**Synopsis**

**on**

**Mapping Ecological Landscape, Habitat Changes and Socio-Economic Transformations in Changthang, Ladakh, India**

**Submitted by**

**Diksha Bhati**

**Ph.D. Candidate**

**Registration No. 1201014220**

**Supervisor: Prof Vinay SP Sinha and Co Supervisor: Prof Anuradha Banerjee**

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**Centre for the Study of Regional Development**

**School of Social Sciences**

**Jawaharlal Nehru University**

**New Delhi 110067**

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*Ph.D. Synopsis*

**Statement of the Problem**

The nomadic-pastoralists of Changthang lead a very challenging life daring below minus five to minus thirty-five degrees temperature during winters. Life has never been easy to them; year after year shepherding in such chilling winter is arduous. Multiplying their challenges are the adjustment to the modern pace of the world. Already a trying nomadic life invaded by the necessities of the modern world comes together to form the saga of their being in today’s ‘new’ Ladakh. It is an established fact that Mountainous areas are environmentally most fragile eco-systems in the world. It encompasses a harsh environment within which is very unstable and unsuitable for agrarian cultivation. The primary reason is a very cold and dry climate together with difficult terrain makes it unyielding for agriculture. Therefore, as an adaptation Nomadic pastoralism has been the only way of surviving in the high elevation alpine steppe rangeland of Changthang in Ladakh. Changthang is home to many nomadic pastoralists of the region out of them Changpas is one.

The Changpas has a long history of habitation in the region. They moved to the region in 8th CE from Tibet. With the coming of modern era, they are witnessing change. Together with the changes and challenges to the environment, lives of Changpas are going through a constant process of change in terms of mobility, adaptability etc. They are not a stranger to adapting to changes in their environment; the mobility inherent in a pastoral production system is a product of the community being fine-tuned to take actions based on the changes in their immediate environment. However, the process of modernization has had a profound impact on the lives of people living in the rangelands of Changthang. The changes that they are facing today are more significant and are likely to have long term effects on their way of life and the ecosystems they reside in.

A very diverse structure and composition is characteristic to Rangelands of the Himalayas. The Changthang Plateau in eastern Ladakh is located on the western extension of the Tibetan plateau (Goodall, 2004: 218). This region is a representative example of a very important biogeographic province within the Indian trans-Himalayan region. The rangelands of the Changthang Plateau have a cold–arid ecosystem. Although these rangelands are considered resource-poor in terms of biomass production, vegetation cover, and floristic diversity, they support a high density of domestic livestock and a variety of wild herbivores. In recent years, ecologists and conservationists have questioned the sustainability of livestock grazing in these areas and the integrity of this ecosystem, given the rapid socioeconomic changes and steady increase in the population of livestock.

The study focuses on gaining a comprehensive knowledge of the changes happening in the physical environment, socio-economic, political and cultural aspects of the Changpas of Changthang Region from eastern Ladakh from 1975 to 2021. This knowledge is essential for defining the changing parameters of a pastoral environment. Pastoralism functions within a complex system balancing physical and anthropogenic change against environmental and socio-economic limitations. Ecological resources depend on the environment and the pattern of their usage. The changes to the region depend on the integral human factors and politico- economic factors from without. Both environment and pastoralists react to changing pastoral parameters such as pastoral mobility and economic forces; and this in turn impacts land cover, land-use and livelihood practices. At the same time due to inclusion into the modern state structure, their socio-economic and political fabric has been drastically altered. The decisions that the nomads take is dependent on the power structure they constitute and the changes taking place in the power structure due to the influence of outside world. It is important to investigate how they relate to the narratives around themselves and how these narratives are changing. Therefore, it becomes essential to look into the question relating to the changing environment and changing power structure. Who defines nature and in what ways? The study looks into understanding the power relations in the region and the effect it has on the lives of the nomads.

**Objectives**

1. To map the land use and landcover changes in the rangelands of eastern Ladakh between 1975 to 2021
2. To assess the changes in climatic parameters in relation to ecological landscape
3. To assessing the changes in the socio-economic conditions (household structure, occupation and livestock management) of the Changpas in the light of changing land use and landcover pattern
4. To evaluate the changing relationship between Changpas and the state and the other political institutions in Changthang, traditional and those of the state (In terms of state policies, changed political status and political participation) and the effect they have on the lives of Changpas.

**Research Questions**

1. What have been the changes in the land-use and landcover pattern of eastern Ladakh since 1991 to 2024?
2. What are the variations in the climatic parameters of Changthang?
3. What is the relationship between climatic parameters and ecological setting of Changthang on a decadal time scale?
4. What have been the changes in the social-economic conditions of the Changpas in light of the changes in the land-use and landcover pattern of the study area?
5. What are the power relations within the Changpas? What has been the relationship between Changpas, the State and other political institutions? What are the changes in these relationships?
6. How does these power relations affect the adaptations of the Changpas to their contemporary environment?

**Database**

**Primary Sources**

Observations; In-depth Interviews; Semi-Structured Interviews; Structured Questionnaires

**Secondary Sources**

1. Secondary Data Sources: The Census of India, Gazetteer of British India and Gazetteer of District Planning Commission, Ministry of Tourism Annual Reports, Various reports from District Evaluation and Statistics Office including District Statistical Handbook, District Economic Review and Block Wise Village Amenity Directory, Agricultural Census, The Ladakh Gazette, Forest Survey of India, Ladakh Autonomous Hill Development Council, Animal Husbandry Data, Sheep Husbandry Data, Data from Non-Governmental Organizations (NGOs), IMD Leh Station
2. Remote Sensed Source:

Digital Elevation Model: SRTM and ASTER

Optical Satellite Imagery: LANDSAT and MODIS

**Methodology**

The Study uses both Qualitative and Quantitative methods for collecting and analysing the

information gathered from the study area and from the secondary sources.

Pastoral Nomadic societies need to be seen in the larger social, cultural and historical context to understand the relationship that exists between the nomads and the social formations around. At the same time, it is important for the study to learn the relational role that nomadism plays inside the society as a whole. Therefore, the study uses Ethnographic research methods. Ethnography involves two levels of research i.e., macro and micro. Macro research is done before reaching the field and micro is done during the fieldwork. Macro research involves using historical sources, government documents, local newspapers, radio and web articles and reading contemporary research to familiarize the researcher with the study area. Micro research involves participant-observation like using structured questionnaires, semi-structured and unstructured interviews. Last two are used more often in ethnographic research for the flexibility they provide and to put the information gathered in a broader scope. Participant observation also helps to cross-reference the information gathered by the researcher. Apart from these the study will also use self-reporting by the respondents to gather information that can add more to the study. The next step will be to analyse the data collected and to look for patterns that could answer the research questions suggested in the study.

To access the ecological landscape GIS and Remote Sensing will be used. To map the spatio-temporal changes in ecological landscape there will be a mapping of the Land use land cover, Vegetal Mapping, Grazing area mapping, Physiography, Mapping of water sources and soil map. All these will be done using optical satellite imagery from Landsat MSS, Landsat TM and Landsat OLI for the specific time period. Land Use and Land Cover mapping will be done to assess decadal changes, accuracy assessment will be done using Kappa Coefficient. For mapping vegetation and water sources Normalized differential Vegetation Index and Normal differential Water Index will be used.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Serial No | Satellite | Entity ID | Acquisition Date | Path | Row |
| 1. | **LANDSAT MSS (1975-1979):** | EMP159R36\_3M19790607 | 1979-06-07 | 159 | 36 |
|  |  | EMP157R37\_2M19770413 | 1977-04-13 | 157 | 37 |
|  |  | EMP157R36\_2M19761120 | 1976-11-20 | 157 | 36 |
|  |  | EMP158R36\_2M19760910 | 1976-09-10 | 158 | 36 |
|  |  | EMP158R37\_2M19760910 | 1976-09-10 | 158 | 37 |
|  |  | EMP159R37\_2M19751110 | 1975-11-10 | 159 | 37 |
| 2. | **LANDSAT TM (1991)** | **LT05\_L2SP\_146037\_19900802\_20200915\_02\_T1** | 1990/08/02 | 146 | 037 |
|  |  | LT05\_L2SP\_146036\_19900802\_20200916\_02\_T1 | 1990/08/02 | 146 | 036 |
|  |  | LT05\_L2SP\_147036\_19910828\_20200915\_02\_T1 | 1991/08/28 | 147 | 036 |
|  |  | LT05\_L2SP\_147037\_19911116\_20200915\_02\_T1 | 1991/11/16 | 147 | 037 |
| 3. | **LANDSAT TM (2000)** | **LT05\_L2SP\_147037\_20010111\_20200906\_02\_T1** | 2001/01/11 | 147 | 037 |
|  |  | LT05\_L2SP\_146036\_20000509\_20200907\_02\_T1 | 2000/05/09 | 146 | 036 |
|  |  | LT05\_L2SP\_146037\_20000509\_20200907\_02\_T1 | 2000/05/09 | 146 | 037 |
|  |  | LT05\_L2SP\_147036\_20000329\_20200907\_02\_T1 | 2000/03/29 | 147 | 036 |
| 4. | LANDSAT 8 OLI-TIRS (2021) | LC08\_L2SP\_146037\_20211010\_20211019\_02\_T1 | 2021/10/10 | 146 | 037 |
|  |  | LC08\_L2SP\_148036\_20211008\_20211018\_02\_T1 | 2021/10/08 | 148 | 036 |
|  |  | LC08\_L2SP\_148037\_20211008\_20211018\_02\_T1 | 2021/10/08 | 148 | 037 |
|  |  | LC08\_L2SP\_147036\_20211001\_20211013\_02\_T1 | 2021/10/01 | 147 | 036 |
|  |  | LC08\_L2SP\_147037\_20211001\_20211013\_02\_T1 | 2021/10/01 | 147 | 037 |

For assessing the relationship between climatic factors and the ecological landscape, assessment of the Optical Satellite Imageries will be done such as LULC, Source of meltwater, vectorization of water bodies, vegetation and snow mapping and others. Digital Elevation Model (DEM) will be used for Relative Relief, Slope, stream delineation, stream ordering. The following datasets will be sued for temperature and precipitation:

1. Temperature:

* CRU-Climatic data (Temperature) half degree data (1901-2019)
* Land Surface Temperature (LST): MOD11A2 TerraMODIS satellite. (2000-present)
* India Meteorological Department data: Leh Station

2. Precipitation:

* CRU- Climatic data (precipitation) half degree data (1901-2019).
* TRMM/GPM data from NASA Giovanni (1998-Present)
* India Meteorological Department data: Leh Station

For the third objective, Random Sampling technique will be used to survey households from the three villages for participation in the study. Structured and Semi-Structured Questionnaires will be employed to study the changes in the social-economic conditions (household structure, occupation and livestock management) of the Changpas in light of the changes in the land-use and landcover pattern of the three villages.

Participant observations, Semi-Structured interviews will be used to understand the power relations within the Changpas and the state and other political institutions (In terms of state policies, changed political status and political participation).

**Literature Review**

*Land-use and Land Cover Changes in Rangelands of Pastoral Environment*

Rangelands are deﬁned by the presence of grass and trees used by grazers or browsers, and encompass vegetation types ranging from complete grass cover, through woodlands with as much as 80% canopy cover, to pastures within dense forests. Despite advances in rangeland ecology, some management specialists hold to the misconception that rangelands are natural entities which, in the absence of human impact, would persist unchanging within climate epochs. Some rangelands are indeed largely edaphically or climatically determined (arid/xeric; coastal zone, alpine and wetland ecosystems). More generally, large areas of rangelands are maintained in their current state by the interaction of human and biophysical drivers (Solbrig, 1993; Sneath, 1998). Thus, human activities are commonly a functional part of these ‘‘semi-natural’’ ecosystems, and reducing or eliminating human use will trigger significant changes. Temperate and tropical rangelands are both highly dynamic and also resilient, moving through multiple vegetation states, either as successional sequences or by shifting chaotically in response to random interplay of human and biophysical drivers (Walker, 1993).

A rangeland has a natural ‘carrying capacity’ for livestock. This ‘carrying capacity’ is believed to derive from agro-ecological potential and to be relatively constant. The intrinsic variability of rangeland ecology, however, makes it difficult to distinguish directional change (such as loss of biodiversity or soil degradation) from readily reversible fluctuations, such that interpretations of ‘‘degradation’’ and ‘‘desertification’’ must be viewed cautiously (Sandford, 1983; Puigdefabregas, 1998). Rangelands in arid or semi-arid tropical and subtropical zones are increasingly seen as non-equilibrium ecosystems. Modification in the biological productivity of these rangelands at the annual to decadal time scales is mainly governed by biophysical drivers (e.g., interannual rainfall variability, ENSO events), with stocking rates having less long-term effect on productive potential (Behnke et al., 1993). Less arid systems in tropical and subtropical areas are increasingly seen as governed by a combination of human and biophysical drivers, and may be more prone to being developed through intensification and conversion.

State policies throughout sub-Saharan Africa are framed under the assumption that pastoralists overstock rangelands, leading to degradation. The resulting management strategies aim to control, modify, and even obliterate traditional patterns of pastoralism, including the development of watering points or long-term exclusion of grazing (Ellis and Swift, 1988; Niamir Fuller, 1998). Two common pathways follow. Weakened indigenous pastoral systems undermine local economies and resource institutions or precipitate urban migration with rural remittances, either of which may lead to land alienation and conversion, with concentration in the remaining areas, local overstocking and degradation. Alternatively, exclusion and reduced grazing lead to changes in species diversity, vegetation cover and plant production, with implications for biodiversity conservation and/or animal production. In wetter rangelands, reduced burning leads to increasing woodlands. Evidence indicates that grazing, rather than being inherently destructive, is necessary for the maintenance of tropical rangelands (Oba et al., 2000). Rangeland dynamics in northern Europe over the last 2500–3000 years reveal a trajectory of change in some ways comparable to trends of intensification across the African Sahel today (Bassett and Zueli, 2000). Holocene climate change triggered the shift from migratory pastoralism to village formation, with associated winter fodder systems (hay meadows) complemented by large areas for summer grazing (Berglund, 1991). The presence of livestock increased soil nutrients around villages, improving agricultural production. Prevailing land tenure systems, which regulated land subdivision between generations, and population increase triggered land reforms. Agricultural intensification and mechanization from the mid-20th century removed the nutrient connection between arable lands and livestock, separating cultivated plains from mountain and forest areas used for grazing. For example, northern European rangelands, which also depend on grazing, are increasingly converted to intensive fodder production or forestry. The conversion and fragmentation of these temperate semi-natural rangelands leads to progressive loss of biodiversity, species connectivity, and means for recovery. (Lambin et al.)

Despite representing a unique ecosystem in terms of biotic resources (Rawat et al. 2002), there has been little effort to understand the rich biodiversity (Namgail et al. 2005), the impact of climate change, and the associated vulnerabilities in Changthang. The studies from the Tibetan side of the Changthang Plateau indicates the thinning of glaciers, erratic precipitation patterns, and the increase in the minimum temperature during winter has been affecting the vegetation and grasslands (Yang et al. 2012; Liu et al. 2000; Wilkes 2008). For Ladakh as a whole, which shares a similar geography and altitude, the impacts of global climate change have been prominent in the form of extreme heat, cold waves, flash floods, and pest invasions. Meteorological data, recorded by the Indian Air Force, shows that the temperature in the region rose by 1 degree Celsius over the last 35 years (Kumar 2009). Observations and community perspectives from Changthang also corroborate a substantial decrease in snowfall over the last 20 years, which is directly affecting changes in species composition and the decreasing productivity of grasslands. (Chandan et al. 2007).

The rangelands of the Changthang Plateau represent a cold–arid ecosystem. Although these rangelands are considered resource-poor in terms of biomass production, vegetation cover, and floristic diversity, they support a high density of domestic livestock and a variety of wild herbivores. In recent years, ecologists and conservationists have questioned the sustainability of livestock grazing in these areas and the integrity of this ecosystem, given the rapid socioeconomic changes and steady increase in the population of livestock. Therefore, it becomes necessary to study the land-use and land cover changes in the region.

*Climate Change vis a vis Ecological Landscape*

The Himalayas are the highest mountain range/landmass of the world. This region is characterized by a complex topography and varied land cover/land use patterns. It has a significant influence on the weather and climatic patterns over the south Asian region (Kumar et al. 1999; Dey and Bhanu Kumar 1982). The Himalayan glaciers are storehouses of water and replenish the mountain rivers (Bookhagen and Burbank 2010; Immerzeel et al. 2010, 2013; Kaser et al. 2010). The Himalayas influence climate at global, regional, local, and micro scales, and in turn, the climate at all four scales impacts the Himalayan climate itself (Dimri and Niyogi 2013). All of these factors combined, the changes occurring over the Himalayas have a major impact on the climatology, hydrology, and ecology of the Indian region. Heterogeneous topography is a characteristic feature of mountainous regions and shows a large variety of climatic conditions over a comparatively smaller gradient (Bhutiyani et al. 2007). Amplified variations in temperature and precipitation patterns are noted in such regions (Jhajharia and Singh 2011). As these regions are most vulnerable to climate change (IPCC, 2007), they are used as indicators of change with a focus on trends and consequences (UNEP 2009). The higher sensitivity of mountainous regions towards the impacts of extreme variation in the climate makes such studies even more important.

Leh at 3500m shows an extreme annual range of temperatures ranging from 34.8 °C in summer to −27.9 °C in winter with an annual mean temperature of 7.3 °C. The precipitation over Leh falls mostly during the monsoon period with the extreme precipitating events (cloudbursts) also occurring during the same period. During winter and pre-monsoon also, there is significant precipitation over Leh due to the influence of western disturbances. But on an average, the daily precipitation amounts range from 0.5 to 1.5 mm/day. These conditions define the climate of the Leh region as cold and arid (dry). The changing climate shows a slowly changing trend of the climate variables when considered as a time series. A statistical analysis of the climate over Leh using different datasets shows a slight but significant trend of change. Considering the different temperature datasets over Leh, there is an overall significant warming trend over the years in most datasets. On the other hand, overall linear precipitation trends over Leh show varied results with different datasets, with some showing increasing and others showing decreasing trends, but significant increasing precipitation is seen in few datasets. The temperature and precipitation variability of Leh climatology is further analysed using polynomial trend lines with a comparative analysis between different datasets. This comparative analysis comes up with interesting information on the climatology over Leh. It is noted that from 1901 to 1979 there is a warm period over Leh followed by lowering temperature during 1979–1991, after which from 1991 onwards, the temperature again increased rapidly. Further, analysis of precipitation reveals that, after a low precipitation period before 1970, there was a period of increasing precipitation trend from 1970 to 1995, but after 1995 onwards, there is again a decreasing trend in the precipitation. This varied trend of increasing/ decreasing temperature and precipitation over different time periods is statistically significant. Further, the variable temperature and precipitation trends show that there is somewhat of an inverse relationship between temperature and precipitation over Leh. Before the 1970s, there was a relatively warm period which led to lower precipitation over the region. Between the 1970s to mid-1990s, there is higher precipitation over Leh associated with lower temperature. In the recent decades, the mid-1990s onwards, the temperature is showing a rapidly increasing trend and consequently precipitation shows a decreasing trend. Despite the decreasing trend of precipitation amounts over the region in recent decades, there is an overall increasing trend of precipitation and warming temperatures over the years for Leh. There is also some indication of decreasing number of days having high precipitation though reported otherwise. This suggests that overall, the region is receiving more rainfall than the arid region is used to. This analysis indicating a rapid increase in temperature and varied precipitation patterns in recent decades foreshadows Climate change over Leh (Ladakh), India. This change in the climatic pattern might have irreversible impacts over the region leading to devastating consequences. Any region is adapted to its consistent climate over many years; a changing climate is problematic as it disrupts the delicate balance between the historical climate and ecology of the region. Though Leh is a cold and arid region, a warming environment and shift in precipitation patterns will have a significant impact on the ecology, vegetation, wildlife, hydrology, cryosphere, and even the human society (agriculture and transport). Increasing precipitation might be considered good for an arid region from an anthropogenic point of view but will not be correct at all for the region’s ecosystem. In addition, this increase in form of extreme events or cloudbursts further cause extreme amount of devastation without the possibility of water excess available during the time to be stored for future. Thus, changing climate over the region will significantly impact the region negatively and perhaps irrevocably.

*Socio-economic changes of Pastoralists*

Historically, nomadic pastoralists have moved their herds over large areas to manage uncertainty and risk (Scones, 1995), and for converting sparse vegetation into human food. Khazanov (1994:17) gives a definition of pastoral nomadism: “…. pastoral nomadism may be defined from the economic point of view as a distinct form of food-producing economy in which extensive mobile pastoralism is the predominant activity, and in which the majority of the population is drawn into periodic migrations.”

According to Miller (1998) nomadic pastoralism on the Tibetan Plateau is characterized by a harsh environment where the grazing lands are divided by rugged mountain ranges, deep river valleys, and large lake basins that give rise to a great diversity in topography, climate, vegetation, and pastoral production practices. Nomadic pastoralism on the Tibetan plateau differs from pastoralism in the semi-arid regions of Eurasia and Africa due to ecological factors (Miller, 1998). Water is normally the limiting factor in the nomadic areas of Africa and Eurasia, while high altitude is a characteristic for the nomadic communities of the Tibetan Plateau, not lack of water (Miller, 1998).

The Changthang means the northern plains and it is a high-altitude plateau, bounded by Tibet (China) in the east and the Zanskar, Ladakh and Karakorum Mountain ranges in the west. The region is geographically situated in the eastern part of Ladakh. The nomads that move with their livestock across this plateau are known as the Changpas, or “people from the north”. The Changthang is situated on the western extension of the Tibetan plateau and the people have cultural and linguistic similarities with Tibet (Goodall, 2004: 218), and Ladakh is the only region in India with a Buddhist majority. The nomads of the Indian Changthang plateau have been exposed to major changes during the last forty years due to political factors as well as increased development activities and interaction with the outside world. Major changes occurred in the wake of the Sino-Indian border dispute in 1961-1962, where India discovered that Chinese had annexed a large area in the border region in association with Chinese exertion of control in Tibet (Ahmed, 1996; Chaudhuri, 2000). Thousands of Tibetan refugees entered India and settled in the border region, in towns and all over the Indian Changthang. The Changpas were essentially forced to leave behind large winter grazing areas near the border due to a high number of refugees and soldiers in the area. The migration pattern changed and the nomads had to search for new winter rangeland. At the same time, the Changpas had to increase their population with hundreds of Tibetan refugees with thousands of livestock. In addition to changes in migration pattern and increased population, the nomads were facing socio-economic changes, due to externally driven influences from development activities and improvement of infrastructure. The border dispute brought about a high degree of military activity in Ladakh. Roads were built and thousands of soldiers entered the region. The army brought in highly subsidised food and supplies that the nomads could purchase inexpensively, which led to an end of the old trading routes and a change from subsistence economy into market economy (Ahmed, 1996). The nomads of the Changthang produce the finest pashmina wool in the world, which is the thin and fine inner wool from the Changra goat. Pashmina is also known as cashmere, and the fine quality is due to the harsh climate on the high mountain plateau where the goats are reared. The government has shown great interest in the pashmina production and they have recently started supporting the nomads of the whole Changthang area with various incentives to promote the pashmina production and to reduce the livestock mortality (ICIMOD 1999). The Changpas are dependent upon the market for selling their pashmina wool, thus in the absence of a minimum support price, they are not always able to get a good price for their products. At the same time as the government is enhancing the livestock productivity, the Wildlife Department of Jammu and Kashmir had moved to declare a substantial part of the Changthang region a wildlife sanctuary. The Tso Kar Basin in the Changthang has been of great interest for the Wildlife Department and conservationists due to the wildlife in the area, but it is also used by the Changpas for winter grazing. The increase in livestock number in the area raises the question of impacts of grazing pressure on the rangelands and on the human-wildlife interaction. The western Changthang opened up for foreigners in 1994 and thousands of tourists are entering the area during the summer season and groups of trekking tourists are camping in the nomadic land, with pack animals that graze the pastures (Tshangspa, 2000). In spite of all the development activities and social transformations that may be taking place in the Changthang, there is recent evidence of nomads leaving their traditional lifestyle, to move to Leh and other settled villages (Chaudhuri, 2000; Goodall, 2000). These transformations may have far reaching consequences on the livelihoods of people as well as conservation and there is thus an urgent need to assess the impacts of such changes on the people’s economy in particular and the ecosystem in the area as a whole. The traditional way of living and management of the livestock in the Changthang are changing due to externally driven factors, and there is an urgent need to understand the present use of the rangeland for a better understanding of the impacts of the changes that are taking place. Traditional nomadic pastoralism in the Changthang is based on mobility of the livestock due to the fact that the animals have to be fed throughout the year. Social organization, production system and herd management are all based on flexibility in relation to the variable environment, and there is an urgent need to understand the complexity of the pastoral use of the rangelands, and a need to understand the importance of mobility and risk management as a whole to understand the impacts of the changes that are occurring, for managing a sustainable livelihood of the nomads, for sustainable use of the natural resources and co-existence between human and wildlife (Fox et al., 1994; Miller, 1998; Schaller, 1998; Niamir-Fuller, 1999).

Due to their relative isolation, the nomadic pastoral communities of Rupshu-Kharnak have experienced significant changes as a result of the broader economic and political changes during the past 40 years. The increasing rate of outmigration and settlement has accompanied these broader changes. One of the more significant events was the closure of the border with Tibet following the Sino-Indian conflict of 1962 and the subsequent loss of important pastures. In addition to a reduction in the total area available for grazing, the Changpa communities have also had to accommodate a large number of Tibetan refugees and their herds. The introduction of subsidized food rations and improved road access have reduced the need for arduous long-distance trade journeys. However, this has occurred at the expense of traditional inter-village trade networks and has increased the need for cash in the local economy. With the increased availability of education and health care to the settled population in and around Leh, there is also a growing sense of relative deprivation among many of the nomadic pastoralists. More recently, issues surrounding access to the rangelands from the competing interests of tourism and wildlife conservation have added to the challenges facing pastoralists in Rupshu-Kharnak (Fox et al 1994; Gujja et al 2003).

Over the past four decades, approximately one-quarter of the original population of Rupshu-Kharnak has settled in and around Leh. A loss of productivity from the pastoral areas associated with significant outmigration will have important implications for Ladakh’s economy. This relates to the supply of animal products to the urban population, but more importantly, to the valuable export commodity of pashmina, which is the raw fibre for cashmere produced by the goats in Rupshu-Kharnak.

There is more outmigration from Kharnak to Leh to a settlement area in the city called as Kharnakling. Kharnak does not have lake like the other two settlements and is completely cut off in winters along with lack of water resources. The people who have migrated from here are living off on their income generated from livestock and their main goal is to get education for their children so that they find a stable job in the future.

There has been lesser migration from Samad as compared to Kharnak. Unlike the Kharnak Changpa, families who choose to leave Samad are permitted to continue pastoralism in absentia, with family or friends taking care of their animals during the winter months. This is conditional upon the maintenance of their financial, social and cultural obligations to the community in Samad. Migration to Leh from Korzok is very low and has a character of gender balanced intra-rural migration.

There is a need to encourage and promote pastoralism in Rupshu-Kharnak. Not out of a sense of sentimentality for a ‘remnant culture,’ but because as a livelihood system, it has the potential to provide a higher standard of living than subsistence farming (Barfield 1993), or indeed, life in the informal sector of an urban area (Meir 1986). The Changpa nomadic pastoralists have a long and successful history of pastoral management in the rangelands of Rupshu-Kharnak. There is a need to promote adaptive strategies such as seasonal circulation and absentee pastoralism that enable the Changpa to meet their changing circumstances. It is toward such positive strategies that attention should be focused, as it is here that the ‘future’ of pastoralism in Ladakh lies. (Goodall,2004)

*Relationship between the Changpas and the State and other Institutions of Power*

After the Indo-China war of 1962 borders were closed and heavy militarisation of the area happened. In order to launch the primacy of the military authority in the region, a centrally controlled ‘**Inner Line Area Policy**’ was introduced in the Changthang. As a legacy of the colonial times, this policy has been guided by a complex system of administrative zones which were supposed to aim to curtail the mobility of ‘outsiders’ with regards to travel to and settlement in the region in question and also serves to delimit the reach of the legal code that governs the rest of the country. During colonial times, this system of exclusionary control for certain areas through legalities such as the 1873 Bengal-Eastern Frontier Regulation for the hill areas in the northeast parts of India prevented plains people from moving into the hills. In the postcolonial era, the policy has also served this purpose for regions such as the Changthang borders, putting restrictions on property ownership or free movement of the outsiders in order to provide special rights to the military. As a result, certain parts of the border regions in India today require special permits by non-residents to travel into these zones, and these regions are characterized by a visible military presence.

The developmentalist path that Arunachal has embarked upon is neither the result of a choice made by policy-makers about what is best for the well-being of the people of Arunachal, nor is it evidence of the inevitability of ‘progress’ and ‘civilization’. Rather, it is the intended and unintended consequence of the Indian state’s efforts to assert control over this frontier region and to make it a ‘normal’ part of India’s national space. The same has been done with Changthang. Baruah (2003:932) sees the logic of developmentalism in frontier regions being embedded ‘in the institutions of the Indian State that have been put in place in pursuit of the goal of nationalizing space’. Seeing it as a ‘national security driven process’ Baruah (2003:917) believes that the development process has made India’s everyday control over this frontier space more effective. Baruah (2003) discusses the structural disempowerment of tribal people in cases where the local government or councils are completely dependent on New Delhi for their finances and thus vulnerable to New Delhi’s direct involvement in their day-to-day affairs.

Controlled by the centralized Ministry of Home Affairs, the Border Area Development Programme (BADP) consists of the bulk of the development programmes implemented in Changthang. Policy matters, such as the guidelines of the BADP, the geographical location where the BADP programmes are implemented, the allocation of funds, and so on, are guided by decisions made by an exclusively centralized committee empowered for this purpose. This committee is primarily composed of a high-ranking centralized bureaucracy along with representatives from the ITBP and other military units. With a minimal presence of the erstwhile Jammu and Kashmir state actors, all the development decisions were planned away from the region. These development decisions were generally political in nature, catering to priorities that are mostly non-local and mostly helped retain a military supremacy in the region. The disassociation of the local people from their development decisions and the unpredictability of a typical development course has led to a situation where declining pastoral activities or migrating to Leh have become more common after 1962. According to one estimate, almost 30% of the Changpa nomads had migrated to Leh by 1998 (Goodall 2007). The potential of the State government institutions, which could have played an effective role after the 1962 war in Changthang, has suffered considerably from the impact of the military authority and centralized control of Changthang. Therefore, whether it is civil democratic rights, or alternative development strategies, all have had to be subordinated to the project of frontierization of Changthang. Being subservient to such processes or to the larger national good appears to be inherent in even the thinking of the State officials who perceive Changthang primarily as a militarized border zone.

The case of the State development programme in Changthang reveals that those who follow a nomadic lifestyle and livelihood are regarded as having occupied inferior positions. This view of the Changthang region has also led to a larger development agenda of encouraging sedentarisation amongst the Changpa nomads. The bureaucracy of the block education department has always found it difficult to impart primary and secondary education to the nomadic children due to the local ‘nomadic’ lifestyles. The appointed school teachers are generally not keen to constantly move and stay in yak-hair tents with the pastoral nomadic families. Recently, a residential school for the nomadic children has been built by the state government in the Puga valley, and is thought that nomadic children can be imparted education more effectively with the help of sedentary hostel accommodation. This process of sedentarisation through development is also promoted within the Korzok-based nomadic housing programmes. The efforts to sedentarise the Changpa nomads constantly contradict the other State development policies for the region. Local government departments, such as Sheep Husbandry, continue to promote various schemes where nomadism is an essential strategy to reap benefits out of State investments in the pashmina industry.

The Changthang Wildlife Sanctuary, as well as all the protected areas in India, is a result of centrally planned policies and overseen by the Ministry of Environment and Forest (MoEF) based in Delhi. When the standing committee of the National Board for Wildlife (NBWL) under the chairmanship of the Minister of State (Forest and Wildlife) had decided to forego the wildlife concerns in the interest of national defence needs in Changthang in 2009, it was a unilateral decision. The committee diverted a major part of the Changthang Wildlife Sanctuary for building a network of five metalled roads, proposed by the ITBP in a meeting held in Paryavaran Bhawan in New Delhi. The committee meeting was held in the far away location in Delhi where the MoEF finalised the ‘denotification’, without involving the regional wildlife authorities.

Ever since Ladakh was carved out of the State of Jammu and Kashmir and made into a Union Territory without legislature on October 31, 2019, many of the locals are a worried lot. Articles 370 and 35A of the Constitution had protected some rights of the Ladakhi’s. The abrogation of these Articles has left the land, economy, identity and culture of the place exposed to outside meddling.

The demand for the inclusion of Ladakh in the Sixth Schedule of the Constitution has gained urgency for two reasons. The first one was the need to protect the fragile environment of the region against an unsustainable “development” model that would inevitably follow if outsiders are allowed to buy land and build indiscriminate structures with the profit motive. There are apprehensions that an influx of trade, industry, commerce and people who are unfamiliar with the cultural, religious and traditional essence of the place will disrupt the quiet way of life of Ladakhi’s.

The second reason was the announcement of the Citizenship (Amendment) Act (CAA) by the Union government, which would force the people to prove their antecedents and threatened to divide the religiously tolerant community of Ladakh along communal lines. The areas demarcated under the Sixth Schedule have been exempted from the CAA, which will guard the regions against the influx of Hindus from Pakistan, Bangladesh and Afghanistan. Even if these people are granted Indian citizenship as per the CAA, they will not be able to buy land or have trading rights in these places.

Ladakh Autonomous Hill Development Council (LAHDC) is the administrative body that governs Ladakh. LAHDC, Leh was constituted in accordance with the Ladakh Autonomous Hill Development Council Act, 1995. The council came into being with the holding of elections on August 28,1995. The democratic constitution of the Council has heralded democratic decentralization of planning process with the involvement of people at the grass root level. Owing to the difficult geographical problems, the need for greater public participation in the planning and development process was all the more necessary. However as of now, the Ladakh Autonomous Hill Development Council is enabled to take administrative decisions on land, development schemes, budget, health, education, the environment, employment, roads, language and culture, among other things. But these are only executive powers wherein the LAHDC can act as an administrator to manage development as listed under the LAHDC Act of 1997. While land is under the purview of the LAHDC, it cannot make laws with regard to restrictions upon the use or transfer of any land. It can only allot and specify the use of government land. In order for the LAHDC to be constitutionally recognised, it needs to be identified as an ADC under the Sixth Schedule, which would endow it with legislative and judicial powers. It would then be empowered to protect the land, environment and culture of the region.

The ADCs and the Regional Councils under the Sixth Schedule have the power to make laws, receive funds from the Consolidated Fund of India and develop the region in the areas of health care, education, roads and regulations. This enables the security of the indigenous population’s economy, environment and traditions. Parliamentary laws either do not apply to autonomous districts and autonomous regions or can have varied degrees of application. Therefore, it remains to be seen in the future as to what happens to Ladakh.

The study also will focus on the traditional institutions of power among the Changpas to see how does that affect their ability to adapt with changes in their contemporary environment.

**Study Area/Region**

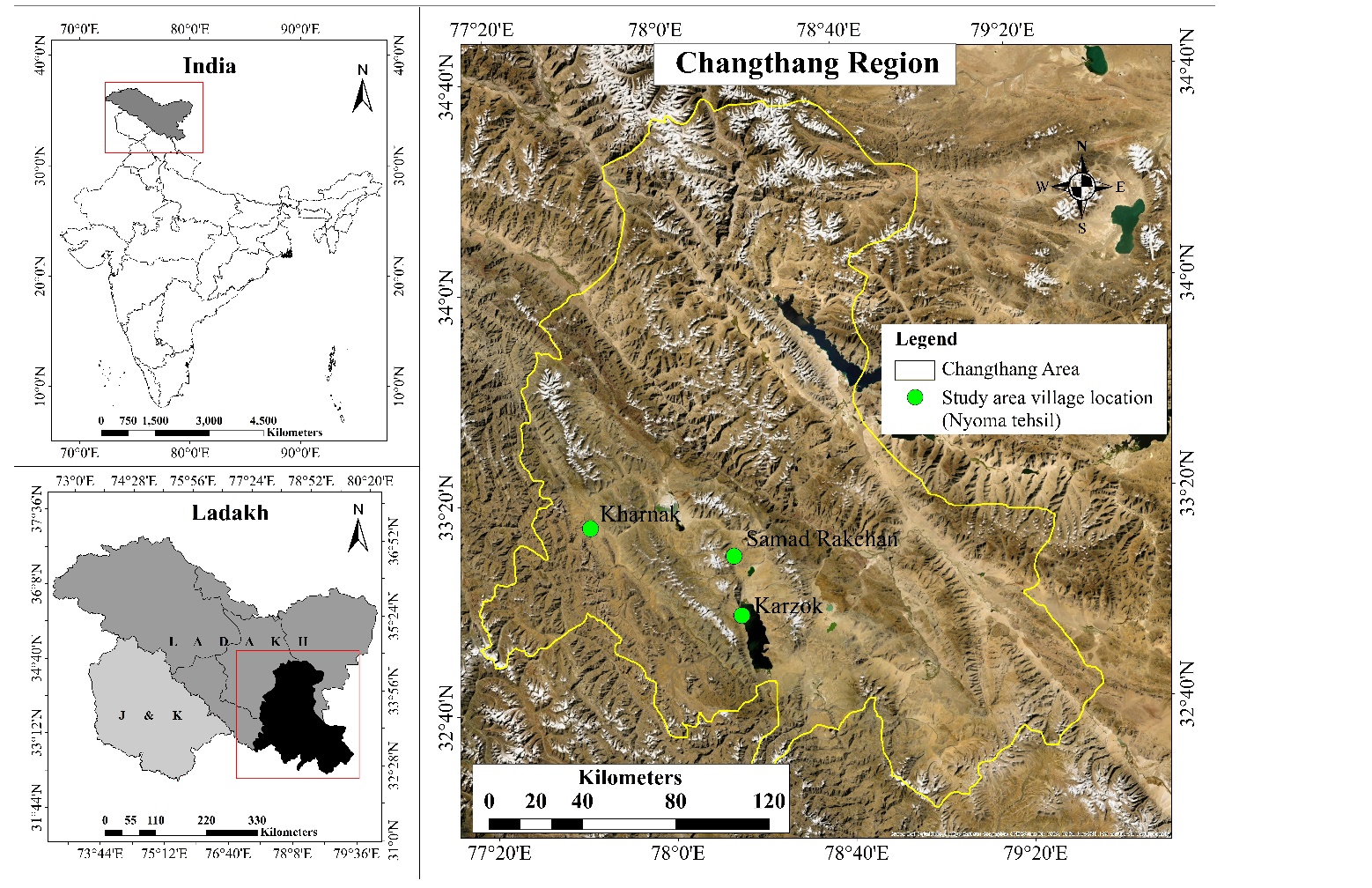


Figure- Map of the region indicating the selected villages

**Geographical**

Ladakh is located in the temperate latitudes between the Karakoram and Himalaya Ranges. The region is characterized by high altitude, extreme aridity, and marked variation in diurnal and seasonal temperatures. Leh district is a high-altitude cold desert spread over approximately 45,000 km2. This rain-shadow region is semiarid to arid, with winter temperatures dropping to below 25 degrees Celsius. The eastern part of the district, called Changthang, on the other hand, comprises high plateaus and rolling hills (usually >4000 m) interspersed with lake and river basins that have moist patches of relatively dense graminoid vegetation. Most of the remaining arid region is dominated by medium to sparse steppe vegetation. Changthang covers approximately 20,000 km2. Changthang is a Tibetan word meaning northern plain or plateau. Chang means “north” and thang or tang means “plain”. The Changpa are thus northerners (Rosing, 2006). It is an elevated altitude plateau of Leh district of Ladakh Region, bordering by Tibet (China) in the east, with huge highlands and vast lakes. The people of the Changthang are nomadic pastoralists, they are known as 'Changpa', for 'northerners,' or 'Drukpa' for 'nomads' in Tibetan. The people are divided into two sections. One is called Rongpa (Yulpa)—that is to say, ‘dwellers in villages’, and the other, the Changpa, meaning “dwellers in the desert’. The Changpas are a nomadic pastoral community who rare animals they move from place to place across the Changthang, staying in yak wool tents (rebos). The Changpas speak Changkyet/Chanskat, a Tibetan dialect (Bhasin, 2012). In Changthang, winters are cold and Arctic-like, despite the latitude, due to the high elevation and very harsh with temperatures falling to -40°C associated with heavy snowfalls and bitter winds. During the brief summer, temperatures are high in the day, but fall to around 0°C at night. The remoteness and relatively low productivity due to low temperatures and dry climate have left it relatively little exploited. (Thsangspa, 2000)”. Less than 1% of the geographical area in Changthang is cultivated, most of the vegetated zone is used by the Changpa nomads as grazing grounds (Rawat and Adhikari 2002).

Rupshu-Kharnak is home to three nomadic pastoral communities. This region lies in the elevated south-east corner of Ladakh. The combined effects of low precipitation, extreme temperature fluctuations, low nutrient and poor soil conditions limit the natural vegetation of Rupshu-Kharnak to various species of grasses and small woody shrubs, and make the area unsuitable for agriculture or permanent settlements. The broad, undulating, high altitude plains are, however, well suited to mobile pastoralism and have been managed as such by the nomadic Changpa for many thousands of years. The nomadic pastoral population of Rupshu-Kharnak is comprised of three independent groups located at Kharnak, Samad and Korzok. The household (as represented by the main and subsidiary tent) is the basic unit of social and economic organization. Each community follows a year-round migration cycle, living in tents and grazing their herds of sheep, goats and yak on pastures that are communally regulated.

**Political**

Ladakh, also known as the ‘Land of High Passes’, is the northernmost, largest and the second least populous Union Territory of India and was formed on October 31, 2019. The UT shares borders with Himachal Pradesh and Jammu & Kashmir and its neighbouring countries are Pakistan, China and Afghanistan. Administratively, Ladakh is divided into two districts: the western Kargil district and the eastern Leh district. Leh is the largest district in the country in terms of area. It is one of the coldest and most elevated inhabited regions of the world having 112 inhabited and 1 uninhabited village. As per census 1991 population of the district is estimated as 0.895 lacs which is risen to 1.17 lacs during census 2001. Population growth rate of 29.97% has been recorded during the decade 1991-2001 in the district. As per 2001 census 75.57% population is residing in the rural area. The biggest ethnic group is Buddhist having 77.30% of population followed by Muslims with 13.78% and Hindus with 8.16%. The main working force account for 33.07% to the total population whereas marginal workers account for 16.50 % and non-workers 49.58%. The main occupation engaging the working force is cultivation (37.92%), agriculture labour (4.28%), household industry (1.24%) and other works (56.56%). The three villages Samad, Korzok and Kharnak that are chosen for the study lie under the sub-division Nyoma and block Rupshu-Puga.

**Design of Research**

Chapter-1 - Introduction

Chpater-2 - Introduction to Pastoralism, Rangeland dynamics, Pastoralist Environment, Spatio-temporal distribution of LULC, Vegetal Mapping, grazing land mapping, Physiography, Soil Map, Water Source Mapping, Elevation Map, Accuracy assessment

Chapter-3 - Assessment of relationship between climatic factors and the ecological landscape, assessment of the Optical Satellite Imageries will be done such as LULC, Source of meltwater, vectorization of water bodies, vegetation and snow mapping and others. Digital Elevation Model (DEM) will be used for Relative Relief, Slope, stream delineation, stream ordering.

Chapter-4 - Socio-economic changes in the livelihood of Changpas, Household Structure, Pastoral Management- Herding practices, Pasture Mobility Patterns, Occupational structure, Education, Health

Chapter-5 - Power relations among the Changpas, changing relationship between Changpas and the state and the other political institutions in the Changthang Plateau, State policies, changed political status and political participation

Chapter-6 - Conclusion

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