NATIONAL SEMINAR ON
HIMALAYA: ENVIRONMENT AND DEVELOPMENT

NOVEMBER 10, 2012

Souvenir with Abstracts

ORGANISED BY

HIMALAYA SAMIKSHA PARISHAD

IN COLLABORATION WITH

• DEPARTMENT OF GEOGRAPHY, UNIVERSITY OF CALCUTTA; • NATIONAL ATLAS AND THEMATIC MAPPING ORGANISATION; • NETAJI INSTITUTE FOR ASIAN STUDIES; • DEPARTMENT OF FOREST, GOVT. OF WEST BENGAL

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Department of Geography, University of Calcutta
35, Ballygunj Circular Road
Kolkata 700019

IN COLLABORATION WITH

Department of Geography, University of Calcutta
National Atlas and Thematic Mapping Organisation
Netaji Institute for Asian Studies
Department of Forest, Government of West Bengal

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Preamble

The Himalaya Samiksha Parishad is an academic organisation playing a significant role as a resource centre for disseminating information about the Himalayas.

The Parishad was set up in 1976. At present the organisation has a wide base with members from different walks of life. Scholars from varied disciplines like anthropology, geography, botany and zoology take active part in its activities. The Parishad organises occasional lectures and brings out its annual journal Himalaya Prashanga (ISSN:2231-1076) which is now in its 36th year of publication. In October 2010 the Parishad had organised a successful seminar on Perspectives of Himalayan Environment.

The Parishad aims to provide the *National Seminar on Himalaya: Environment and Development* as a stimulative platform to discuss and exchange ideas on various aspects of the Himalaya.

The Himalaya is a unique ecological niche which exhibits a rich biodiversity and provides a large base of resource endowment in the form of forest, water, and mineral wealth. Here 'development' itself is very crucial in a sense that it brings two way effects; firstly, if the development strategies adopted are not in consensus with this fragile mountain eco-system it may lead to a rapid devastation; secondly, as a process development reflects spatial inequality which in long run manifest into ethnic disharmony and provoke insurgency too. Owing to its geographical location, it also plays an important role in regional geopolitics.

The Himalaya Samiksha Parishad feels that a better understanding of the Himalaya- its geographical, developmental and geo-political influence as well as the man-nature relationship would go a long way in understanding the present problems of the region.

~ Seminar Organising Committee

Theme-I: Tectonics and geomorphology

QUANTITATIVE ANALYSIS OF BALASAN BASIN GEOMORPHOLOGY, DARJEELING, WEST BENGAL

Shuvasish Karmokar

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In the present paper, an attempt has been made to study in detail the morphometric characteristics of the geomorphology of Balasan basin. Morphometry is the quantitative technique to define the relationship between landforms and the geomorphic processes which act upon them. The drainage basin of Balasan, a sixth order stream, located in Darjeeling Himalaya, West Bengal, was quantitatively analysed using modern morphometric techniques. The area under study falls in the eastern Himalaya, a prominent physiographic region in the northeast India. Humid sub tropical climate with the influence of monsoon prevails in this part of the world. Darjeeling gneiss of Archaeans era, Gorubathan formation, Siwalik group and the alluvial formation of recent to sub recent of Quaternary period are the major rock formations present in the area under study. Geologically the basin exposes glacio-fluvial and fluvial surfaces. The study identifies three distinct hydro-morphological units in the basin: (a) Mountainous zone of Darjeeling Himalaya, (b) Tarai and Bhabar area in the foothills and (c) The plain zone.

LANDSLIDE PEBBLE ANALYSIS USING ZINGG'S SHAPE DIAGRAM: A CASE-STUDY OF DARJEELING HIMALAYAN REGION

Somasis Sengupta

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The Zingg's Shape Diagram devised by Zingg in 1934 is used for understanding the mechanism and mode of transport of pediment particles down the slope. This diagram is basically a scatter plot constructed by taking the ratios of the particle size in the three axes. For a circular or spherical particle, the inter-axis ratio tends to be 1 as a spherical particle should have equal lengths along the three axes. Deviations of the particles from sphericity will decrease this inter-axis ratio. Zingg has recognised four shape categories based on this ratio viz. prolate,

oblate, equant and roller. A spherical body will invariably fall in the equant or roller category in the Zingg's Diagram and oblate or prolate categories will be associated with angular particles. In case of humid regions like Darjeeling, the presence of water acts as a lubricant for the transportation of particles and hence they should generally fall in the equant or roller categories.

This paper focuses on the materials deposited at the base of an isolated landslide in Darjeeling Town and an attempt has been made to understand the mechanism of transportation of these particles by using a Zingg's Diagram. Study of the diagram implies that about 52 per cent of materials fall in the angular classes. This is an anomalous feature for a humid area like Darjeeling since the angular particles are generally associated with wind-dominated arid regions. Therefore, the materials deposited at the base of this landslide have been transported without the action of water. Hence, it may be concluded that the above landslide in Darjeeling may have been caused due to factors other than rainfall. It is pertinent to mention here that according to the locals, the above mentioned landslide had occurred in the month of February, 2011 which is a low-rainfall period in this area. Moreover, this area is situated in the vicinity of a construction site. So, the primary finding that has emerged from the present study is that anthropogenic factors like construction may sometimes lead to landslides in a humid area even without water as a medium of transport.

FORMATION OF HIMALAYAS: THE MYSTERY CONTINUES

Soumi Mitra

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The Himalayas is the youngest fold mountain of the world and is also tectonically and geomorphologically the most active unit on the earth surface. Even today the Himalayas are rising at a rate of 5 mm/yr, a clear evidence of which is provided by the fast flowing rivers of the area that are still in their youthful stage of development. Thus the main theme of this paper is to bring forth the tectonic and geomorphological scenario of the Himalayas which remain the most well known combination of reality and myth from its birth i.e. early Cretaceous to the present era.

The origin of the Himalayas as explained by the modern plate tectonic theory emphasises that this mountain range was formed as a result of continental collision or orogeny along a convergent plate boundary between the Indo-Australian plate and Eurasian plate. While explaining the tectonic formation of the Himalayas we can also refer to the Geosyncline theory of Dally which promotes how the Himalayas slowly rose from the Tethys geosyncline due to

compressional forces acting from either side by Angara land and Gondowana land. The formation can also be described through the Isostasy theory put forward by G.B. Airy.

The most striking findings of the above discussion is that the Himalayas are still being uplifted at the rate of 5 mm/ yr since the Indo-Australian plate is still moving into the Asiatic plate at about 67 mm/ yr. The Indo-Australian plate is converging beneath the Asiatic plate at the rate of 20 mm/ yr and the entire endogenetic force which is generated due to this phenomenon is totally absorbed by these tectonic mountains: the Himalayas along its southern front – the result of which is its continuous rise. So this discussion attempts to throw light on some of the important factors of tectonic formation of the Himalayas and some of its geomorphological characteristics.

INTERPRETING MORPHOMETRIC PARAMETERS OF SUPIN RIVER BASIN, UTTARAKHAND, INDIA

Ujjwal Bhandari

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Morphometric analysis is important in any hydrological investigation and it is inevitable in development and management of a drainage basin. In the present paper, an attempt has been made to study the morphometric parameters of Supin river basin of Uttarakhand, India. Morphometric characteristics have been studied on the basis of SRTM DEM data with 90 m spatial resolution and LANDSAT-5TM satellite image. For this study, hydrology based GIS functions have been used in evaluation of linear, areal and relief morphometry of Supin river basin. Watershed boundary, flow accumulation, flow direction, flow length, stream ordering, contour, slope-aspect, hill shade have been prepared using ArcGIS. A number of 20 morphometric indices have been generated for all the sub-watersheds to understand the geomorphological behavior of the Supin river basin. Landuse/ landcover map shows 6 major classes such as farmland, temperate forest, alpine meadow, alpine scrub, bare rock, Ice. The total area of the basin is 565.407 km^2. Supin river basin is a 6th order river basin having average bifurcation ratio of 1.741 indicating significant structural control. The total stream length is 2783.960 km and the length ratio and drainage density is 2.379 and 4.92 km km^{-2} respectively. Finally some possible interpretations have been done by statistical relationship between different morphometric parameters to identify morphological responses of the supin river basin.

Theme-II: Climate, water resource, forest and biodiversity

WATER SUPPLY VIS-À-VIS CLIMATE CHANGE IN THE DARJEELING HILLS: PRESENT SCENARIO AND THE FUTURE

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Inadequate water supply in the Darjeeling hills is one of the most pervasive of problems that undermine the socio-economic and aesthetic development of one million permanent residents and over one lakh tourists during the dry months. Settlements in Darjeeling hills have developed at or near the perennial sources of water mostly jhoras/springs. Conducive climatic condition along with natural vegetative cover in the watershed ensured perennial supply over the centuries.

Rapid population growth coupled with heedless deforestation, unscientific and unplanned use of land has led to the establishment of vicious cycle of degradation. As a result, the surface water availability during the dry months reduced considerably over the past hundred years. Sample survey in Bijanbari area (2010) reveals that over 40 per cent springs remain dry during lean period and according to the elderly villagers, the springs were perennial in their early childhood. Even in the protected Senchal watershed out of 26 perennial springs, now only 12 exist. Water yield from the survived springs is found to have reduced considerably. One experimental study done in 1991 on the Veenita Jhora near St. Paul's school showed a minimum yield of 15 gallon/hour that has reduced to only 6 gallon/hour in 2010 i.e., a reduction by an alarming rate of 60 per cent in 15 years.

Alarming temperature rise along with lowering in atmospheric humidity during the past hundred years has increased the biological demand of water and at the same time gradual decrease in number of rainy days and amount of precipitation makes the scenario further complicated.

Fortunately, Darjeeling hill is endowed with plenty of ground water resource in the form of aquifers tapped in both confined and unconfined conditions in paleo-channels, fluvio-glacial and paleo-slope deposits. The future area of exploitation for augmenting drinking water supply in Darjeeling hills should be concentrated in following three sources: (i) rain water harvesting; (ii) tapping of surface water

i.e., spring/jhora and (iii) harnessing ground water through bore-hole wells.

Of course, how long the water resources as mentioned above are going to last, when water sources all over the world are drying up and ground water levels are going down due to over exploitation and the effect of climate change. However, in Darjeeling Himalaya we might expect a bounty of ground water as the climate warms and the snows melts. In fact, during next few decades the volume of water will increase in the mountains as a result of melting of snow due to global warming.

CLIMATE CHANGE AND GEO-HAZARDS IN HIMALAYAS: CONCERNS FOR HIMACHAL PRADESH

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There is no denying the fact that climate change is a global phenomenon today and the impacts are also felt now and then but they are not uniform everywhere. Threat of human induced climate change has attracted the attention of scientists and policy makers in the last three decades. The Himalayas are a fragile system and the impacts of climate change in this region are being felt more than any other part of the earth. The climatic change has far reaching repercussions in rugged and mountainous region like the Himalayas, where majority of the people are engaged in primary pursuits and are directly dependent on the natural endowments for their day to day needs. The situation is more precarious in the states like Himachal Pradesh where nearly 80 per cent people are engaged in agriculture including horticulture and animal husbandry. The state of Himachal Pradesh, by virtue of its location, in the very sensitive zone is assumed to be highly vulnerable to climatic changes as the economy of the state is wholly dependent on sectors like the hydro-power generation, horticulture, agriculture, forestry and tourism to some extent. Moreover one of the drastic impacts of climate change will be on the sustainability of water resources, as the Himalayan glaciers are melting at a very fast rate. The retreat of the glacial snouts, variation in the snowline patterns can very well indicate the extent of warming. Therefore, any change in the climate and related phenomenon shall affect the life-support system and certainly lead to multifaceted disasters. In the Himalayan state of Himachal Pradesh, the threat that may and are leading to disasters includes extreme weather conditions, water scarcity in different parts, glacier retreat, floods and droughts. However, the disasters are as old as the humanity is, but their magnitude and frequency has gone up manifolds in the recent past. This may be attributed to the change in peoples' action and aspirations beside the

developmental strides taken during past few decades. The climatic change in the state may be realised and viewed through increase in temperature, decrease in rainfall and snow and shift in seasons. The state needs to adapt and adopt strong policy measures to rest the changes. The state government has taken some initiatives, but they are yet to give the desired results. In the present study an effort has been made to understand and highlight the climatic changes in Himachal Pradesh and resultant disasters of these changes, besides analysing the efforts of the Government.

WATER CRISIS IN THE SIKKIM HIMALAYAS

Bidisha Barua and Jit Ghosh

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Water resource is recognised as a scarce and precious natural resource. Water resources are vital to every human society. Hence it needs to be planned, developed and conserved.

The state of Sikkim has enormous water resources available through various rivers and hill streams. However, the same could not been put to utilization because of the land availability constraints and uneven water distribution. The state is known for its water resource but now days this glory is going to fade for several reasons.

Due to rapid growth of population the scarcity of water is acute in urban areas during the peak tourist seasons. The crisis is also found in the winter season due to shortfall in water supply. The increased frequency of natural hazards like landslide, flash floods etc disrupt the water distribution system. On the other hand, there is problem of microbial water contamination. In this backdrop the hydel power promises a prosperous future for a sustainable water resource management.

WATER RESOURCES OF DARJEELING DISTRICT: THE PROBLEMS AND THEIR MANAGEMENT

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The Himalayan water resources in the form of glaciers, rivers, lakes, springs and streams are under increasing threat from environmental and climate change as well as population growth, changing economic activity, rapid urbanisation, inefficient water use and land use change. The problem of drinking water

scarcity is being felt across the Himalayan region due to climate-induced impacts on precipitation patterns such as rise in rainfall intensity, reduction in its temporal spread, and a marked decline in winter rain, coupled with other anthropogenic causes.

Darjeeling is the northernmost district of West Bengal in the lap of Himalayas with a total area of 3,202 square kilometres. It is situated at an average altitude of 2,050 m., having annual average maximum temperature of 14.9°C and minimum 8.9°C, and annual mean rainfall of 3,092 mm. Here the climate largely depends on elevation and aspect. The monsoon is a period of continuous rainfall while the winters are usually too cold and dry.

Darjeeling originally was the summer capital and military base of the British. The population of this hill station has increased rapidly from 1,900 in 1850 to 1,842,034 in 2011. Thus, the old distribution system and supply lines have become defunct to provide water to the rising population. Only 36 per cent of the rural population in the district and 39 per cent of urban people has access to safe drinking water. This paper aims to analyse the causes and effects of water crisis of Darjeeling district.

There have been increasing instances of springs drying up or becoming seasonal. This has been attributed to population increase, erosion of top soils, erratic rainfall patterns, deforestation, forest fires, and developmental activities (construction of roads, buildings, etc) adversely impacting the spring catchments. Consequently, a limited amount of rainwater infiltrates to recharge the groundwater, thereby creating a hydrological imbalance. According to local residents, even in monsoon months, water is supplied through pipes once in two to three days. The situation is worst in the lean season when the interval exceeds up to ten days.

Shortage of drinking water in Darjeeling town has been felt over the past thirty years and one of the main causes of the water scarcity is shortage of reservoirs. But the problem still remains unsolved. Presently, the town is supplied with drinking water from the twin lakes of Senchal at Singdhap, but due to poor maintenance of the reservoir and leakage, they have almost degenerated. Considering the need of growing population and rapid inflow of tourists, it is urgently necessary to construct more reservoirs. Besides, there is also need for construction of subsidiary tanks in each and every village and ward as per the availability of space.

MELTING OF GLACIERS AND ITS IMPACT ON HIMALAYAN RIVER REGIMES

Jaidul Islam and **Ismail Houque**

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Snow and glacial melt are important hydrologic process in the Himalayan basins and changes in temperature and precipitation are expected to seriously affect the melt characteristics. It's a scary thought, but scientists say the 40 per cent of humanity living in South Asia and China could well be living with little drinking water within 50 years as global warming melts Himalayan glaciers which are considered as the region's main water source. The glaciers supply 8.6 million cubic metres every year to Asian rivers, including the Yangtze and Yellow Rivers in China, the Ganga in India, the Indus in Pakistan, the Brahmaputra in Bangladesh and Burma's Irrawaddy. But as global warming increases, the glaciers have been rapidly retreating, with average temperatures in the Himalayas increasing by 1 °C since the 1970s. According to World Wide Fund report a quarter of the world's glaciers could disappear by 2050 and half by 2100. Melt water is extremely important in Indus basin and important for the Brahmaputra basin, but plays a modest role for the Ganges, Yangze and Yellow rivers. Present paper aims to assess the impact of melt of glaciers in Himalayan mountain on the flow of Himalayan rivers. The study reveals that the present glacier scenario results in a decrease in the mean upstream water-supply from upper Indus, Ganges and Brahmaputra rivers.

LONG-TERM VARIATION IN RAINFALL AND TEMPERATURE IN CHAMBA DISTRICT, HIMACHAL PRADESH

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Chamba district lying in the north-western corner of Himachal Pradesh shows a perfect example of long-term changes in two important weather components viz. rainfall and temperature. Rainfall, maximum temperature, minimum temperature and average temperature of 100 years (1901-2000) have been taken to detect the long-term changes in weather condition for Chamba district. The rates of change in annual rainfall is +1.119 mm/year while in case of annual maximum temperature, annual minimum temperature and annual average temperature the corresponding values are found to be +0.032°C/year, +0.060°C/year and +0.050°C/year respectively. This connotes a slight positive change in rainfall rise

and a negligible positive change in temperature rise during this long time period. Some natural and man-made factors are responsible for this change.

IMPACT OF HUMAN INTERVENTIONS IN HIMALAYAN RIVERS

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Human interference with nature often leading to abuse of environment has brought about an enormous ecological alteration in the Brahmaputra-Ganga-Indus system over centuries. It has left the most dynamic mountain-building and sediment transfer system under the potential threat. In the scale of destruction the abuse is massive, and beyond recovery, if not warded off are long. Over this vastly composite landscape, human activities like unscrupulous deforestation, extensive agriculture, transport-networks, and construction of dams are dominant.

The present paper aims to describe the human interventions in Himalayan region and its impact on environmental changes. The study is based on secondary data. The study finds that the roots of changes are basically socioeconomic and political rather than narrowly environmental. It also shows that dry season flow of Himalayan Rivers have decreased after deforestation and sediment load has increased. Debris being mobilised on the steep slopes flows directly into the rivers giving a very high sediment-delivery ratio, and is subsequently carried into the Ganges Plain by fluvial transport, inducing flood hazard.

IMPACT OF CLIMATE CHANGE ON FORESTS: A STUDY OF WESTERN HIMALAYAN REGION IN INDIA

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This paper focuses on the changes in vegetation structure and biogeography due to climate change in western Himalaya. Western Himalaya comprises Jammu and Kashmir, Himachal Pradesh and Uttarakhand. In this mountainous region, eight categories of vegetation are found, like Himalayan dry temperate, subalpine and alpine, subtropical moist pine forest, Himalayan moist temperate, subtropical dry evergreen, tropical moist deciduous and tropical dry deciduous. The primary objective of this study is to identify the most vulnerable vegetation area within the region. This paper is based on an approach borrowed from the ecological concepts viz. the global vegetation dynamics model (IBIS method). This IBIS

grid model has been applied for mapping the zones of vegetation vulnerability.

The major conclusion that has emerged from the present study is that out of total 65 grids, the vegetation characteristics of 25 grids (39 per cent) are projected to undergo change region by 2030s. Another important finding that has come out from this investigation is that subalpine and Alpine vegetation along with Himalayan moist temperate forests are facing the highest threat with regard to their depletion.

GLOBAL WARMING, CLIMATE CHANGE AND ICE MELTING: DANGEROUS EFFECTS ON THE SOCIETY IN DARJEELING HIMALAYA

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Global warming and climate change has put millions of people at risk from glacier retreat and its impact. Climate change over the next century will further affect the rate at which glaciers melt. Average global temperatures are expected to rise by 1.4º-5.8ºC by the end of the 21st century. Simulations project that a 4ºC rise in temperature would eliminate nearly all of the world's glaciers (the melt-down of the Greenland ice sheets could be triggered at a temperature increase of 2º to 3ºC). Glaciers are extremely important because they respond rapidly to climate change and their loss directly affects the human population and ecosystem. Continued, widespread melting of glaciers during the coming century will lead to flood, water shortage for millions of people, and sea level rise threatening and destroying coastal communities and habitats.

None of these unfortunate events calls into question the evidence that warming is unequivocal and that human activity is the primary cause. But they undoubtedly create confusion among the public and, in this regard, their timing could not be worse. The UN negotiations failed to deliver an agreement that would prevent dangerous climate change, and the world now lacks a unified vision of the way forward for climate policy.

This paper attempts to portray the impact of the melting glaciers on the hill society of the Darjiling Himalayas.

Theme-III: Assessment and mitigation of hazards

DISASTER RISK MANAGEMENT OF THE ROADS: DARJEELING HILL AREAS

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Landslides are major threats to life and property in the mountainous terrains around the world. Due to the growing urbanisation and uncontrolled land use of the limitedly available mountainous areas, on global scale, there is an increasing trend of landslide hazards and associated risks. A recent global risk assessment study, undertaken by Nadim, indicates that the regions with the highest risk of such danger can be found in Colombia, Tajikistan, India, and Nepal, where the estimated number of people killed per year per 100 square kilometres was found to be greater than one thousand.

At present the prevention of loss of life and property due to natural calamities is being viewed very seriously by the Government of India. In the past, the main role played by the Government in case of various disasters was confined mainly to post-disaster activities that included providing relief and organising rehabilitation. The Uttarkashi Earthquake of 1991, Killari Earthquake of 1993 and the devastating Malpa landslide along the Kailash-Mansarovar route in 1998 acted as an eye-opener for the Government for a proactive approach rather than waiting for a disaster to occur. As a part of this strategy, the Government decided to institute task forces for landslide hazard zonation mapping and geo-technical investigations along with land use zonation and regulation.

Landslides of different types are frequent in geo-dynamically active domains in the Himalayan and Arakan-Yoma belt of the northeastern parts of the country as well as in the relatively stable domains of the Meghalaya Plateau, Western Ghats and Nilgiri Hills.

Darjeeling hill area is famous for its scenic beauty which attracts tourists from all over the world. But to develop such type of industry, like tourism at any place, the first priority is to develop certain infrastructure, among them road network is the most important. But such development depends to a large extent on its

ecological set up. Building up and maintenance of the roadway linkages in the Sikkim and Darjeeling Himalayan regions have been a major problem for the engineers and planners.

During the incessant rains in monsoon period, these roadways sometimes get blocked due to landslides for indefinite period affecting the mobility of the hill people. Due to limited number of roadways in the region and absence of alternative route, people as well as essential commodities get stranded on the road during such natural calamities.

The main causes responsible for landslide hazards along the roads in the hill areas are; Large scale deforestation especially along the jhora banks and road stretch, lack of proper and controlled drainage system, jhora blocking due to non disposable garbage dumping, lack of proper building rules, excessive heavy vehicular movements etc. Illegal mining and stone quarrying are the main causative factors which have made this geologically unstable region to a vulnerable one. The roads in this region have never been examined with its carrying capacity in respect of geologic structure, soil profile and extent of erosion, geomorphologic analysis along with the evaluation of existing natural vegetation and their importance in the maintenance of the road.

In this paper some mitigative approaches have been suggested for development and management of the road stretches in a sustainable manner.

LANDSLIDES ALONG NATIONAL HIGHWAY 1A IN JAMMU AND KASHMIR STATE

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Mountains play a catalytic role in the whole range of denudation processes. The geology, climate, undulating topography, steep slope, and anthropogenic impact contribute to the prevalence of landslides. The ubiquitous steep slopes resulting from tectonic forces provide abundant locations for landslide occurrence. Landslides are results of tectonic setting and anthropogenic processes.

Landslides represent spontaneous rapid mass movements on the Himalayan slopes. This phenomenon evidently involves a number of distinct processes. The triggering motion itself and its long range outcome, which can be landscape forming. In the possible mechanical causes of landslides, one has to distinguish between the long range and immediate effects. These are the part and parcel of

the normal long range landscape development. The ongoing endogenic uplift has to be compensated by downhill mass movements.

In Jammu and Kashmir Himalayas, the landslide hazard has led to the disaster by exerting pressure on the economy of the state. The present study highlights the details of landslides along the National Highway 1A.

LANDSLIDE HAZARD AND PROVISION OF GEO-SYNTHETIC MITIGATION SYSTEMS IN THE HIMALAYAN REGION: AN ENVIRONMENTAL REVIEW

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In the Himalayan region to mitigate landslide hazard, direct protection of the steeply sloping rock face consisting of closely-jointed rocks is required. Landslide is considered a significant environmental hazard in the Himalayas, more common in eastern Himalaya than the western Himalaya.

Geo-synthetics are synthetic products, thin and flexible, made from natural or synthetic polymer used in the mountainous as erosion protection system. One group of civil and environmental engineers considered geo-synthetic protection as an ideal method to arrest landslide aiming to environmental protection and economic development in the Himalayan region.

The objective of this paper is to review different methods of geo-synthetic protections in the Himalayan region to mitigate landslide hazard and to evaluate their environmental significances. This paper is mainly based on literature reviews and field based personal experiences. Method is nomothetic in the analysis of geo-synthetic applications in the hilly regions throughout the world and it is idiographic when Himalayan region has been considered as a case study for reasons obvious. There are common geo-synthetic methods including planar structures like geo-textile, geo-nets, geo-grids, geo-mats, etc. and three dimensional structures like geo-bags, gabions and concrete filled mattresses, etc. Besides, there are jute-based biodegradable geo-synthetics. In the Himalayan region, to mitigate landslide hazard, reinforced earth through geo-textiles, gabion structures formed out of wire mesh and filled with durable stone are necessary. Gabions are highly permeable and dissipating the flow. In higher water flow regimes geo-meshes and geo-mats with natural grasses are significant protective measurements. Geo-synthetics are essentially long-term solutions, in many cases they are also space-saving, cost-saving and eco-friendly. It is quite economical due to its minimum transportation cost, negligible installation charges, low minimum maintenance cost and environment friendly.

PERCEPTION OF GEO-HAZARDS IN THE SUB-HIMALAYAN WEST BENGAL

Arindam Basak

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Geo-hazards are very common in environmentally vulnerable regions. The problem accentuates if the environmentally vulnerable region is inhabited by human population. The increasing pressure of human population is forcing people to move into this highly vulnerable regions in spite of the recurring danger associated with this kind of human settlement. This ultimately results into loss of human lives, loss of property, destruction of house and infrastructure, environmental degradation etc. Tindharia and Kalijhora located in such highly vulnerable zone are affected by frequent landslides and associated problems. The problem increases during the rainy season as this region receives substantial amount of monsoonal rainfall. A combining effect of these factors is the never-ending hardship people in this region undergo annually. The problem becomes severe as majority of the population living in this region are either below the poverty line or just hovering above that threshold, because in case of any disaster it is the poorer group who tends to suffer the most.

In this paper an attempt has been made to study the human perception of hazard in this region. The study is entirely based on primary survey done with an objective to understand how people living in such highly vulnerable region adjust and respond to any geo-hazard with the potential to destroy their normal fabric of life. A survey of about 129 respondents has been carried out for the present study. The respondents were selected on a random basis with efforts being made to assess the perception and reaction from each and every section of the society. This has been done keeping in mind the fact that the impact of hazard tend to vary for different vulnerable groups, the vulnerability in this study being determined by the respondent's socio-economic and cultural background in addition to the natural setup of the study area.

LANDSLIDE IN DARJILING HIMALAYA- FATALITY OF THE AFFECTED AREA, SOME PLANNING AND MANAGEMENT

Biplab Das

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A landslide is a geological phenomenon, which includes a wide range of material movement, such as rock fall, deep failure of slopes, and shallow debris flow,

which occur mostly in the mountain environment. Although the action of gravity is the primary driving force for a landslide to occur, there are other contributing factors affecting the original slope stability. It is the result of a complex interaction among several factors, primarily involving geological, geomorphological and meteorological factors. This phenomenon cause enormous damage to roads, bridges, and houses besides causing huge loss of life. The present study is an attempt towards the landslide hazard assessment, sustainable land management and development, which are the essential keys to reduce the negative impact of the occurrence of this hazard.

EARTHQUAKES AND LANDSLIDES IN HIMALAYAN BELT AND IT'S MANAGEMENT

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Earthquake is a sudden series of vibration or shock waves generated within the earth caused by movement of the earth's crust or by volcanic activity. On the other hand landslide may be defined as a type of mass movement in which the material displaced retains its coherence as a single body as it moves over a clearly defined plane of sliding. Earthquake and landslide are two natural as well as man-made hazards, which occur in the Himalayan belt as regular phenomena. Every year there is a great loss of property, human lives and loss of natural resources. The Himalayas is an active tectonic zone due to collision of the Indian and Eurasian plate. Hence this region is particularly vulnerable to earthquakes and landslides. With the help of proper geomorphological knowledge, use of remote sensing techniques, and human awareness the problems of earthquake and landslide in the Himalayan belt can be effectively managed.

LANDSLIDE HAZARD IN SIKKIM AND BHUTAN HIMALAYAS: GEOLOGICAL CONTROL AND HUMAN INTERVENTION

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Both Sikkim and Bhutan are situated on a part of the inner and the axial belts of eastern Himalayas receive heavy and intense rainfall during the monsoon period and snowfall during winter. Thus, the area suffers repeated slope failures during the rains as well as during the thawing of winter snow. Over the last two decades, a number of slides have occurred and some of these have aggravated

due to unscientific buildings construction over the vulnerable geological structure. The roads, buildings and many other properties of different parts of the eastern Himalayas are affected by the slide. In the Bhutan Himalaya, landslides are often triggered by cutting of the slope for road construction. Intensive deforestation for agriculture leaves the land vulnerable to landslides. The possible human impact could be the result of construction of road and other infrastructure on these slopes without proper planning. Blasting for road construction is also one of the main triggers for landslides. Rainfall induced slope failure is the most common geo-environment hazard in Bhutan. Saturation of soil not only increases the pore water pressure but also degrades the soil strength. There is a direct correlation between the amount of rainfall and the incidence of landslides. The areas that are most prone to rainfall induced failures are heavily fractured composed of weathered rocks of phyllites, slates and schists that contain high amounts of clay minerals. The risk from such slope failure will only increase as more roads are cut into the hills and mountains. The geotechnical investigation had been done and suitable control measures suggested by geologists and geomorphologists from time to time. However, this slide has continued to pose hazards to the communications along the NH31A, Rongyek road and state highway over the Gangtok town and national high way of Bhutan. A detailed study has been carried out in the recent past on the major slides in Sikkim and Bhutan Himalayas. The results of this study show the present status of the slide through RS & GIS techniques, the causative factors, mechanism and mitigation measures.

Theme-IV: Environmental appraisal and eco-tourism

তরাই থেকে কাঞ্চনজঙ্ঘা : পূর্ব হিমালয়ের নিসর্গশোভার পথ ধরে

গুরুপ্রসাদ চট্টোপাধ্যায়

ভূগোল বিভাগ, বিশ্বভারতী বিশ্ববিদ্যালয়, শান্তিনিকেতন

ভারতের উত্তর সীমা বরাবর পশ্চিম থেকে পূবে যে বিশাল হিমালয়ের বিস্তার ভারতীয় মানুষজনের কাছে তা শুধু এক পর্বতমাত্র নয়। হাজার হাজার বছর ধরে এই হিমালয়কে কেন্দ্র করে তার বর্ণময় প্রাকৃতিক শোভাকে বর্ণনা ও বিশ্লেষণ করে সৃষ্টি হয়েছে পুরাণ এবং সাহিত্য, গড়ে উঠেছে ভারতীয় আধ্যাত্মিকতার এক অনন্য জগৎ। অভিযাত্রীদের কাছে হিমালয়ের ডাক তার অন্দরমহলের, তার অত্যুচ্চ শৃঙ্গমালাকে জয় করবার জন্য আছে অদম্য হাতছানি।

আধুনিক গবেষকদের জন্য হিমালয় মেলে দিয়েছে বিশাল রত্ন সম্ভার। এই পর্যটন কাহিনী পূর্ব হিমালয়ের তরাই থেকে কাঞ্চনজঙ্ঘার অন্দরমহল পর্যন্ত গবেষণামূলক অভিযানের এক বর্ণনাক্রমিক ইতিবৃত্ত। ২০০৯ সাল থেকে এই ২০১২ সাল পর্যন্ত এই গবেষক সিকিম হিমালয়ের কাঞ্চনজঙ্ঘা শিখরমালা অঞ্চলে একাধিকবার অভিযান করেছেন। হিমালয়ের এই অঞ্চলের ওপর ভুবন উষ্ণায়নের ফল যেভাবে প্রভাব ফেলছে, বিশেষত হিমবাহগুলির অবস্থা ও অবস্থানের যে ব্যাপক পরিবর্তন ঘটেছে ও ঘটে চলেছে সেই বিষয় তথ্যানুসন্ধানের জন্যই এই অভিযান। এই প্রবন্ধটি তারই আংশিক প্রতিচ্ছবি।

নতুনদিল্লীর বিশ্ববিদ্যালয় মঞ্জুরী আয়োগের অর্থানুকূল্যে ২০১০ সালের অক্টোবর মাসের মধ্যভাগ থেকে শেষ পর্যন্ত স্থায়ী এই অভিযান শুরু হয় উত্তরবঙ্গে দার্জিলিং জেলার শিলিগুড়ি থেকে এবং বর্তমান গবেষক সহ তার নেতৃত্বাধীনে অভিযাত্রীদল দীর্ঘ পথ অতিক্রম করে, দুর্গম সিকিম হিমালয়ের উত্তর পশ্চিমাংশে কাঞ্চনজঙ্ঘা শিখরমালার মধ্যবর্তী গোচালা গিরিপথ পর্যন্ত পৌঁছায়। গবেষক ওই অঞ্চলে হিমবাহগুলির ওপর সমীক্ষার কাজ সম্পন্ন করেন।

শিলিগুড়ি থেকে রওনা হয়ে তরাই-এর অরণ্যভূমি পার হয়ে তিস্তানদীর উপত্যকা ধরে পশ্চিম সিকিমের ইয়কসম জনপদ পর্যন্ত প্রথম ১৮০ কিলোমিটার যাত্রাপথ যাত্রীগাড়ীতে। তরাই-এর গভীর অরণ্য অতিক্রম করে অবহিমালয়ের নিসর্গশোভার পথ ধরে। পরিবর্তিত হতে থাকে পার্বত্য প্রকৃতির রূপ ও বৈচিত্র্য। মাত্র দুই দশক আগেও ইয়কসম ছিল একটি ছোট পাহাড়ী গ্রাম মাত্র। বর্তমানে ক্রমাগত দেশী ও বিদেশী পর্যটক সমাগমে আজ দ্রুত এই গ্রাম পার্বত্য শহরের রূপ গ্রহণ করতে চলেছে। ইয়কসম শব্দের অর্থ তিনজন লামার মিলমস্থল। কথিত আছে একাদশ শতকে তিব্বত থেকে কাঞ্চনজঙ্ঘার গিরিকন্দর অতিক্রম করে তিনজন জ্ঞানী লামা (বৌদ্ধ ধর্ম গুরু) এখানে এসে মিলিত হয়েছিলেন। এঁদের নাম যথাক্রমে লা চেন চেম্বো, না দাক সেম্পো এবং কারতক কুন্ডো। এঁরাই প্রথম সিকিম হিমালয় পরিভ্রমণ করে বৌদ্ধধর্ম প্রচার করেন। ইয়কসম গ্রামটির উচ্চতা প্রায় ১৪৬০ মি.।

ইয়কসম থেকে চারটি ঘোড়ায় পরবর্তী দুই সপ্তাহের রসদ, তাঁবু, গবেষণার সরঞ্জাম ইত্যাদি নিয়ে, সঙ্গে দুইজন শেরপা সহ আমাদের চারজনের অভিযাত্রীদল পায়ে চলা পথ ধরে রাথাং নদীর অরণ্যময় গিরিপথ ধরে রওনা দিই। প্রথম দিনে যাত্রাপথের দৈর্ঘ্য ১৫ কিলোমিটার। প্রথম ১০ কিলোমিটার গিরিপথ ধরে উত্তরে, তারপর অবশিষ্ট ৪ কিলোমিটার চড়াইয়ের পথে ২৭৪০ মি. উচ্চতায় বাখিম বনবাংলো পর্যন্ত। সে বছর মৌসুমী বায়ুর প্রভাব তখনও এই অঞ্চলে শেষ হয়ে যায়নি। চলার পথে আকাশ আঁধার করে বর্ষার মেঘ নেমে আসে। শুরু হয় অবিরাম বর্ষণ। তারই মধ্যে সারাদিন পথ চলার পর পৌঁছাই বাখিম - রাথাং নদীর খাত থেকে অন্তত সাড়ে তিন হাজার ফুট উচ্চতায়।

পরের দিন আকাশ পরিষ্কার, প্রকৃতির স্বচ্ছতায় পার্বত্য অরণ্যের শ্যামলিমা স্নিগ্ধ হয়ে দেখা দেয়। বাখিমের বনবাংলো থেকে চড়াইয়ের পথে আমরা সদলে রওনা হই সকালের প্রাতরাশের পরই। প্রথম তিন কিলোমিটার দূরত্ব পার হয়ে প্রায় ৩০৫০ মি. উচ্চতায় শেষ গ্রাম চোখা -

মাত্র ১০-১২টি তিব্বতি পরিবারের বসবাস। কাঠ ও পাথরের বাড়ীঘর এবং একটি বৌদ্ধ মনাষ্ট্রি নিয়ে নির্জন হিমালয়ের অরণ্য বেষ্টনে ছোট্ট জনপদ। উত্তরে অরণ্যভূমির ফাঁক দিয়ে কাঞ্চনজঙ্ঘার কয়েক পার্শ্বহিমশিখর উঁকি মারে। এখানে একটু বিশ্রামের পর আবার উত্তরে আরও চড়াইয়ের পথে।

চোখা গ্রাম থেকে উজানে জংরী নামক পার্বত্য তৃণভূমির দূরত্ব প্রায় ১২ কিলোমিটার। পথের প্রথমাংশ অত্যন্ত ঘন স্প্রুস, দেওদার ও রডোডেনড্রনের জঙ্গলের মধ্য দিয়ে। উচ্চতা বৃদ্ধির সঙ্গে সঙ্গে বাতাসে অক্সিজেনের পরিমাণ কমে আসে। আমাদের চলার গতিও ক্রমশ ধীর হতে থাকে। সারাদিনে তরুসীমা পার হয়ে জংরীর প্রান্তভূমিতে পৌঁছাতেই সন্ধ্যার ঘন অন্ধকার নেমে আসে। পূর্ব দিগন্তে পর্বতসীমার ওপরে ধীরে ধীরে উঠে আসে পূর্ণিমার চাঁদ। হিমালয়ের সান্ধ্য নির্জনতা মনোহারী হয়ে ওঠে। আমরা জংরীর এক সুবিধামত জায়গায় ঝরণার ধারে আমাদের তাঁবু-আশ্রয় তৈরী করে নিই। উচ্চতা এখানে ৩৯৬০ মি. এর মতো; অবস্থান ঠিক তরুসীমার ওপরে।

অভিযানের তৃতীয় দিনে আমাদের গন্তব্য নির্ধারিত হয় জংরীর তৃণভূমিকে বাঁয়ে রেখে তার পূর্বসীমা ধরে এগিয়ে চলা। এরপর প্রেক ছু নামক নদীর খাতে নেমে তাকে অতিক্রম করে কিছু উত্তরে থাংসিং তৃণভূমির ক্যাম্পিং অঞ্চল। পথের মোট দূরত্ব ২০ কিলোমিটারের মত। পার্বত্য তৃণভূমি ছাড়িয়ে আবার অরণ্যময় গিরিখাতের মধ্য দিয়ে এবং দিনের শেষে আর এক পার্বত্য তৃণভূমির প্রান্তে - না থাংসিং, উচ্চতা ৩৯৬০ মি. এর কাছাকাছি।

অভিযানের চতুর্থ দিনে পথের দূরত্ব মাত্র ১০ কিলোমিটার - উদ্দেশ্য এই পথের শেষ নির্দিষ্ট ক্যাম্পিং গ্রাউন্ড - লা মানে। এর সমগ্র পথই তৃণভূমির ওপর দিয়ে।, চড়াইও তেমন তীব্র নয়। কাঞ্চনজঙ্ঘার হিমবন্ত গিরিশিখর চলার পথে ক্রমশ ব্যপ্ত ও মনোহারী হয়ে ওঠে। 'লা মানে' শব্দবন্ধের তিব্বতি অর্থ গিরিপথের নীচে আশ্রয়। স্থানটির নিসর্গ দৃশ্য অপরূপ - অদূরে বিশাল তুষারগিরি, কাঞ্চনজঙ্ঘার প্রধান শিখর আর ডানদিকে পান্ডিম হিমশিখর।

কাঞ্চনজঙ্ঘা শব্দটির তিব্বতি ভাষায় প্রকৃত উচ্চারণ হল কাংচেনজিঙা। কাং অর্থে বরফ, চেন - বড়, জি - ভান্ডার ও ঙা অর্থে পাঁচ। সম্মিলিতভাবে এই হিমশিখর হল বরফ বা তুষারমন্ডিত বিশাল পঞ্চভান্ডার।

লা মানের পাশ দিয়ে প্রবাহিত হয়ে আসছে যে প্রেক ছু নদী, তার উৎস অংলোকতাং হিমবাহ। গবেষণায় প্রমাণিত হয়েছে, বিগত মাত্র ৫০ বছরের মধ্যে এই হিমবাহটির মোট আয়তন ৮০ শতাংশেরও বেশী হ্রাস পেয়ে বর্তমানে এর মাত্র ২০ শতাংশেরও কম অবশিষ্ট আছে।

কয়েকদিন 'লা মানে' ক্যাম্পিং গ্রাউন্ডে অবস্থান করে এই হিমবাহের পশ্চাদ্‌পসরণের গতিপ্রকৃতি ও সৃষ্ট ভূমিরূপের ওপর গবেষণা ও কাঞ্চনজঙ্ঘার নিসর্গ দর্শনের মাধ্যমে অভিজ্ঞতা সঞ্চয় করে বর্তমান এই গবেষকের নেতৃত্বাধীন অভিযাত্রীদল ফিরে আসেন।

JHUM CULTIVATION IN WEST SIANG, ARUNACHAL PRADESH: CHANGE DETECTION STUDY (1970-2000) AND ITS ANALYSIS

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Shifting cultivation (jhum) is a primitive practice of cultivation in the states of North Eastern Hill region of India. It involves clearing of forest on sloping land, usually before December, dry and burning debris before the onset of monsoon and finally cropping. After harvest, the land is left fallow and the cultivators repeat the process in a new plot designated for the year. First plot remains fallow, and vegetative regeneration takes place till the plot is reused for the same purpose in a cycle. The cycle usually ranged from 22-30 years, but with increase in human population and constant increase demands for land, the Jhum cycle has got reduced to 5-6 years. As a result jhum cultivation causes serious land degradation and ecological problems. Traditionally, most of the tribal population practiced jhum and were termed as jhumias. The term "Jhumia" is a generic term used for tribal people dependent on shifting cultivation as the primary source of livelihood.

Arunachal Pradesh, the hills of the rising sun, is situated in the north-eastern corner of India extending from 26°30' N to 29°30' N and 91°30' E to 97°30' E. Much of Arunachal Pradesh is covered by the Himalayas. Jhum accounts for 1.10 lakh hectares of area, which is just 1.7 per cent of the total geographical area (8,374,200 hectares) of the state. The practice of shifting cultivation is an important occupation for the people of Arunachal Pradesh. This kind of agriculture is the only means of livelihoodin the remote rural villages of the state. Jhumming is very closely associated with the culture and tradition of this region. The rites performed before and during the process of sowing, harvesting and storage depict the association of jhumming with the local tribal culture. Jhum is,therefore, a traditional method of crop farming practices in most part of Arunachal Pradesh, which was earlier ecologically sustainable because of long jhum cycle. But, in the recent past, due to high population pressure and reduction in the jhum cycle, low fertility, high soil erosion and loss of biodiversity have occurred.

In this paper West Siang district of Arunachal Pradesh have been selected to study the spatio-temporal change in Jhum over four decades from 1973 to 2001. Landsat TM and ETM satellite imageries have been registered, mosaicked and then used to delineate the Jhum areas for creating vector layers. The total jhum areas for each year under study have been calculated to create a comparative picture. This suggests a change in area over the years. Finally, the merits and demerits of Jhum and its effect on environment are studied in detail.

NEW DESTINATIONS OF TOURISTS IN HIMALAYAN REGION

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For most of the people of West Bengal, Darjeeling and its adjoining areas were considered as the only tourists' destination in the Himalayan region. Darjeeling is famous for 3 Ts, viz. Tourist, Tea and Timber. Darjeeling is famous not only for general tourists, but also for trekkers and people who wants to enjoy mountaineering. But the political disturbances in those areas compelled the tourists to find other destinations. Such destinations include tourist spots in Sikkim, adjacent countries like Bhutan and Nepal, etc. But tourists from West Bengal do not feel comfortable in those regions due to many reasons. Attempts have been made to attract tourists from West Bengal to various tourist spots in Sikkim. To visit Bhutan, excepting Phuentsholing, one needs entry permit. Moreover foreign tourists get more advantage than Indian counterpart. Touring different destinations of Nepal, visitors needs to spend much more compared with visit to Darjeeling. Thus tourists from West Bengal, who want to enjoy Himalayan beauty, are totally confused at the time of choosing the destination. Hence they are in search of exploring new destinations in Himalayan region within West Bengal or adjacent areas.

NEORA VALLEY NATIONAL PARK: A VIRGIN FOREST WITH ECO-TOURISM PROSPECT

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The Neora Valley National Park spreads over 88 km^2, located between latitudes 26°52'03"N - 27°07'35"N and longitudes 88°45'E - 88°50'E, is a compact patch of virgin forest, is a global *biodiversity hotspot* in the eastern Himalayas. It was notified as a National Park in 1986 under the Wildlife (Protection) Act, 1972. It is contiguous with Sikkim and Bhutan at its northern and north-eastern boundaries respectively and links the Pangolakha Wildlife Sanctuary in Sikkim and the Torsa Strict Reserve of Bhutan. The name of this park came from the river Neora, the main water source of the valley. Neora Valley, one of the least tracts of virgin wilderness in the country consists of mixed species like rhododendron, bamboo, oak, ferns, sal etc. The Valley also has numerous species of orchids. The fauna consist of such endangered species as the clouded leopard, red-panda, and musk deer. The park rich in bird life houses the bearded vulture,

Himalayan griffon, red legged falcon, pigeons, doves, great pied hornbill and a large number of migratory birds like whistling thrush etc. Much of the park is still inaccessible making it an adventurous place for the nature lovers / trekkers who can take the challenge to explore the still-unknown terrain in the Kalimpong hills. Virgin natural forests, dense bamboo groves, colorful canopy of Rhododendron trees, lush green valley, meandering rivers with snowcapped mountains in the backdrop makes the park a world tourist destination. With the increasing number of tourists day by day in the national park the numbers of hotels, resorts are also increasing.

The paper focuses on the future challenges to protect the forest and its rich biodiversity from human interference. So, eco-tourism must be practiced in the park not only to protect the nature but also to support the local people.

EXPLORING THE TRANQUIL BEAUTY OF THE HIMALAYAS: THE HAR-KI-DUN VALLEY TREK

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The Har-Ki-Dun valley, famous for its serene and mystic beauty, is located in Uttarkashi district of Uttarakhand (31º05'57"N-31º13'35"N latitudes, 78º22'44"E-78º37'25"E longitudes). Nestled in the upper catchments of river Tons, it is one of the most fascinating and lesser exploited area of Garhwal Himalayas. The beautiful Har-Ki-Dun valley has a backdrop of snow-clad Himalayan mountain peaks like Banderpunch (6352 m), Swargarohini (6287 m) etc. and dense forest of pine, deodar and conifers. Swargorohini derives its name from the legends of Mahabharata associated with it that its peak forms the path to heaven that was followed by Pandavas, Draupadi and their Dog. Therefore, the term Har-Ki-Dun literally means Valley of Gods. This is a land of *Kauravas* and here only in whole world you will find the inhabitants worship *Duryodhana* – the *Kaurava* prince – and *Karna*. The Har-ki-Dun Gad is a meltwater stream originating from Jamdar glacier. Jamdar glacier initiates from the lofty Banderpunch Range. The combined stream of the two rivers – Har-Ki-Dun Gad and Borasu Gad (originates from Borasu glacier) – flow out of this valley as Har-ki-Dun Gad. Downstream, it meets with the Ruinsara Gad to form Supin River which later combines with the Rupin River near the settlement of Netwar to get christened as the Tons River. The Tons is a tributary of Yamuna River and this region is actually a sub-basin of the Yamuna watershed. A substantial portion of the Har-Ki-Dun valley is over 4,000 m. The region receives significant amount

of snowfall for at least 4-5 months of the year.

The trek to Har-Ki-Dun valley commenced from the small village of Taluka which is accessible by a rickety road from Sankri village that surprisingly remains functional almost throughout the year. This trekking trip through the remote Himalayan valley had all the archetypal appeal: ascending gentle trails through luxuriant oak and conifer forests and past traditional mountain villages which give way to the alpine meadows that are scattered with flowers and flowering herbs. The trail from Taluka to Har-Ki-Dun was 27 km passing through the small isolated villages of Datmir, Gangar, Osla and Seema. These quaint villages are located along the Supin River. The life style, dress, dialect, traditions and the religious sentiments of the inhabitants of these villages are markedly different from the rest of Garhwal Himalaya. The trail was extremely picturesque. Little streams crossed our path. Enroute we had a wonderful view of the Banderpunch peak towards east of Ruinsara Gad. The trek terminated at the Garhwal Mandal Vikas Nigam-operated tourist rest house in the Har-Ki-Dun valley. The landscape of the Har-Ki-Dun valley is dominated by the scenic Swargarohini Massif and Jamdar Glacier. This area harbours almost all the major groups of the high altitude flowers, birds and animals in the Himalayan zone. This valley is a delight for the nature lovers, botanists and zoologists with its exquisite and rare assemblage of different kinds of species.

ENVIRONMENTAL PROTECTION AND POTENTIALITY OF ECO-TOURISM IN THE UNIQUE TRAIL OF THE SINGALILA RANGE, WEST BENGAL

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The Great Singalila Range is a huge thrust root which lies at the base of the Kangchendzonga Massif. It is a part of the lesser Himalaya comprising of snow-capped peaks, deep gorges, high slopes and long spur (e.g., Rimbik Danda, 16 km), gullies, ravines and hilly rivers, varied erosion and hazard prone areas (geo-environmental in type), forest clothed slopes as well as denuded peak (due to deforestation, unlimited grazing and forest fire) and a rich biodiversity. Overall the region has a fragile ecosystem. It is in the threatened stage of its own natural and aboriginal balance due to unconscious human activities. Environmental protection as well as promotion of eco-tourism in the region is the most desirable for its living.

Latitudinal extension of the trail (Maneybhanjan to Phalut distance covered: 54

kms) is from 26°59' N to 27°13' N and longitudinally it is from 87°59' E to 88°08' E. It has a distinctiveness regarding its geomorphic, climatic as well as cultural scenario. It is noteworthy for its complex geopolitics. The trail is situated in the western part of the Darjeeling district of West Bengal, India along the International Boundary between Nepal and India. At the extreme north, beyond Phalut (the second highest peak of this range, 3,630 m above the mean sea level) lies the tri-junction border comprising Nepal, West Bengal and Sikkim.

The area may be called a trail of cultural assimilation because of the racial, caste and religious differences and above all the differences in citizenship (Indian and Nepali) are not the problematic matter to the inhabitants of the region. There are few hamlets over and around the serpentine ridge. Livelihood of these people is totally dependent on its natural resource, small scale agricultural practices supplemented by animal husbandry and tourism. Increasing population pressure, tourists (domestic and foreign) influx, increasing number of vehicles (its vibration and sound pollution), increasing demand of food and fuel, solid wastes, lack of properly trained guides, lack of environment awareness are the reasons for the disturbance of this unique ecological niche of West Bengal.

The paper tries to draw attention to the region regarding its physical and socio-cultural scenario and the reciprocal relations among each component of the system. It attempts to explain the problems and suggest some remedial measures to move forward to the path of environmental protection and promotion of eco-tourism, which can give the sustainable existence to its inhabitants.

TOURISM IN ARUNACHAL PRADESH: A GLORIOUS PROSPECT

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Tourism has been recognised as one of the major engines for inclusive growth and employment. It has been universally acknowledged that the travel and tourism sector contributes substantially in reducing poverty and empowering women, and new employment opportunities.

The north-eastern states of India have huge scope in tourism. Among them Arunachal Pradesh has been selected as the study area which is known as 'The land of the rising sun'. It has 16 districts and 57 blocks and it shares its border with China, Mayanmar and Bhutan with a population of 13.82 lakh (Census of India, 2011) and an area of about 83,743 square kilometres. It has the lowest population density of about 17 persons/ square kilometres in India. The state has

a sex ratio of 920 and literacy rate of 66.95 per cent (Census of India, 2011). There are 13 major tribes with a rich cultural diversity based on a traditional agricultural economy. For several reasons it has not yet been well recognised as a state of tourists' attraction despite the natural beauty of the eastern Himalaya.

The existing famous tourist destinations are Tawang, Basar, Bomdila, Bhalukpong, Dirang, Ziro Point, Itanaga, Malinithan etc. Among the six tourist circuits the west Arunachal circuit is most visited. With one Biosphere Reserve (Dibang-dihang), two national parks (Nandapaha and Monling), six wildlife sanctuaries, one orchid sanctuary (Sessa), many archiological sights, monastries it has full potentiality to become an attractive tourist destination for the nature lovers. Other attractions are waving rivers, snow-clad mountain and stubborn plain, lakes, pass, falls, green lash valley, rich biodiversity. In addition, the state provides abundant scope for mountain sports like angling, boating, rafting, trekking and hiking. Bhalukpong is the main entry of the state (hills starts here). The journey is of almost 16 hours in car from Guwahati to Tawang and the roads are in poor condition causing trouble to tourists but less bothered by the inhabitants and Govt as development in a sensitive border state like Arunachal can focus it to neighbouring country like China and other terrorist activity also. Even no big projects are set up for the same reason.

It is found from the study that hotels are available (run by women mainly) in almost all tourist spots with expensive food and drinking water, low transport facility (3-4 public buses daily), high paid private cars, less no of hotels, limited tourist seasons, poor road and railway connectivity, only one entry route for the state etc. Physical hazards like flood, earthquake, local cyclone etc. hamper tourism not only in this state but also in north-east India. Moreover army camps and strong checking and permit system also discourage people to explore the state.

The study also suggests some solutions to promote the economy of the state like increasing number of public transport, opening new routes, develop eco-tourism and ethno-tourism (highlighting the tribes like Adis, Ataapani etc), setting up more Govt. guest houses, developing infrastructure like road, power etc. Also tourism campaigning can attract tourist (both domestic and foreign) specially focusing on the tribal development to promote tourism. Tourism in Arunachal Pradesh needs to be promoted by an aggressive and well co-ordinated marketing strategy. The state can be a strong contender for hosting international events on cultural and heritage tourism, eco-tourism and adventure tourism.

ALONG, ARUNACHAL: EXPLORATION OF GOD'S OWN CREATION

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Along is a picturesque valley, located in between the mountains of eastern Himalaya, created by Siyom and Sipu, two tributaries of mighty Siang (Brahmaputra), with impenetrable forests, wide rivers, deep gorges and a wonderful plantation. By road there are two main approaches to *Along*, one from Silapathar, Assam and other from Pasighat, Arunachal. Apart from the blissful solitude and primitive natural surroundings along Siyomthere there are some beautiful places. There is another destination Mechuka, approximately 100 km north of *Along* where the spectacular Mechuka lake is situated amidst archaic forested mountains with a pictorial view of distant dazzling snowcapped peaks.

Along is inhabited by Adi (Gallong) Tribes. There are some nearby tribal villages like Kabu, Kaying, Jirdin, Paia. A visit to these villages will provide an insight into the local culture of this part of Arunachal. On Selapathar-Along Road, Likabali and Malinithan are famous archeological sites.

But transport facilities are very poor and the conditions of roads are bad resulting in frequent accidents and casualties. Availability of private cars for tourists is scarce and public transportation system is very poor and risky because small crimes are common. In *Along,* accommodation facilities are of low standard. Perhaps, the biggest problem of this part is political unrest where 3-4 day long bandhs, protests and demonstrations are very common. It may be concluded that if this tourist route is properly developed, like that of the Bomdilla-Tawang route, it has a very promising future and will help in rejuvenating the socio-economic conditions of this part of Arunachal.

SUSTAINABLE AGRICULTURAL DEVELOPMENT IN THE NORTH EAST HIMALAYAN REGION OF INDIA

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North East (NE) Himalayan states of India have a total geographical area of 5.63 per cent and a population of 1.13 per cent of the country. These states are quite different and unique in nature due to their distinct terrain comprising mountains, hills and plateaus interspersed with valleys. The tribal people of the NE India are

dependent on agriculture and related activities connected to land. Agriculture is practiced for sustenance and not for commercial activities except for some location-specific tea growing. The region produces only 1.5 per cent of the country's total food grain production that provides livelihood support to 70 per cent of the population. The present study tries to assess the associated factors related to sustainability of the agriculture in the NE states. The study finds that the region is deficient in food grains, and the gap between demand and supply has been widening further. In terms of per capita income the study area as a whole is placed amongst the poorest regions in India. The per capita income of Rs. 12,407 is less than that of the national average of Rs. 17,978/- (as in 2001-02). There is a dire need to take necessary measures so that the per capita income of the region is increased. A suitable policy of the government is, therefore, warranted which can not only boost the economic conditions of the poor tribal population as well as ensure sustainable supply of resources.

চাদর ট্রেক : ২০১২

রতনলাল বিশ্বাস

পর্বতারোহী ও অভিযাত্রী

লাদাখের মাঝে প্রবাহিত সিন্ধু নদকে সবচেয়ে বেশী সমৃদ্ধ করেছে জাঁসকার নদী। জাঁসকার উপত্যকা ও রূপসু উপত্যকার পশ্চিমাংশে প্রবাহিত সকল ছোট বড় নদীর সম্মিলিত ধারার নাম জান্‌সকার নদী। জান্‌সকার সদয় পদুম থেকে এ নদী জান্‌সকার গিরিশিরাকে খন্ডিত করে উত্তরে প্রবাহিত এ নদী নিমোর কাছে মিলিত হয়েছে সিন্ধু নদে। জান্‌সকার উপত্যকায় ২৫টি গ্রামে পৌঁছনোর জন্য একমাত্র গাড়ী পথ কারগিল থেকে পেনজি লা পেরিয়ে। অপর পথগুলি গ্রেট হিমালয় বিভাজিকা বা জান্‌সকার গিরিশিরার উপর অবস্থিত কঠিন গিরিবর্ত্ম অতিক্রম করে। শীতকালে যখন তাপমাত্রা নেমে যায় -২৫ সে. থেকে -৪০ সে.-এর নীচে, তখন এ সকল পথ বন্ধ হয়ে যায়। বহির্জগত থেকে বিচ্ছিন্ন হয়ে যায় জান্‌সকার উপত্যকার লোকজনেরা। জান্‌সকারবাসীরা একান্ত প্রয়োজনে সেই সময়ে বেছে নেয় এক দুর্গম ও অভিনব পথ। বহুকাল ধরে তারা জমাটধারা ভাসমান বরফে ঢাকা জান্‌সকার নদীর উপর দিয়ে যাতায়াত শুরু করে, মাত্র মাস দুয়েকের জন্য। এ পথই চাদর বা চাদ্দর পথ। রঙিন খাড়া পাহাড় কেটে প্রবাহিত নদীর দু পাশ ভয়ংকর ও সুন্দর। দুপাশ থেকে নেমে আসা অসংখ্য ছোট বড় ঝরনা ধারা এসময়ে হিমপ্রপাত। পরবর্তীকালে এ পথে জান্‌সকারবাসীদের সঙ্গে পা মেলাতে শুরু করলেন বিদেশী অভিযাত্রীরা। এ বছর ফেব্রুয়ারী মাসের প্রথম সপ্তাহে আমরা কয়েকজন এ পথে ওদের সঙ্গী হলাম। বিগত ৪০ বছরের অভিযাত্রী জীবনে এ এক অন্য স্বাদের অভিজ্ঞতা।

ENVIRONMENTAL APPRAISAL OF ECO-TOURISM: A STUDY IN WEST SIKKIM

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Eco-tourism can be defined as travel to natural areas following the environmental codes of conducts. If environmental norms are violated, eco-tourism becomes eco-terrorism. Sikkim a northeastern hilly State of India is popularly known as eco-tourists' paradise. The exposure of the natural areas of Sikkim to the tourism industry has already generated environmental concerns due to reports of various negative impacts of tourism on habitat, economy and society. It is therefore the right time to attempt environmental appraisal on eco-tourism in Sikkim Himalaya. For this particular study two eco-tourism hubs of west Sikkim – Yuksam and Uttarey – have been chosen from the stand point of the nature of activities recently evolved in these places to cater to the visitors. The objective is to evaluate their performances in marketing eco-tourism with critical appraisal on sustainability issues.

HOW TO PROTECT THE GREAT TREASURE OF TOURISM

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The Himalaya is one of the greatest mountain ranges on the Earth. With its natural beauty, it attracts people from all over the world. It is a treasure of ethnicity, storehouse of medicinal plants and the favorite destination of rock-climbers. Thus, it is rich in tourism potentiality. The countries like Nepal, Bhutan, Tibet, China and India take pride in the fact that some portion of their territory falls within the mighty Himalayan Region.

The primary objective of this paper is to study the tourism potentiality of Himalaya. Every regional division of the Himalaya is unique with respect to its significance to tourism. While the Tibetan Himalaya is a treasure of religious and nature-based tourism, Nepal Himalaya is equally famous for rafting, rock-climbing etc. The eastern Himalaya passing through Bhutan is unique for its silence. Another objective is to consider the man-nature relationship, which includes an investigation into the growth of tourism in the Himalaya region and its impact on the environment.

The current paper is based on the analysis of secondary data including the open sources from websites. These throw light on the vice-versa relationship of the

growth of tourism in the Himalaya region and the sustainability of the environment. It was observed that the countries having the opportunity to supplement the tourism industry by utilising the Himalaya are often disregarding the factor of environmental sustainability. It has also been observed in this study that positive aspects like growth of foreign exchange earnings in Nepal and India due to Himalayan tourism has come at a high price to the Himalayan environment.

Finally, it may be concluded that the plans that have been framed for the sustainable development of the Himalaya need to be implemented at the grass-root level for their effectiveness and desired outcome.

ENVIRONMENTAL AWARENESS OF THE HIMALAYAN TOURISTS

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The Himalaya is famous for its unique physical forms, bio-diversity and attractive cultural landscape. Tourists from many parts of the world come to enjoy its serene beauty. The local people heavily depend on the expanding tourism industry of the region. But, mass-scale development of tourism industry is destroying the environment and ecology of the Himalayas. Materials used, especially the non-degradable items like plastic, by the tourists often cause serious problems in the form of land and water pollution. The tourism policy should include environmental concerns along with appropriate technology to mitigate the problem.

This paper highlights some of the environmental issues related to tourism industry and need for environmental awareness among the Himalayan tourists.

DEVELOPMENT OF SUSTAINABLE TOURISM IN PELLING- A CRITICAL APPRAISAL

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Pelling is a small village in the cadastral block of Gyalshing Tehsil of West Sikkim, India. It is situated amidst the backdrop of Eastern Himalayan range at an altitude of 2,073 m and provides a magnificent view of the Himalaya including Mount Khangchen-Dzonga, Mount Makalu, Mount Pandim etc. Tourism has got enormous potential in Pelling for natural beauty, historical and cultural treasures and is being practiced in an organised manner since 2000.

Today it is emerging as the second biggest tourist destination in Sikkim after Gangtok, the state capital. Virgin alpine vegetation, rich bio-diversity, beauty of lakes and waterfalls, age-old monasteries and historical places related with the saga of Sikkim Dynasty along with the spectacular views of Mount Khangchen-Dzonga attracts a good number of foreign and domestic tourists seasonally; and gradually over time Pelling has changed from a small village to a Semi-Urban Transit Tourist centre. This process of neo-urbanisation has ushered in huge number of in-migration both permanent (hoteliers and stakeholders) and temporary (tourists) and has induced the development of very 'urban infrastructure' to cater the needs of 'Target Tourist Groups.' In spite of having a planned tourism strategies and a clear vision towards the sustainable development, within a short span, it has started to exhibit a kind of negative feedback to its environment because of unscientific land use changes, construction of multistoried hotels, diversion of jhoras, and above all the ignorance towards its fragility from seismic activity and landslide vulnerability. In addition, the tourism multiplier effects are also below expectation because of high amount of 'leakage' from the regional economy both in the form of tourism input and output.

The present paper attempts to find the mode of tourism practice in Pelling in spatial and temporal context, and critically analyses its sustainability considering the environmental and economic impacts.

ATTRACTION OF SCENIC BEAUTY: A CASE STUDY OF NORTH SIKKIM

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The tiny Himalayan state of Sikkim has emerged as one of the most attractive tourist destinations in recent years. The lofty mountain range dominated by the world's third highest peak, Kanchenjunga along with many other smaller interesting peak, the rich flora and fauna of the region, religious and cultural heritage and of course the hospitable people of Sikkim are some of the reasons that attracts tourists from both India and abroad.

The main objectives of this paper are to find out the main tourist attractions as well as the facilities provided to the tourists and various problems regarding tourism in north Sikkim. For this study, primary survey was done and secondary data was collected from the tourism department of Sikkim Government.

The main tourist spots of north Sikkim are Gurudongmer, Yumthung, Zero

Point, Katao, Lachen and Lachung. It has been observed that although north Sikkim is a hazard prone district, many tourists come to enjoy its scenic beauty from different parts of the world.

Theme-V: Management of natural resources and policy implementation

MICRO-WATERSHED CHARACTERISATION AND MANAGEMENT - BHIM KHOLA WATERSHED, DARJILING, DARJEELING DISTRICT, WEST BENGAL

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Natural resources and their utilisation and management within Bhim khola watershed, Darjiling give a unique natural pattern, although this pattern is not the ultimate factor for the development without considering and evaluating the natural resources within the watershed. So proper and scientific land use, land degradation protection, soil fertility enhancement, conservation of water is imperative. So watershed characterisation and management are the major points for the sustainability of this watershed.

This Bhim khola watershed is a high priority zone. Bhim khola is one of the important right bank tributary of Balason in upper reaches. The source of Bhim khola is at Ghum (2,200 m). The region is now in a highly deteriorating conditions through intensive deforestation, large scale construction and cultivation on the steep slopes. The Bhim Khola watershed, located in the Darjeeling Subdivision, Darjeeling District, West Bengal, covers an area of about 15.93 sq.km. Geographically the watershed is located in between 26°57' N to 27°01' N latitude and 88°12'E to 88°16'E longitude. The altitude of the study area ranges from 900 m to 2,400 m above MSL. This watershed falls under Balason Basin. The area has dendritic and sub-parallel drainage patterns. This watershed comprises of four Gram Panchayats and five Mouzas. The population density of the watershed is 420 persons km^{-2}.

In Bhim Khola watershed, it is observed that the Nehrugram, Shishubikas FV, Lamin, Minju, Bhalukhop area under Ghoom Khasmahal Gram panchayat are the most vulnerable area in respect of landslide occurrences and related hazards.

Soil conservation is the only way to protect the productive lands though the water related problems are alarming in this watershed. The recommendations for micro-level planning for the watershed may be the uses of bio-fertilizers for tea plant rotation, livestock-poultry and associated activities should also be taken into consideration and the development of eco-tourism for optimum utilisation of natural resources to improve the standard of living.

NEW GROWTH MEASURES IN HIMALAYAN REGION: HIMALAYAN DAY 2012

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Himalayas have been the soul of the country by virtue of cultural, ethnic, ecological and economical values. It has not only been guarding country's border but constantly serving its people by enriching soil, air, water etc. Unfortunately importance of Himalayas was always underestimated for its integral role in overall development of the Nation. Deterioration of Himalayan system due to inadequate attention has threatened our Life Supporting Resources. Status of forest, water, air soil has become alarmingly grim. There are two facts that need to be seriously brought to cognizance. Life cannot sustain without natural resources and Himalaya is the major donor of the same. Since Himalayan health largely decides climate, economy and ecology of the nation, substantial attention to its native become equally important as latter shape its ecology and environment. Himalayan communities had always been deprived of any pervasive development which their counterpart enjoyed. They suffered in past but never resented because of their candidness. Statehood to Himalayan states of course has been one of the initiatives to address socio-political issues but because of inappropriate approach, desire development scale could not be scored.

Recently long negligence of Himalayan system has caused larger adverse impacts. The sustained delivery of life support resources is threatened. This system has begun to cease due to degenerating governing factors. The impact of adversity is not only limited to Himalayan community only but its curse are visible everywhere now. Scarce water discharge, poor soil and air quality are some of them.

The issue is debatable in two fronts. Whether Himalayas should only be considered in isolation as a nature or commodity or its inhabitants should be considered the integral part of the system deciding its behaviour. Himalayan growth must be measured along with the state of its native. Rural health will help

Himalayan health and so of the country. There must be specific approach to rural Himalayas where development should focus more on enriching natural resources besides routine development activities. There must be resource regenerating employment opportunity for rural Himalayas. This would help its native and country as a whole. It is high time to open a debate on status of Himalaya and its efficacies to serve communities. There have been a number of movements to conserve Himalayan resources but unfortunately they don't have much to claim in saving Himalaya's dignity. It is often now resonate whether saving of Himalaya is the responsibility of its native only? The resources have been shrinking fast and ultimate brunt has to be born by everyone of us. Natural resources are governed by law but various statutes on natural resources have hampered sustainable local developmental activities that go in harmony with nature. It can not be denied that in some cases legislations have brought some relief to nature at national level but more often the cost of implementing such laws is borne by the local communities who are deprived of using these resources for their sustenance. Moreover, there has not been any Resource Credit Mechanism that would have compensated local needs of the community in lieu of such deprivations. The forest is denied to local community who cannot benefit from natural resources. The gigantic rivers emanating from mountains fulfilling electricity and irrigation needs of the country have not been of much use to local communities.The day is being organised across the Himalayan states, in Jammu and Kashmir, Himachal Pradesh, Uttarakhand and northeastern states by a number of social organizations committed to conservation of the Himalayas. The celebration attempts to draw attention of planners, policy makers and people at large to promote overall common interests. The discussion issue of Himalayan Day of this year focused on whether we need a New Growth Measure for the Nation? This measure will be environmental centric and will highlight the growth/addition of water, forest, soil etc in the given year. This is important mainly because of gross negligence of environment in recent past and the consequences replacement of the same are to be encountered in the future.

Theme-VI: Role of geo-informatics in natural hazard and environmental management

LANDSLIDE HAZARD ZONATION (LHZ) MAP OF KURSEONG SUBDIVISION OF THE DARJEELING HIMALAYAS

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Landslide hazard zonation has been practiced in India since 1980s. Most of the studies are mainly based on cumulative weightage of different parameters. Hazard zonation mapping involves a detailed assessment and analysis of the past occurrences of landslides in terms of their location, magnitude and frequency with respect to various geo-environmental factors that influence landslides and mass movements. The factors that affect slope instability are varied and their interaction processes are complex depending on terrain set up and climatic characteristics. Bureau of Indian Standards (BIS), the regulatory body that specifies scientific codes and practices, has formulated the guidelines (BIS, 1998) for preparing landslide hazard zonation map at 1:50,000 scale. Till now this technique is considered as the standard method of preparing LHZ in India. The BIS guidelines recommended an indirect knowledge-driven (heuristic) approach to landslide hazard mapping according to the method originally proposed by Anbalagan (1992). These guidelines provide specified weights or ranks to a set of pre-defined factors.

The present paper aims at analysing the sequential development of landslide hazard zonation practices in India since 1980. A landslide hazard zonation map has also been prepared on the basis of BIS technique with slight modifications. LISS-III and PAN images, SOI toposheet of 1:50,000 scale, GSI map, secondary databases collected from Kurseong BDO office and tea gardens have been used as raw materials for preparing the base maps. Landslide spots have been demarcated with the help of GPS. Both pre-(80 numbers) and post earthquake (18-09-2011) landslide (101 numbers) spots have been plotted on the individual layers as well as on the final hazard zonation map from which it is found that most of the landslide events have occurred in the moderate landslide hazard zonation category. It is also found that most of the landslides have been occurring in Darjeeling gneiss and Daling series of formations.

INTERPRETATION OF CHANGING LANDUSE – LANDCOVER OF SIKKIM HIMALAYA THROUGH REMOTE SENSING AND GIS

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Sikkim Himalaya is a part of Eastern Himalaya and is situated between 20°9' N to 27°5' N latitudes and 87°59' E to 88°56' E longitudes. Landuse pattern of Sikkim is strongly influenced by its physiography and climate as these two factors directly determine agricultural activities and occurrence of vegetation cover. In this particular study, the changing landuse – landcover pattern of Sikkim Himalaya for the last two decades is highlighted through the application of remote sensing and GIS techniques. This study also emphasises the adverse effect of tourism in this region.

Remote sensing is an important tool for analysing landuse - landcover changes in a mountainous region since it is mostly inaccessible even in this era of modern transportation. IRS-1D LISS-III satellite images of 2000 and 2010 are used for the purpose of interpretation. With the help of GIS techniques different types of land use characteristics have been identified and further analysis has been done using georeferenced maps. ERDAS and ArcGIS softwares have been used for this purpose. The land use patterns are categorised as- agricultural land, settlement, forest cover and degraded forest. Field study was also conducted for proper identification of landuse classes.

Requirement of good quality timber coupled with uncontrolled tourism, the forest cover is getting destructed. This, in turn increases land degradation as well as hazards like landslides. Morphological changes are clearly identified by these techniques. The changing patterns of settlement, agricultural land and forest cover can easily be recognised. Agricultural land and forest cover are degraded for the construction of hotels and amusement centres.

PRIORITISATION FOR WATERSHED MANAGEMENT BASED ON LANDUSE / LAND COVER CHANGE AND MORPHOMETRIC ANALYSIS: A STUDY ON BHILANGANA BASIN, UTTARAKHAND

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Watershed prioritization assumes an important role in natural resources management as well as watershed management. The present study has

emphasised on a comparative study of prioritization of watersheds for monitoring and management based on landuse/ land cover change and morphometric analysis using remote sensing and GIS (Geographical Information System). The area selected for this study is the Bhilangana river basin in Uttarakhand state of India, which is a tributary of Bhagirathi River. Different types of morphometric parameters have been derived on linear and aerial aspects from each of sub-watersheds. Considering all the morphometric parameters (linear and aerial aspect) and their effects on land degradation/ erosion, derived parametric values are assigned to the sub-basins based on Range Equalisation Method. Overall composite values are computed using all the morphometric parameters for the individual sub-basins. Suitable cartographic techniques are employed to depict the conditions of the parameters along with the tables.

Landuse/ land cover classification has been carried out using 1990 and 2010 Landsat TM 5 satellite images. The identified landuse/ land cover categories are water body, dense forest, open forest, scrub, snow and barren outcrop which have been used to assign values after detection of change rate. Here also same method of Range Equalisation is adopted to compute the values. Composite landuse/ land cover based priority category has been derived for each of the sub-watershed. Final prioritisation is determined considering both the aspects of morphometry and landuse/ land cover change. Ranges of vulnerability of the sub-water basins are portrayed on a map. The sub-watershed SW-2 has been put on the highest priority followed by SW-1 for monitoring/ management based on both aspects of morphometry and landuse/ land cover change.

Theme-VII: Transport development, accessibility and urbanisation

A SOCIO-ECONOMIC PROFILE OF SLUMS IN MIRIK TOWN

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Rapid urbanisation brought about by migration and natural growth has resulted in the multifarious problems in the towns and cities all over the world. One such problem is the emergence of slums. Almost one billion people or 32 per cent of the world's urban population live in slums and if no serious action is taken, the

number of slums dwellers worldwide is projected to rise to about 2 billion by 2030 (*UN-Habitat 2001*). In fact slums are the characteristics of the mega cities but nowadays it is emerging and rapidly growing even in small and medium sized towns of the hill areas. Mirik town with a total population of 9,112 has the highest percentage of slum population (44.79 per cent) among the urban centers of hill areas of Darjeeling district. Mirik, being a small sized hill town, the causes of slum formation and its expansion are remarkably different from the ones that are applicable to other such slums in metropolises and industrial towns of the nearby plains. This paper highlights the evolving problem of slums in Mirik town as a result of the accelerated pace of urbanisation in this hill town.

THE VULNERABLE TOWNS OF EASTERN HIMALAYAS: A CASE STUDY OF DARJEELING

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Darjeeling Himalaya is one of the best bio-diversity hot-spots in the world. Tectonically, it is very much vulnerable to disaster. Disasters like landslides affect the valuable flora and fauna of the region. Rapid urbanisation in a few points like Darjeeling town increases the vulnerability and it is high time to be prepared for disaster mitigation in order to save the habitat and its ecosystem.

This paper is a case study-based attempt to evaluate the risk factors associated with the human activities in the unstable young folded mountain region.

THE PATTERN OF URBANISATION IN DARJILING DISTRICT OF WEST BENGAL

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The Darjiling district in West Bengal is unique by its own features as it contains a part of the mountainous ranges of the eastern Himalayas. Naturally the influence of the Himalayas on the socio-economic life of the district is overwhelming. Thus, an attempt has been made to analyse the pattern of urbanisation in this mountainous district.

The main objectives of this paper are to identify the trend of urban growth, to analyse the changing pattern of city size distribution, to explain the nature of urban primacy and to discuss the prospect and policies of urbanisation.

In the first phase, data have been collected from various sources like District Statistical Handbook, District Census Handbook and others. Then elaborate statistical analyses of data have been done. Suitable maps and diagrams have been prepared on the basis of those analyses.

A district level comparison of the level of urbanisation shows that Darjiling ranks in middle order (with 32.34 per cent of its total population living in urban areas in 2001) along with Barddhaman and Hugli. The process of urbanisation shows a constant growth. Level of urbanisation was 20.56 per cent in 1951 that has increased by nearly 12 per cent in the following five decades. But the growth rate has fluctuated over time. Comparative analysis between rural and urban growth shows that urban population has grown at a higher rate than its rural counterpart that may be attributed to a steady outflow of rural people to urban centers in search of employment and business.

Urbanisation in Darjiling is characterised by relatively small number of urban centres in comparison to most of other districts. In 1991 there were four municipalities, one notified area and five non-municipal towns. Number of non-municipal towns has increased to twenty four in 2011 which indicates spread of urbanisation.

Urban growth in Darjiling is definitely characterised by urban primacy and unequal distribution of towns of different sizes. Siliguri Municipal Corporation (Part) is the primate city with a population of 2,84,602 in 2001. Darjiling Municipality contained the second highest population, with 1,07,197 persons in 2001, less than half of the population in the primate city of Siliguri. Moreover small and medium towns dominate the district so far as number of urban centres is concerned.

The mountains with a different environmental set up; geographic and geomorphic characteristics may not support the excessive concentration of urban population in its towns and cities. Class I towns in the region have very little scope for their spatial expansion. Moreover cities in this mountainous terrain have not emerged as a result of planned intervention historically, except a few like Darjiling (M), Kalimpong (M), Kurseong (M). Most of the urban centres are the expanded version of the trade centres in the region or have developed centering tea gardens. Hence these centres need to be controlled and directed in a sustainable path. The medium and small towns can be developed as major growth centres in the region through appropriate planning and policy intervention to accommodate the rising urban population. Such intervention may also reduce the spatial disparity in the levels of urbanisation in the region.

IMPLEMENTING THE URBAN PLANNING MEASURES –A STUDY ON SHIMLA, HIMACHAL PRADESH

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The premier city of Shimla, often regarded as the "British Jewel of the Orient", has now been transformed into a haphazard and unplanned growing urban settlement within a period of less than two hundred years from its inception in around 1815 A.D. The city has been witnessing several environmental, transportation, infrastructural, tourism, housing and institution related problems, which require immediate address. Ribbon-like development of human settlements along the major transport corridors emanating from the city calls for stringent measures. Though restrictions on the use of charcoal and polythene have given the city a big sigh of relief from pollution, yet out of place disposal of the solid waste is a matter of serious concern. Tackling such urban issues is indeed posing tough challenges for the urban planners in framing certain measures of urban renewal. The Urban Renewal Process in the name of Jawahar Lal Nehru National Urban Renewal Mission (JNNURM) pointed out the issues like inadequate water supply, sewerage and sanitation, traffic congestion etc. With the noble motto of "*Green Shimla Clean Shimla*", the urban planners have identified measures to decongest the city and give it the status of *Best Planned Indian Hill City* and *Best Tourist Destination*. Focused attention to integrated development of infrastructure services at the micro-level could probably ensure Shimla to be the "*Hill City with Vibrant Economy, Rich Heritage and Better Quality of Life".*

This paper also indicates the urban primacy of Shimla that poses a hindrance to the growth of other urban centres of Himachal Pradesh and identifies the city's zone of influence on its surroundings. The paper highlights the necessity for the identification of potential growth foci within Himachal Pradesh that would help to decongest Shimla with proper decentralization policies.

RURAL ROADS IN DARJILING HIMALAYAS: A CRITICAL APPRAISAL

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Road is the only means of communication for the rural people of the Darjiling Himalayas. The Darjiling Himalaya consists of the major part of the Darjiling District of West Bengal. It covers the three hill sub-divisions of the district

namely, Darjeeling Sadar, Kalimpong and Kurseong and eight CD Blocks which is about 1,721 km^2 while the total area of the district comes to about 3,149 km^2.

The villages near the important towns like Darjiling, Kalimpong and Kurseong have relatively good connectivity while those in the remote areas of the Himalayas have lower development of road infrastructure. Also the villages within the tea gardens are linked with moderately good roads for easy transportation of tea leaves for processing and marketing. Such villages have an influence of the spread effect of the better road infrastructure.

But the physiographic character of the region has resulted in the decline of the road infrastructure. Due to the varying geological structure, slope, active natural processes of weathering and mass wasting and natural hazards the rural roads has been in a deteriorating condition.

The study revealed that the varying rural road infrastructure has had an impact on the spatial development of the rural areas of the Darjiling Himalayas. Therefore, it seems that there is an urgent need to work out a comprehensive rural transport planning strategy capable of addressing the need of developing the rural roads in fragile and backward areas of the Darjiling Himalayas. This in turn can bring in sustainable rural development by enhancing rural employment potential, rural income and general improvement in the rural quality of human life. The Pradhan Mantri Gram Sadak Yojana (PMGSY) has been initiated since 2001 in the Darjiling Himalayas for betterment of rural connectivity and overall progress of human development. There are several hill villages that need to be connected for which the PMGSY is a unique scope.

AN APPRAISAL OF SUSTAINABLE TRANSPORT DEVELOPMENT IN DARJEELING TOWN

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Rising income, coupled with a greater mobility, has increased automobile use. It is true for hill towns like Darjeeling. Darjeeling is the northern most district of West Bengal. Darjeeling town is located on a ridge, shaped in the form of the letter Y. It is the headquarter of the Darjeeling district and being a municipal town it has diversified problems, transport is one of them. The present paper discusses the critical issues affecting sustainable transport development in this town. The main objective of this paper is to identify the various traffic problems and its characteristics within the town. Finally this paper suggests problem specific and location specific sustainable transport strategies, which can be fruitful for this hill town of West Bengal.

Theme-VIII: Socio-cultural aspects of Himalayan region

GANGTOK AND ITS SURROUNDINGS — AN OVERVIEW

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Sikkim is a tiny hilly state of India located between 27º0'48" and 27º07' North latitudes and 88º0'55" and 88º25' East longitudes in the northeastern Himalayan region covering an area of 7,096 km^2.

East district of Sikkim claims 954 km^2 (13.44 per cent) of total area of Sikkim. Gangtok is the capital of Sikkim state where the elevation ranges between 1,200 and 1,800 m. It experiences mountain type of climate with variation of rainfall and temperature. Soil of the area is infertile but it is suitable for deciduous and evergreen forest. Major agricultural crops include food grain, pulses, oilseeds, fruits and spices. Agriculture generates large employment opportunity. Most of the industries namely - textile industry, forest based industry, handicrafts and household industry, tea industry etc. belong to cottage and small scale industry having both male and female workers. In the absence of large-scale industries towns and bazars are the main places of economic activities of the state. East district of Sikkim is the most populated one (population density: 257/ km^2).

About 76.95 per cent of the total population of about 2,45,040 (Census of India, 2001) in the East district lives in Gangtok subdivision. Gangtok (29,354 population) has 17.85 per cent of the total population of Sikkim. Literacy rate in Gangtok is 83.9 per cent out of which 87.8 per cent are male literates and 79.2 per cent are female literates. While total literacy rate is 74.7 per cent for East district. The district is inhabited by Lepchas (aboriginals), Bhutias and Sherpas. The sex ratio in urban areas of Gangtok subdivision is 845 and in rural areas it is 820 females/ 1000 males. The major religions are Buddhism and Hinduism. Educational status, healthcare and childcare facilities are quite satisfactory. Nearly 47.6 per cent of the total population of East district is working population. In Gangtok working and non-working population are 44.3 per cent and 55.7 per cent respectively. From the strategic point of view, Gangtok's location is quite significant. The lofty mountains, the skyline, the serenity of river Tista and the people of Gangtok have made the region a unique one with a green pollution free and eco-friendly environment.

SPACE AND CULTURE IN GRAPHIC NARRATIVES: A CASE STUDY OF HIMALAYAS IN TINTIN COMICS

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Cultural landscapes are identified according to the interactions between the natural landscape and the society. Literary descriptions, as well as graphic narratives, often discuss the geography behind literature and the search for geography in it-- to explain the regional geographical nuances.

This paper explores the depiction of Himalaya in a graphic narrative format. It tries to understand the ethnographical realities as represented from an European viewpoint as well as from the expansionist attitude of the literary late-romantic or post-romantic travel writer, given to subjective musings rather than to conventional and systematic observation. The adventures of Tintin by Herge, in its unique graphic narrative style, understood this subjectivity while explaining the realities of Himalaya.

STATUS OF CHILD IMMUNIZATION IN SOME SELECTED BLOCKS IN DARJEELING DISTRICT

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Immunization programmes aim to reduce morbidity and mortality among the children due to vaccine preventable diseases. Vaccination against some of the most fatal diseases is one of the best cost-effective interventions of modern time. Following successful eradication of Smallpox by effective vaccination in 1975, the expanded programme of immunization was launched in India in 1978 to control other vaccine preventable diseases. Initially six diseases were selected for vaccination: Diphtheria, Pertussis, Tetanus, Poliomyelitis, Typhoid and Childhood Tuberculosis. Considering the extent of inconsistencies and instabilities in immunization coverage in India, it is very important to know the gaps in coverage of immunization programmes.

The study area comprises of some blocks of the Darjeeling district of the Himalayan region to find out the success of child immunization programme. District Darjeeling comprises of four sub divisions namely Darjeeling Sadar, Kurseong, Kalimpong and Siliguri, out of which the first three are hilly areas and the last one, is located in plain area which is known as Tarai. The population of Darjeeling is also exceedingly heterogeneous. A large number of people are

Nepalies, Lepchas, Bhotias, Tibetans and Marwaries other than Bengalees. The people are mostly of either caste like SC, ST and OBC.

Keeping in mind these evidences, this objectives are to find out the immunization status of Darjeeling district to find out the socio-economic factors on which child immunization depend specially in this region where population and demography is exceedingly heterogeneous.

A cross-sectional study was carried out in Naxalbari block and Matigara block of Darjeeling district. The area of study is predominantly rural hilly and foothills parts of this district under Naxalbari and Matigara blocks. Yule's coefficient of association have been calculated to show the association or dissociation between child immunization and various socio-economic variables like mothers' education, fathers' education etc. Logistic regression (binary) analysis has been used to examine the likelihood of the full immunization of children in terms of the various factors. Gender, birth order, mothers' age, mothers' education, fathers' education, fathers' income, fathers' occupation, distance from the health facilities, religion of the child have been considered as various immunization determining factors.

Various reasons like poor knowledge of the proper age of the child for immunization, lack of vaccine in the health facility on the appointment day, absence of personnel at the health facility, child ill-health at the day of immunization, lack of information about the days for vaccination, forgetting the days of immunization, mother's illness on the day of vaccination, social engagements etc have come up from the field survey as the other predominant reasons for not immunizing the children.

IMPACT OF MAN ON SOCIO-ECONOMIC DEVELOPMENT: A CASE STUDY OF THE DARJEELING HIMALAYA

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"The Himalayas are not merely Indian territory. They are the heart of India. For thousands of years, Indian history, culture, poetry and folklore have remained closely linked with the Himalayas". -Jawaharlal Nehru

Rapid growth of population has become the most critical developmental constraint in Darjeeling Himalaya. The growing population has constantly multiplied the pressure on land. Tremendous planning difficulties have been

posed by the unanticipated population increase, which has limited the per capita benefits of regional development. The variations in climate, soil, drainage patterns, cultural landscape etc. provide differential socio-economic conditions for human resource development in Darjeeling Himalaya. Its economy is largely based on tea, agriculture and tourism, where the former has played a significant role in the development of the region since the beginning. Thus, the area under study proves to be a complicated region requiring considerable care and attention in the matter of intensive development.

GEOGRAPHICAL REALITIES OF HIMALAYA IN TRAVEL WRITINGS: A REVIEW OF TWO BENGALI TRAVELOGUES

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In ancient and medieval period travelogues were considered as an important source of geographical information. Apparently, Himalaya appears as a natural wall to the Indian subcontinent but in reality it has been a source of spiritual influence on the Indian culture. So many travelogues on Himalayan region particularly, in Bengali, have been written during the last century. Here, two travelogues, 'Himaranya' by Swami Ramananda Bharati and 'Sherpader Deshe' by Umaprasad Mukhopadhya are taken into consideration.

Swami Ramananda Bharati started his journey to Kailash and Mansarovar as a pilgrim in 1898 and he wrote his travel experiences with sacred view in 1900-1901. Due to non-availability of modern transport, Ramananda completed his long journey by foot and riding on animals. It is evident from his writings that his outlook or perspective was religious but geographical in nature.

Umaprasad Mukhopadhya, well-acquainted in Himalayan travel wrote the book 'Sherpader Deshe'. It is a book on the travel of Nepal-Himalayas. The writer travelled twice (1966 and 1975) in this region. Mainly, the experiences of his journey have got a footing in this book. His travelogue has become a wonderful blending of amazing and multifarious description of the Himalayan nature together with the lives of hill people. Thus, his travelogue has reached the status of a geographical record.

SOCIO-CULTURAL ASPECTS OF MANALI, HIMACHAL PRADESH

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The western Himalayas has served as a habitat of different races and tribes. Himachal Pradesh is a glaring example of diversity of culture, tradition and

living style. The arrival of different streams of people and the fusion of currents and cross currents has contributed largely to the apparent diversity in culture. In this paper Manali town has been taken as a case study.

The town is located at an altitude of 1,950 m in the Beas river valley. It is an important hill station of the Himachal Himalayas, near the northern end of the Kullu valley. The folk tradition, culture and festivals reflect the distinct and unique socio-cultural lifestyle of the indigenous inhabitants of the region. The varied culture of this region reflects the rich traditional legacy and ancestral heritage that has diffused to modern era from the ancient past. The cultural traits of the hill region are unaltered and unaffected by the rapid industrialisation of the modern time and bring out the traditional cultural values of the society. It displays the varied yet enriched socio-cultural lifestyle of the local tribal population. All religious ceremonies, which are celebrated by local people, are just to appease the god and goddesses associated with nature.

The author makes an attempt to study the socio-cultural and folk traditions and its influence on the hill society.

INTER-DISTRICT VARIATIONS IN POPULATION CHARACTERISTICS OF SIKKIM, EASTERN HIMALAYA

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The northern boundary of India is formed by the Himalayan Mountains. Sikkim, a state lying in the north-eastern part of India, is one of the most physically accessible sections of the eastern Himalayas. Sikkim is completely landlocked and surrounded by Nepal in the west, Tibet (China) in the north, Bhutan in the west and West Bengal in the south. The areal extension of Sikkim is 27º04'46"N to 28º07'48"N latitude and 88º00'58"E to 88º55'25"E longitude. It has a great geopolitical importance due to its strategic location.

There is wide range of district level variations in the population characteristics of Sikkim. This study is an attempt to find out the inter-district variations in the population characteristics such as population growth, population density distribution, literacy, sex-ratio and child population (0–6 years) in Sikkim.

The study reveals that as per 2011 census, the highest population density is observed in East district (295 km^{-2}) and the lowest population density in North district (10 km^{-2}). The highest sex ratio is 941 females / 1000 males found in West district while lowest sex ratio of 769 females / 1000 males is in North district. During the last decade (2001–2011) the highest and lowest population

growth is observed in East district (14.80 per cent) and North district (5.67 per cent) respectively. The highest and lowest male and female literacy rate is observed in East district (89.22 per cent and 79.41 per cent) and North district (83.03 per cent, 69.92 per cent) respectively. So, it is clear that there is high range of inter-district variation in population characteristics in Sikkim.

LIVELIHOOD, ECONOMY, TOURISM AND ENVIRONMENTAL DEGRADATION: A CASE STUDY OF MANALI, HIMACHAL PRADESH

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Manali, an old town, is located on the banks of the river Beas in the lap of western Himalyas at a distance of 38 km from Kullu in the northern part of the valley. Geographically, it is situated at 32°15'30"N and 77°10'35"E at an elevation of about 1900 meters. It is situated in the central most district of Himachal Pradesh and surrounded by the high ranges of Lahaul-Spiti and Kumaon Hills. The maximum tourist inflow is seen during May-June. Tourism based economy is the lifeline of both local inhabitants and migrants for their livelihood. Manali Nagar Panchyat has an area of 166.42 hectares with a population of 6,265 persons as per 2001 census. It is regarded as the center of transportation of goods to its surrounding region. National Highway no. 21 which is connected to Manali is the main lifeline for the entire valley. But the higher inflow of tourists and rapid growth of urbanisation lead to various physical and socio-cultural problems. The unique Kulvi culture is losing its identity due to assimilation with the outside world through tourism. Western culture and their life styles are being adopted by local people with the passage of time. Regional set up and growing trade and commerce attract people from outside thereby destroying the small business and livelihood pattern of locals. Increased inflow of tourists is responsible for the degradation of physical and biological set up of this region. High population growth, unplanned and haphazard urban growth is destroying both the beauty of the town and environmental balance. Deposition of wastes in drains for longer period, higher amount of aerosols, higher concentration of population etc are degrading the natural environment.

The aim of the present study is to understand the impact of tourism on both the physical and socio-economic environment. The study reveals that the expansion of the town of Manali at the cost of neighboring forests and agricultural lands is a cause of dissatisfaction among the local people.

ECONOMY OF ARITAR, EAST SIKKIM

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Aritar is a small village in the Rongli sub-division lying in the East district of Sikkim. The village is known for its beautiful landscape. It can be reached by a four hours drive from Gangtok either via Pakyong or Rongpo. Mountainous areas have variations in relief, climatic conditions, vegetation, and soil characteristics. In this region, the undulating terrain plays a main barrier for the development of agriculture, communication system and setting up of industry. Here, the local environment gives opportunities to the local people to shape the economy of Aritar as per their needs. The villagers depend upon the local natural resources of this region. About 87 per cent of the households have their own agricultural land and they practice agriculture mainly to meet their own needs. The highest output comes from the tertiary sector which comprises 65 per cent. Only 30 per cent of the total output comes from the primary sector and the secondary sector contributes about 5 per cent. Lampokhari Lake, Aritar Gumpha, Evergreen Nursery, Kal Khola Falls, Changey Waterfalls, Lunchok Valley, Love Dara are the major tourist spots in and around Aritar. So there is ample scope to develop tourism industry in order to boost the economy of this region.

AN OVERVIEW OF KURSEONG MUNICIPALITY AND SURROUNDING AREAS

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Kurseong or Kharsang- 'the land of white orchid' is situated in the Darjeeling district, West Bengal. The Kurseong sub-division comprises of two hilly towns- Kurseong and Mirik. The Kurseong municipality has 20 wards. The region is flanked by lofty peaks of Himalaya. Due to its geographical position, the area has rugged terrain and mountain climate. The geological as well as socio-economic setting is often disturbed by sudden earthquake and landslide. In the time of monsoon, events of rock fall are also very common. The economy of the region has been developed upon the trio of –tea, tourism and schools. Despite the overall slump of tea industry the local gardens are running well here. Toy train is a special tourist attraction of this area, but after the 2011 earthquake the railway track and national highway 55 was severely damaged, so trains are running till Kurseong now. The famous schools of the municipality attract students from round the world. With the economic advancement of the region the

infrastructures are also developing. The ruggedness of topography is coupled with sparse population but the municipality area has a growing population. The region is showing some positive developmental aspects but the influence of nature is still very strong which needs to be managed efficiently.

HIMALAYA: A DIVERSIFIED NATURAL REGION

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A 'Natural Region' means an area on earth's surface which is essentially homogeneous with respect to the conditions that affect human life. The Himalayas is such a natural region which developed upon different natural characteristics like relief, climate, and natural vegetation etc. But all these characteristics are diverse in this region due to its large longitudinal extension over 2,400 km from the Indus gorge in the west to the Brahmaputra gorge in the east. Himalaya is thus a classic example of a natural region where there are inter-spatial diversities of different natural features. So the Himalayas can be recognized as a 'diversified natural region'. To establish Himalaya as a diversified natural region, it has been divided into different parts from west to east.

An attempt has been made in this paper to show how the different natural character has been diversified from one part of the Himalaya to another.

নগর দার্জিলিঙ-এর বর্তমান পরিস্থিতি ও ভবিষ্যত রূপরেখা

শিশির চ্যাটার্জী

ভূগোল বিভাগ, রায়দিঘী কলেজ, রায়দিঘী

দার্জিলিঙ শহর-এর রাজনৈতিক ভবিষ্যত নিয়ে সমাজ ও নাগরিক চিন্তা জগত গত এক দশক ধরে বারংবার আলোচনা করেছেন, উদ্বেগ প্রকাশ করেছেন এবং আবশ্যই ভবিষ্যতের পথ খুঁজে বেরিয়েছেন । এই কর্মকান্ড এত বেশি প্রকট ছিল যে দার্জিলিঙ শহর এবং তার ভৌগলিক ভবিষ্যত নিয়ে গবেষণাপত্র তৈরির কাজ সাম্প্রতিককালে প্রায় বন্ধ হয়ে গিয়েছিল । বছর ঘুরতে চলল, রাজনৈতিক সদিচ্ছার হাত ধরে দার্জিলিঙ নাগরিকবৃন্দের ভাবনাও বিশ্লেষণের বৃত্তে ফিরে এসেছে, একটু একটু করে সাম্প্রতিক অবস্থার তথ্য পাওয়া যাচ্ছে । বহু ক্ষেত্রে নতুন করে তা তৈরিও করতে হচ্ছে । এই পরিপ্রেক্ষিতে দার্জিলিঙ শহরের ভবিষ্যত বিশ্লেষণ এই গবেষণাপত্রে তুলে ধরার চেষ্টা করা হল ।

আজকের দার্জিলিঙ ঠিক কিরকম ? এক লক্ষ কুড়ি বাইশ হাজার অধিবাসীর দার্জিলিঙ শহর

পর্যটক নিয়ে এখন গড়ে প্রতিদিন প্রায় দেড় লক্ষ মানুষকে পরিষেবা দেয়, ধারণ করে । সবথেকে বড় কথা হল প্রায় এক দশক পর দার্জিলিঙ-শহরে সথানীয় প্রশাসন ও পরিকাঠামো পরিচালনার স্বাভাবিক প্রক্রিয়া ফিরে এসেছে । প্রশাসন ও পরিকাঠামো পরিষেবা গত কয়েক বছর অনুপস্থিত থাকলেও ভূমিধ্বস, রাস্তা বসেঙ যাওয়া, গাছ কাটা, মৃত্তিকা ক্ষয়, জলনির্গম প্রণালীগুলি বিনষ্ট হয়ে যাওয়া এবং দূষণ কোনোটাই তো বন্ধ ছিলনা ! তাই একদিকে যেমন চ্যালেঞ্জ নতুন করে ভূমিধ্বস প্রবণ এলাকাগুলিকে চিহ্নিত করা, পুর দপ্তরের সঙ্গে যোগাযোগ, সেখানকার রাস্তাগুলিকে পুনর্নির্মান করা ও জল নির্গমনের জায়গাগুলিকে উন্মুক্ত করা; অথচ এই মুহূর্তে সব থেকে বড় সমস্যা হল দার্জিলিঙ শহরে নতুন রাজনৈতিক উদ্যোগের সঙ্গে সঙ্গে পার্শ্ববর্তী অঞ্চল থেকে প্রতিদিন অজস্র গ্রামবাসী, তহসিল-মৌজার গরীব মানুষজন একটা কিছু কাজের আশায় অবিরাম আসছেন, যত্রতত্র বাড়ি করছেন, তাদের ওপর প্রশাসনের কোন নিয়ন্ত্রন নেই, এমনকি এই সংখ্যাটা কত তাও তারা জানেন না ! আশ্চর্যের কথা দার্জিলিঙ শহরের প্রাণকেন্দ্র ম্যাল অঞ্চল একটি পূর্ণাঙ্গ বিল্ট আপ অঞ্চল হওয়া সত্ত্বেও এবং দীর্ঘদিন সেখানে নতুন নির্মান কাজ নিষিদ্ধ থাকলেও এখন এই অঞ্চলে ভূমির ঢালের ভারসাম্যের পরোয়া না করে বহুতল বাড়ি তৈরি করা হচ্ছে । এই গবেষণাপত্র তাই চেষ্টা করছে বর্তমান বাস্তবতার আলোকে দার্জিলিঙ নগর এলাকায় ভবিষ্যতের রূপরেখাটি উপস্থিত করতে ।

সাহিত্যে হিমালয় ঃ রূপকের আড়ালে

পীযূষ পোদ্দার

বাংলা বিভাগ, বিশ্বভারতী বিশ্ববিদ্যালয়, শান্তিনিকেতন

‘পূর্ব-পশ্চিম সমুদ্র পর্যন্ত বিস্তৃত হিমালয় পর্বতমালা, পৃথিবীর মানদণ্ডের মতো বিদ্যমান, দেবগনের অধিষ্ঠানভূমি’ সংস্কৃত সাহিত্যে এমনভাবে হিমালয়ের পরিচয় পাওয়া গেলেও সেখানে সত্যিই দেবতারা থাকতেন কিনা তা আরো অনেক শ্রমসাধ্য গবেষণায় উপলব্ধ হতে পারে। আধুনিক ভারতবর্ষের ভৌগোলিক-মানবিক-সাহিত্যবীক্ষায় হিমালয় এক বিরাট বিষয়। পর্বতের প্রতিশব্দ রূপে হিমালয়ের প্রয়োগ থাকলেও সাহিত্যে হিমালয় একটি জীবন্ত চরিত্র।কালিদাস তাঁর ‘কুমারসম্ভব’ কাব্যে হিমালয়ের অনুপম বর্ণনা করেছেন।

বাংলা সাহিত্যের শাক্তপদাবলীতে হিমালয়কে গিরিরাজ বলা হয়েছে। হিমালয় সম্পর্কসূত্রে মেনকার স্বামী, মৈনাক এবং উমার পিতা। গিরিরাজ সম্বোধনে হিমালয়ের দাঢ্যতা প্রকাশিত হয়েছে। মা মেনকা বাঙালী ঘরের মায়ের মতো মেয়ে উমার জন্য চিন্তিত, ব্যাকুলা। দরিদ্র শিবের ঘরে রাজদুলালী উমা না জানি কত কষ্টে রয়েছে। গিরিরাজ হিমালয় তো পুরুষ, তাই মেয়ের মন তেমন বুঝতে পারবেন না বলেই হয়ত মেনকা বলেছে-‘মেয়ের যেরূপ মন মায়ে বোঝে যেমন /পুরুষ পাষান তুমি বোঝ না তেমন’। রূপকে ও আক্ষরিক অর্থে নারী তো স্নেহ সুধাময়ী, কল্যান কামী, অর্ধেক আকাশ; পুরুষ গিরিরাজ স্নেহহীন না হলেও তার প্রকৃতি দৃঢ় ,ঋজু, অটল; নারীর স্নেহ-স্নিগ্ধতা তার অভিধানের বাইরে।

বাংলা গদ্য সাহিত্যে হিমালয়ের বিরাট বিস্তৃতি। দেবেন্দ্রনাথ ঠাকুর অধ্যাত্ম-অনুভূতির সঙ্গে ভ্রমনের তথ্য যুক্ত করেছেন তাঁর হিমালয় বর্ণনায়। প্রবোধকুমার সান্যাল একাধিক বার হিমালয় ভ্রমনের অভিজ্ঞতা লিপিবদ্ধ করেছেন 'মহাপ্রস্থানের পথে' ও 'দেবাত্মা হিমালয়' গ্রন্থে। স্বাদু গদ্যে সৌন্দর্য রসিক লেখক হিমালয়ের বর্ণনা দিয়েছেন। জলধর সেনের 'হিমালয়', উমাপ্রসাদ মুখোপাধ্যায়ের 'পঞ্চকেদার' ও 'গঙ্গাবতরণ' হিমালয় বিষয়ে উল্লেখযোগ্য গ্রন্থ।উমাপ্রসাদ এক চিরন্তন পথিক সত্তা নিয়ে গাড়োয়াল হিমালয় ও তৎসংলগ্ন অঞ্চলের সাবলীল বর্ণনা করেছেন। হিমালয়ের এক মহান আধ্যাত্মিক ও ভৌগোলিক অনুভব বহুদিন থেকে ভারতবাসীর মনে আছে, সাহিত্যে হিমালয়ের সৌন্দর্য বর্ণনার সঙ্গে তার গাম্ভীর্য ও বিস্তৃতি বিভিন্ন অনুসঙ্গে নানা রূপকের আড়ালে অবগাহন করছে।

রবীন্দ্র স্মৃতি কথায় প্রথম হিমালয় যাত্রা

সুদীপ্ত সাউ

বাংলা বিভাগ, নগর কলেজ, নগর

'অস্ত্যুত্তরস্যাং দিশি দেবতাত্মা হিমালয়ো নাম নগাধিরাজঃ । / পূর্বাপরৌ তোয়নিধী বগাহ্য স্থিতঃ পৃথিব্যা ইব মানদন্ডঃ ।।' আমাদের প্রাচীন কবি কালিদাস কুমার সম্ভবম কাব্যের প্রথম সর্গে হিমালয় কে র্পতের রাজা এবং পৃথিবীর মানদন্ড হিসাবে চিহ্নিত করেছেন । তাঁর মেঘদূত সহ অন্যান্য কাব্যে আছে হিমালয় মুগ্ধতার চিত্র । প্রাচীন কাল থেকেই ভারতীয় কবিদের মনোলোক অধিকার করে আছে হিমালয় । কালিদাসের উত্তরসাধক রবীন্দ্রনাথও মুগ্ধ হয়েছিলেন হিমালয়ের মহিমায় । বয়ঃসন্ধিতে পিতার সঙ্গে হিমালয় দর্শন রবীন্দ্রনাথের চেতনায় এক ব্যাপক পরিবর্তন এনেছিল । জীবনস্মৃতির (১৯১২) পাতায় কবির বর্ণনায় দেখি, 'অমৃতসরে মাসখানেক ছিলাম । সেখান হইতে চৈত্র মাসের শেষে ড্যালহৌসি পাহাড়ে যাত্রা করা গেল । . . . হিমালয়ের আহ্বান আমাকে অস্থির করিয়া তুলিতেছিল । যখন ঝাঁপানে করিয়া পাহাড়ে উঠিতেছিলাম তখন পর্বতে উপত্যকা-অধিত্যকা দেশে নানাবিধচ চৈতালী ফসলে স্তরে স্তরে পঙ্‌ক্তিতে পঙ্‌ক্তিতে আগুন লাগিয়া গিয়াছিল । আমরা প্রাতঃকালে দুধ রুটি খাইয়া বাহির হইতাম এবং অপরাহ্নে ডাকবাংলায় আশ্রয় লইতাম । সমস্তদিন আমার দুই চোখের বিরাম ছিলনা । পাছে কিছু-একটা এড়াইয়া যায়, এই আমার ভয় ।'

রবীন্দ্র সাহিত্যে যে বিশ্বাত্ববোধের কথা বলা হয় তার বীজ বপন হয়েছিল পিতার সঙ্গে তার প্রথম হিমালয়ে যাত্রার মধ্য দিয়ে । বক্রোটা পাহাড়ে রাতেরবেলা পিতার সঙ্গে জোতির্বিদ্যাচর্চা আজীবন রবীন্দ্রনাথকে মহাবিশ্বের রহস্যের বিষয়ে কৌতুহলী করে তুলেছিল । হিমালয় যাত্রার ফলে ভৃত্যরাজকতন্ত্রের বাহিরে যে ব্যপ্ত জগতের সঙ্গে তাঁর প্রথম পরিচয় হয়, যার একদিকে আছে অপার প্রাকৃতিক সৌন্দর্য অন্যদিকে মানব চরিত্রের বৈচিত্র । হিমালয় ভ্রমনকালে দেবেন্দ্রনাথ কনিষ্ঠ পুত্রের পড়াশুনার বিষয় সচেতন ছিলেন । দেবেন্দ্রনাথের বিচিত্র বিষয়ে পাঠদান ও পাঠদানের কৌশল পরবর্তী কালে রবীন্দ্রনাথের শিক্ষা চিন্তাকে প্রভাবিত করেছিল ।

এই সন্দর্ভ রচনার উদ্দেশ্য রবীন্দ্রনাথের স্মৃতিকথা ও চিঠিপত্রে ছড়িয়ে থাকা প্রথম হিমালয় যাত্রার বর্ণনা (২৫ এপ্রিল ১৮৭৩ থেকে ২৭ জুন ১৮৭৩ পর্যন্ত) তুলে ধরা এবং তাঁর উত্তরকালের সৃষ্টি ও কর্মে যে ব্যপ্ত প্রভাব তৈরী করেছিলো তার স্বরূপ বিশ্লেষণ ।

Theme-IX: Geopolitics and Himalaya

CLOUDBURSTS AND INDO-CHINA GEOPOLITICS IN THE HIMALAYAN REGION

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Intensity of rainfall in the western part of the Himalayan region has been increasing during the last couple of years. One of the major causes of the increase of rainfall is cloudburst which triggers flashflood. In 2010 about two, in 2011 nearly three and in the last nine months almost five cloudbursts have occurred in this region. More than a thousand of people were killed by this disaster. Basically, Uttarakhand and Himachal Pradesh were mostly affected by the phenomena. Flash floods occurred just after the cloudbursts with a consequence of disastrous situation in the region. The sudden change of very high increase of frequencies of cloudbursts in the region can hardly be explained by natural processes alone. One may suspect the involvement of Chinese geopolitics in the Himalaya, including Tibet and adjacent areas. China is technologically very developed in artificial rain-making by cloud-seeding. Artificial rain is produced by spraying clouds with substances like Silver Iodide or solid carbon dioxide (dry ice), or even finely powdered Sodium Chloride. China uses cigarette-size sticks by rockets to input silver iodide into the cloud to produce artificial rain. Is China inputting such particles over the clouds of the western Himalayan region to make the situation worse? The question needs to be investigated thoroughly keeping in mind the trends of clouds burst and Indo-China geopolitical relations in the Himalayan region.

LATE ABSTRACTS

Theme-V: Management of natural resources and policy implementation

FLUVIAL MORPHOLOGY AND LAND USE MANAGEMENT OF DENTAM KHOLA BASIN, SIKKIM

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The present paper concerns a comprehensive study on the fluvial morphology and its impact on land use management of Dentam Khola basin, West District, Sikkim. This area belongs to the Rangit river basin under Tista drainage system and embodies some fluvial landforms under a tectonically unstable zone which influence the management of land use patterns over the rugged terrain of the basin.

The land use and land cover patterns are mainly influenced by climate, soil, lithology of any particular area. The sub-tropical monsoon climate and with the development of immature soil cover, diversified land use patterns are found over the area. The basin is mostly covered by wet deciduous-coniferous forest resource over the southern part with around 60% land coverage. The rest percentage of land cover are enriched with abundant water resources of the streams, agricultural resources including grain farming, plantation, floriculture on the fluvial terraces and tectonic flats and the most remarkable aesthetic resources based on natural scenic beauty of Sikkim Himalaya which are coming to be important economic bases of the Dentam Khola basin. Socio-economically, the basin is actually based on primary, especially agricultural activities. But, due to the less presence of suitable terrain, less land potentiality, less transport accessibility there is the necessity of land use management and development in the background of present fluvial landscape. The fluvial terraces along with the other physiographic features should be scientifically managed maintaining the ecological sustainability for the development of present land use patterns and overall socio-economic benefit of this area.

FORMATION OF RIVER VALLEY AND LAND USE MANAGEMENT OF CHANDRAPURI, UTTARAKHAND

Mery Biswas

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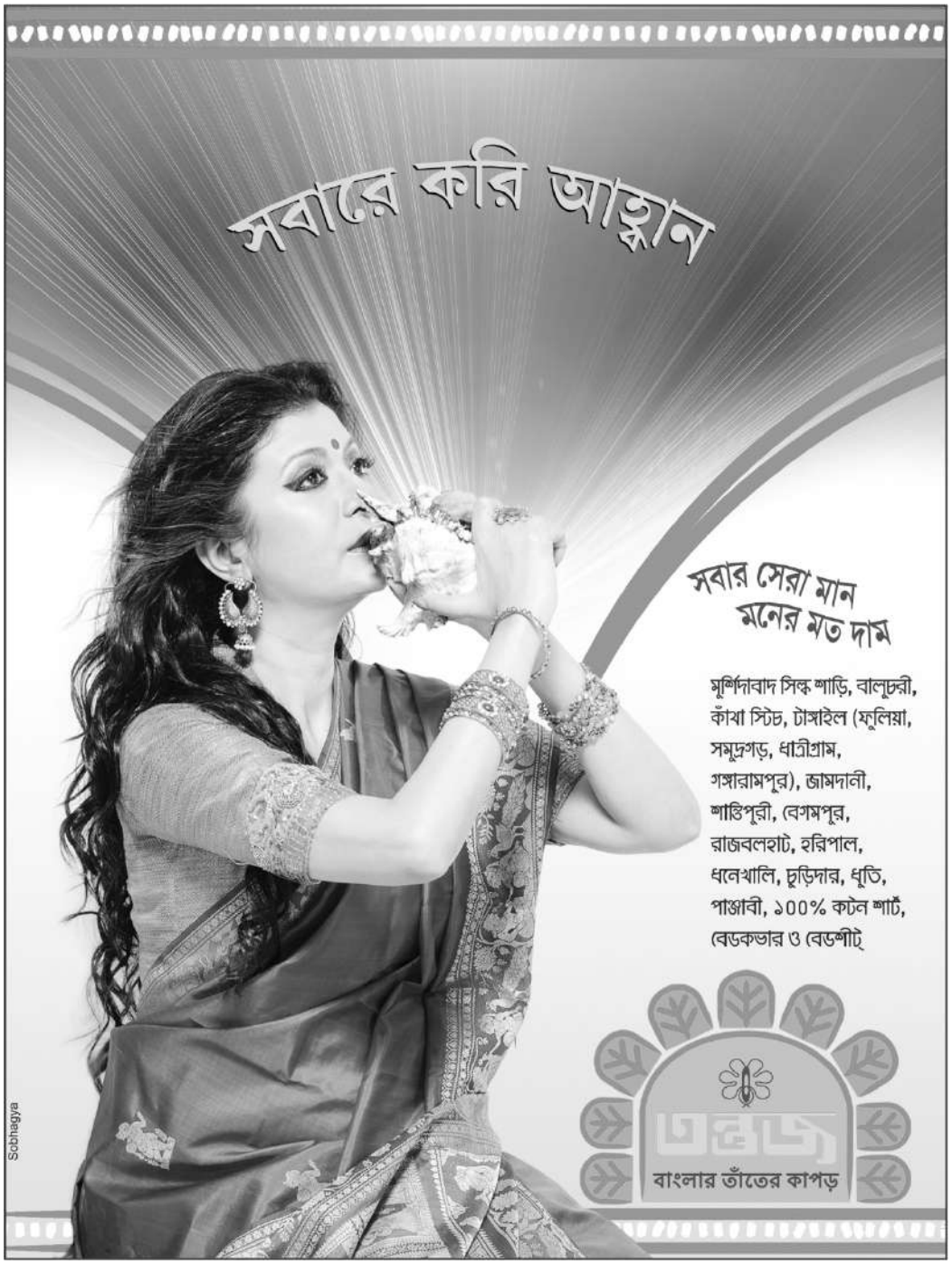
The present paper deals with the formation of river valley and land use management of Chandrapuri. The work is obtained through a case study of Chandrapuri which is situated on the right hand side bank of river Mandakini and under the Ukhimath Tehsil of Rudraprayag district of Uttarakhand. The village is chosen under two physio-cultural aspects; one it is located on the MCT zone of Himalaya another is, among all the villages of Ukhimath Tehsil, it has the highest population density. The present worker has tried to find out how tectonic and climatic causes have become responsible for the development of unpaired river terraces and these terraces are used for major land uses in past as well as today but in a changing nature especially regarding the agricultural system. Two sedimentary belts are well developed ,one is Krol belt in the south(to the north of MBF) and Calc zone of Tejam and Pithoragarh in the north (to the south of (MCT).The entire basin area is under the Garhwal Group and the oldest formation is found to be develop as Rudraprayag formation. The year may be divided into four seasons viz. the cold winter season, (December to February), the hot weather season (March to May), southwest monsoon season (June to September) followed by post monsoon season (October to November).Larger part of the basin is situated on the southern slopes of the outer Himalayas, monsoon currents can penetrate through trenched valleys, the rainfall reaches its maximal in the monsoon season that spans betweens June to September. The result of quantitative analysis, particularly of the landforms ,slope, drainage pattern as well as the soil type have sustained the dominance of fluvial erosion and tectonic activities which have produced the poly-cyclic valley pattern with a complex geomorphic entity. The unpaired multi- terrace formation near Chandrapuri and Auguestmuni exhibits with landforms which are believed to be produce due to the structural control and climatic changes. Actually the fluvial features like valley meander, incised valley side slope, convex walls, modified 'V' shaped valley, composite scarps etc. are prominent along the river valley. Hilly terrain, unfavorable climatic conditions for some crops, lack of or inadequate availability of improved inputs and technology, and lack of credit and marketing facilities, agriculture is less developed. The cropping pattern of the area is mainly based on traditional agriculture. In almost all the hill parts rice, wheat, *mandwa*, and *sanwa* remain the main crops with the maximum area under cultivation. The major crops of each districts are highlighted in the table; for example, barley is an important crop for due to the small size of the land

holdings, farm mechanisation was not technically feasible. On an average, about two-third of the land holdings are marginal in size with an average land. Most elongated wide terraces are suitable for agriculture but irrigation facilities of the area is need to be developed through mini-hydel power projects or water supply may be regularised through pump system from Mandakini river as it is fed by snow melt water and water is available throughout the year. Regarding the soil nature, vegetable cultivation may be hugely developed both for domestic and business purpose which will help to change the occupation structure and strengthening economic and social scenario of the area under study.


সবারে করি আহ্বান
সবার সেরা মান
মনের মত দাম
মুর্শিদাবাদ সিল্ক শাড়ি, বালুচরী,
কাঁথা স্টিচ, টাঙ্গাইল (ফুলিয়া,
সমুদ্রগড়, ধাত্রীগ্রাম,
গঙ্গারামপুর), জামদানী,
শান্তিপুরী, বেগমপুর,
রাজবলহাট, হরিপাল,
ধনেখালি, চুড়িদার, ধুতি,
পাঞ্জাবী, ১০০% কটন শার্ট,
বেডকভার ও বেডশীট্
তন্তুজ
বাংলার তাঁতের কাপড়
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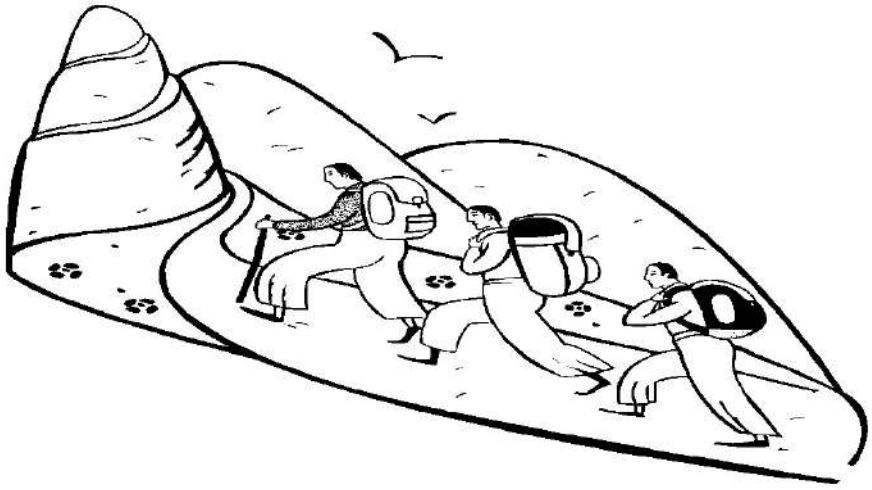

হিমালয়ের যাত্রাপথ শুভ হোক ।

- শুভাকাঙ্ক্ষী '2G'