements is found due to the differences in climate. It is also due to environmental diversity. The spatial and temporal diversity of settlements is also responsible for the variety and variability of settlements. Settlements also have internal diversity.

The diversity of settlements is created by the differences in resource endowment and carrying capacity of the human habitat. The location and remoteness or marginality of settlements also create diversity in settlements.

Economic Diversity - Settlements have differences in land use. The economic diversity in settlements is caused by the differences in available cultivable land and differences in economic activities (agropastoral activities). Variety or variability in settlements is caused by the diversity in methods (or mode) of achieving subsistence and sustainability. Moreover, the effects of habitat heterogeneity create functional diversity in settlements. Diversity in settlements is also created by the differences in facilities available at a place. Even different settlements present different development scenarios (pathways).

Social and Cultural Diversity - Diversity in settlements is created by the heterogeneity in their characteristics, in particular, their human geography creates diversity in settlements. Settlements have demographic diversity. Compact and scattered settlements represent two different features of the landscape. It is reflected in differences in population density. Settlements also have social, cultural and historical diversity. Settlements also have differences due to ethnic diversity.

Literature Survey

Our knowledge of the diversity of mountain landscapes is limited as it is not properly explored. What has been less explored is the interrelationship between mountains, biodiversity and cultural diversity (John Richard Stepp, 2005). It is an attempt to explore the spatial and functional diversity of mountain settlements of the high Himalayan region of Uttarkashi.

The rationale of the Study

Understanding the spatial and functional diversity of settlements can help depict diverse future scenarios by linking suitability and functionality across different spaces.

Aim and Objective

The primary goal of this research is to improve the understanding of scattered settlements of the high Himalayan region. A major objective of this research is to present a comprehensive analysis of diverse landscapes and the diversity of settlements in the Har ki Dun region of Uttarkashi. It makes the characterization of the scattered settlements and evaluates their functional significance.

Virtually no data exist on the nature of dispersed settlements of the high Himalayan region. The present study provides primary data (both spatial and nonspatial) on the scattered settlements of Har ki Dun valley. It also provides demographic and socioeconomic information about these settlements.

Hypothesis

The present research assumes that landscape diversity provides diverse ways of exploiting natural resources and thus increases the sustainability of settlements. The tentative hypothesis for this research is:

- The landscape diversity conditions the spatial and functional diversity of settlements.
- The functional diversity of settlements brings sustainability to the settlements.

Methodology

The location and other spatial information related to the spatial and functional diversity of settlements have been acquired from the remote sensing images. The remote sensing images help to determine the distribution of these settlements. The visual image interpretation of the region reveals everything related to the location and distribution of scattered settlements. Other locational information was acquired through GPS. The information regarding the spatial and functional diversity of these settlements has been obtained from the field study. The field study included field observation (village survey) with a combination of questionnaire surveys and in-depth interviews. The land use and subsistence strategies practiced by communities at those sites have also been obtained from the field study (village survey). The survey report even reveals the social and cultural pattern of distinct geographical places or spaces in the regions.

The spatial and functional diversity of settlements has been identified and distinguished on the basis of land use and type of dwellings (nature of stay). It is further supported by the official statistics of Govt. of India.

The simple statistical method is used to compare the dominant land use of settlements. The spatial and functional analysis of settlements counts the natural environment, resources and logical harmony in land use of each isolated fragment of settlements. It also counts the socio-economic profiles of every fragmented settlement.

Characteristics of Mountain Settlements

Isolated Populations and Scattered Settlements - Mountain settlements are often located far apart. The societies or communities inhabiting such places persist in isolated clusters (populations) owing to terrain and elevation. Isolated clusters (populations) are adapted to the (local) environmental conditions. The findings from previous studies confirm that the population, settlement size and density decrease as elevation increases. The character of settlements also

changes along elevations. Mountain settlements and the land use in and around those settlements are characterised by specific ecological adaptations.

Settlements are scattered on hill slopes with houses far removed from each other by vast expanses of terraced agricultural land. Large tracts of the terrain are too steep to allow terrace cultivation.

Economic or Cultural Adaptation - Settlements characterize the relationship between elevation and economic adaptation of mankind. Although the patterns observed in different regions vary differently, the overall economic or cultural adaptation of communities living in the high Himalayan region allows for extensive use of landscape. It confirms subsistence cultivation, agropastoralism and animal husbandry (transhumance). This diversification is because of the elevation (high topographical relief, climatic variations). It is also because the environmental conditions there are more extreme.

The diversity of cultural adaptation of mountain communities helps them to manage and harvest natural resources available in this region. The existence and survival of mountain communities in these isolated settlements give convincing evidence of the success of the traditional economic or cultural adaptation of these mountain communities.

Location of Settlements - High mountains are generally rarely inhabited, but lower mountains, or higher but less dissected terrains provide home to significant populations, where climate conditions are suitable (Telbisz Tamas, 2020). There is a close relationship between landscape diversity or habitat heterogeneity on settlement diversity. The spatial heterogeneity of landscape and settlement diversity has a considerable influence on the distribution of population.

Settlement landscapes are signs of centuries of human endeavour (Brian K. Roberts, 1996). It is reflected in an intricate pattern of terraced agricultural fields and the cultivation of mountain-specific crops. This adaptation of communities reveals a deep understanding of the physical environment.

Agricultural land is generally found between 1800 and 3000 m. Furthermore, there is a great diversity of agricultural land. These settlements are large and small according to the available land with moderate slopes and adequate land resources.

For a more intensive study of the spatial and functional diversity of mountain settlements, the present study has taken a case study of the valley of Har ki Dun.

Description of the Study Area

Har ki Dun is a distinct geographical entity in the high Himalayan region. It is known as ‘the Valley within Mountains’.

Land and Landscape;

Har ki Dun is situated in Uttarkashi in Garhwal Himalayas. It is spread between 31⁰02' - 31⁰20' N latitude and 77⁰55' - 78⁰40' E longitude. The altitude of the area varies from 1290 m to 6323 m. (Arun Kumar, 2004). The valley of Har ki Dun covers an area of 953.12 sq. Km.

Har ki Dun is an intermountain valley. It is situated in the upper drainage basin of the Tons River. The area is entirely composed of a succession of hills and mountains. It consists of high mountains covered with snow and glaciers, steep peaks and narrow valleys. Two mountain tributaries of river Tons; Rupin and Supin flow through this area. The entire landscape is rugged and highly dissected.

Har ki Dun gets a typical high Himalayan climate with extreme cold weather conditions. A large part of the area remains covered under snow, throughout the year.

Cultural landscape and Human Habitations;

Har ki Dun is a sparsely populated region. The mountain settlements have low population densities. The predominant nature of settlements is entirely scattered. Most of the settlements are located in the mountain valleys or on uplands with lesser slopes. The cultural landscape of the region is a result of centuries of subsistence agriculture. On the other hand, settlements present diversity of land use and diversity in human activities. The settlements also present demographic, economic, social and cultural diversity.

Types of Settlements based on Distinct types of Spatial Land Use

Forms of Settlements	Characteristics
Village Cluster	It is a places of better opportunities for human settlement and multifunctional agriculture (peasants’ settlement), a collection of many residential houses or an area of concentrated population, dispersed but less sparse (more concentrated, high residential density).
That or Fragmented	It is a small,but permanent settlement (collection of few residential

and Isolated Dwellings	houses), scattered dwellings, smaller physical area, an area of least concentrated population, settlements surrounded by unpopulated agricultural land, the ‘sparsity’ of the population display scattered distribution (low residential density)
Chhanis or Dudharies	These settlements consist of loosely scattered houses (huts), a great sparsity of population within a broad area, low land use efficiency/intensity due to the impact of the geographical remoteness, inaccessibility and other factors
Pastoral Settlements or Settlement of Mountain Herders	Pastoral settlements are located close to high mountain pasture areas. These settlements are seasonal or temporary settlements. The pastoral settlements are characterised by the low density of population. Pastoral farmers or shepherds live in the scattered settlement and move around regularly.

To gain a deep understanding of the spatial and functional diversity of mountain settlements, a thorough study of Osla, a mountain settlement of the Har ki Dun valley is carried out in this research.

Village	Osala, Mori, Uttarkashi A ‘Natural Village’
Location	Located at 31.1469N and 78.4152E, Spread over 378.6 Hectares, Inaccessible Area, Remote/Marginal
Land and Landscape	Harsh Environment, Limited Resources
Demography	Inhabited by 151+ Families with a Total Population of 725+, Composed of Socially Different Communities
Settlement Pattern	Diverse and Spatially Scattered, Dispersed due to Fragmented Landscape and Geographical Distribution of Resources, Internally Integrated, Economically and Socially Connected (Interdependencies)
Life and Livelihoods	Diversified and Integrated Subsistence Economy, Sedentary

	Agriculture and Pastoralism, Dependence on Extensive Grassland Pasture, Seasonal Migration
Basic Infrastructure	Inadequate Infrastructure, Need to Develop Basic Amenities and Emergency Services
Sustainability	Self-Reliant, Inherent Resilience
Opportunities / Possibilities	Opportunity for Growth through Diversification of Economy, Opportunities to Realise the Potential of Tourism

A ‘natural village’ connotes a ‘naturally’ coexisting spatial cluster of households (Michael L. Zukosky, 2007). There are three other ‘natural’ villages; Gangar, Dhatmeer and Pawani.

The spatial and functional diversity of dispersed settlements of Osla

	Tok	Dhara, Dabara, Chammali, Kune, Khola, Shati Jani
Osla	Chhani	Vinoi, Halche, Gokura, Sima
	Bugyal	Har Ki Dun, Dhang, Tatka, Jamadar, Rati Doh

The landscape of a dispersed settlement is a reflection of human adaptation to nature (Ingrid Belcakova, 2021).The size, location and function of settlements are determined by landscape diversity. Following is the list of dispersed spaces of other surveyed villages:

	Tok	Dhara, Tipara, Nagani, Charena, Kandoi, Matripath
Datmeer	Chhani	Marodi, Bangoni, Tumadiya Kot, Majhota, Lverang Top, Maghan
	Bugyal	Pustar, Mahanir, Phachkandi, Suru Tal, Bangya, Manjhi Ban
	Tok	Ladana, Chokoti, Moradi, Panchar, Pugulcha
Gangad	Chhani	Gandrani, Ladana, Kansara

	Bugyal	Bhatgair, Shokushada, Dhanga, Kyarkoti, Vishkupade, Cheri Top
	Tok	Tipra, Indra, Mankanda, Pandara, Gutuka, Pata, Rawali, Kulaka
Pawani	Chhani	Pawani Gharat, Indra Top
	Bugyal	Kshamrani, Har Ki Dun, Capu, Bujhoti

Space Organization and Functional Integration of Places

Adaptation to nature, adjustment to the local conditions and conformity with the topography and geomorphology is general characteristics of mountainous settlement. The challenges put forth by physiographic and climatic conditions make human to survive by adapting to the environmental situations and coping with them. The location and distribution of settlements also have obvious geographical adaptation. The dependent on arable agriculture and livestock for their livelihood is both the nature and culture of mountain communities. The upland cultivation, multiple cropping, irrigated and rain-fed agriculture and closely related activities provide sustenance to the small population.

A relative abundance of natural resources encourages the development of village settlements. The advantages of primary activities at other disadvantaged locations favours the growth of settlements at dispersed locations. The mountainous environment provides opportunities or possibilities for (in situ) use of natural resources. The practice of traditional agriculture is the result of centuries of (experiments) of indigenous peoples and the experience of adaptation to environmental conditions (Mahnaz Sarlak, 2021).

But the fragile ecological environment and scattered distribution of suitable resources create constraints to the agglomeration and concentration of population. The location and distribution of settlements are also constrained by distance and the relatively high cost of movement. There is an obvious vertical distribution of land uses with elevation. Therefore, the settlements are scattered and dispersed at different locations.

Besides these scattered distributions of settlements, there is also a functional division of settlements. The diversity of settlements has certain limitations but also some benefits. It provides a strategic advantage in a diverse environment as it provides multiple production areas. It also provides alternative life choices. The spatial and functional diversity of settlements allows

a wider range of possibilities. This distinction of mountainous landscape helps in the diversification (specialization of production) and specialization of functions. Therefore, each scattered settlement has its economic characteristics.

Traditional practices, cultural patterns and local know-how tell a glorious story of human survival and sustainability against the most challenging environment (Nayana R. Singh, 2016). Landscape diversity gives livelihood diversity to the mountain community. Livelihood strategies denote the range and combination of activities and choices made by the community. Thus, it impacts sustainable livelihood.

The agropastoral activities (particularly transhumance) of mountain communities depend on the process of space organization. It influences the spatial and functional integration of settlements. Even the spatial and temporal distribution of sedentary and transhumant activities facilitates the spatial and functional integration of settlements.

The sedentary and transhumant activities of mountain communities contribute to create and manage spatial interaction between settlements. The effect of this interaction and space organization is the functional integration of places.

Conclusion

Landscape diversity has an effect on the spatial distribution of settlements. Mountain settlements have a more scattered distribution. Besides, the high mountain settlements have a fragmented development due to landscape diversity. A few settlements even have scattered and isolated (independent) existence. The landscape diversity creates spatial and also functional diversity in the settlements. In fact, the location and distribution of settlements conform to the landscape features of the area. On the other hand, the function of the settlement depends on its location and distribution. It all leads to the diversity of settlements.

The location and distribution of mountain settlements have obvious geographical adaptability. Adaptation to nature (the terrain and natural environment) and adjustment to the natural conditions are basic characteristics of high mountain settlements. The existence and survival of mountain communities are made possible through the use of the diversity of settlement and production spaces. Increased production through the photosynthetic route helps these settlements to overcome resource scarcity and enhance sustainability. This diversity of settlements has more potentials for local economies. The settlements can use their diversity to develop more opportunities or possibilities.

References

Arun Kumar, Gupta, S.K., and Padmanaban, P. 2004. Some selected fauna of Gobind Pashu Vihar, Conservation Area Series, 18: 1-90 (Published by the Director, Zool. Surv. India, Kolkata). ISBN 81-8171-034-7

Belcakova, Ingrid, Olah, B.; Slamova, M.; Psenakova, Z. 2021, A Cultural and Environmental Assessment of a Landscape Archetype with Dispersed Settlements in Cadca Cadastral District, Slovakia. *Sustainability*, 13, 1200. <https://doi.org/10.3390/su13031200>

Brian K. Roberts, 1996, *Landscapes of Settlement, Prehistory to the present*, Routledge, London, ISBN 0-203-73896-9

Hannes Palang, Ulo Mander and Aarne Luud, 1998, Landscape diversity changes in Estonia, *Landscape and Urban Planning*, Vol. 41, Issues 3–4, [https://doi.org/10.1016/S0169-2046\(98\)00055-3](https://doi.org/10.1016/S0169-2046(98)00055-3)

John Richard Stepp, Hector Castaneda and Sarah Cervone, 2005, Mountains and Biocultural Diversity, *Mountain Research and Development* Vol 25 No 3, ISSN: 2764741

Leser, H., Schaub, D.M., 1995. Geoecosystems and landscape climate ± the approach to biodiversity on landscape scale. *Gaia* 4(4), ISSN 0940-5550 (Print); ISSN 2625-5413 (Online)

Madel Carmen Minguéz Garcia, 2009, Diversity and Symbolism of the Cultural Patrimony of the Aranjuez Royal Palace (Spain) in Karl Donert et al, *Celebrating Geographical Diversity*, DOI: 10.13140/2.1.4174.8166

Mahnaz Sarlak, Laura Valeria Ferretti and Rita Biasi, 2021, The Productive Landscape in the Desert Margin for the Sustainable Development of Rural Settlements: An Innovative Greenbelt for Maranjab Desert in Iran, *Sustainability*, 13(4), 2077; <https://doi.org/10.3390/su13042077>

Michael L. Zukosky, 2007, Making Pastoral Settlement Visible in China, *Nomadic Peoples* Vol. 11, Issue 2, ISSN 0822-7942 (Print), ISSN 1752-2366, doi:10.3167/np.2007.110206

Nayana R. Singh and Gaurav Singh, 2016, Learning from Built Environment of Hill Region of Uttarakhand, India and its Response to Disaster Risk Conference Paper, DOI: 10.5176/2301-394X_ACE16.93

Telbisz Tamas, Brankov Jovana, Calic Jelena, 2020, Topographic and lithologic controls behind mountain depopulation in Zlatibor District (Western Serbia), *J. Mt. Sci.* 17(2) <https://doi.org/10.1007/s11629-019-5861-5>

Zivkovic J., 2019, Human Settlements and Climate Change. In: Leal Filho W., Azeiteiro U., Azul A., Brandli L., Özuyar P., Wall T. (eds) *Climate Action. Encyclopedia of the UN Sustainable Development Goals*. Springer, Cham. https://doi.org/10.1007/978-3-319-71063-1_88-1