ENVIRONMENTAL ISSUES AND HUMAN SECURITY IN THE HIMALAYAS:

A Comparative Study of Sikkim and Eastern Nepal

Thesis submitted to Jawaharlal Nehru University
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DOCTOR OF PHILOSOPHY

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DECLARATION

I declare that the thesis entitled "**Environmental Issues and Human Security in the Himalayas: A Comparative Study of Sikkim and Eastern Nepal**" submitted by me in fulfillment of the requirements for the award of the degree of **DOCTOR OF PHILOSOPHY** of this University is my own work and has not been previously submitted for any other degree of this or any other University.

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CERTIFICATE

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ACRONYMS

ACT -	Affected Citizens of Teesta
ADB -	Asian Development Bank
BBC -	British Broadcasting Corporation
CBS -	Central Statistical Bureau of: Nepal
CEC -	Centre for Environment and Communication
CO^2 -	Carbon dioxide
CPR -	Common Property Resources
CSE -	Centre for Science and Environment
DFID -	Department of International Development
DMT -	Disaster Management Team
EDC -	Eco-development Committee
ERRA -	Earthquake Rehabilitation and Reconstruction Authority
FAO -	Food and Agriculture Organisation
HMG/N-	His Majesty's Government of Nepal
HPDR -	Himachal Pradesh Development Report
GDP -	Gross Domestic Product
GIS -	Geographical Information System
GLOF -	Glacial Lake Outburst Flood
GTZ -	Deutsche Gesellschaft fur Technische Zusammenarbeit
ICIMOD-	International Centre for Integrated Mountain Development
INGO -	International Non Governmental Organisation
IPCC -	Intergovernmental Panel on Climate Change
IUCN -	World Conservation Union [earlier International Union for Conservation of Nature and Natural Resources
JFM -	Joint Forest Management
JFMC -	Joint Forest Management Committee
LPG -	Liquefied Petroleum Gas
MBT -	Main Boundary Thrust
MCT -	Main Central Thrust

MoU -	Memorandum of Understanding
MW -	Mega Watt
NGO -	Non Governmental Organisation
NH -	National Highway
NSET -	National Society of Earthquake Technology: Nepal
NUS -	National University of Singapore
OCHA -	United Nations Office for Coordination of Humanitarian Affairs
UN -	United Nations
UNCED-	United Nations Conference on Environment and Development
UNDP -	United Nations Development Project
UNEP -	United Nations Environment Programme
UNESCO-	United Nations Educational, Scientific and Cultural Organization
UNHCR-	United Nations High Commission for Refugees
UNU -	United Nations University
WB -	World Bank
WCD -	World Commission on Environment and Development
WCMC-	World Conservation Monitoring Centre
WOMP-	World Order Model Project
WWF -	World Wide Fund for Nature
WRI -	World Resource Institute
WSSD -	World Summit on Sustainable Development

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PREFACE

The basic purpose of this research work is to call attention to the significance of environmental parameters on the human security and contribute to the ongoing debate on the larger human security discourses. The study attempts to address the issues related to environmental security in the Himalaya and its relevance to the human security of the region and neighbouring geographical milieu. Apart from understanding and analyzing some of the important environmental issues through quantitative and qualitative measures, the study focuses on the process by which the gains from effective management of environmental parameters would get translated into enhanced human security both at macro and micro levels.

The primary aim of this study is to explore the alternatives and possibilities of enlarging the scope of traditional security perceptions by pushing the boundary and breaking the rigidity of the dominant State centric/military security concepts and its deterministic matrices. In other words, the underlying concern of this study is to make understand the policy makers that promoting security is more important rather than creating security concerns.

How we draw knowledge and make policy has been the subject of vigorous debate and analysis across the globe. The Himalayan region- where scientists, statesmen and citizens confront a unique set of environmental challenges and political legacies- provides a powerful case study (Blaike and Muldavin 2004) in this regard. Poverty, food insecurity, poor health, human displacement, migration, ethnic conflict across the Himalayan region are in one way or other associated to environmental insecurities. Further, the Himalayan environment and its influence on the overall well being of the people both within and outside the region have been colossal since antiquity.

Although there have been some attempts to explore aspects of environmental security, literature in this regard continue to remain limited, scattered and unorganised. No serious, systematic and focused research has been attempted on this vital aspect of human security concerns. In short, there is a notable gap with respect to theoretical, conceptual and applied research on environmental security in the context of the Himalaya. As a consequence, policy makers in the region have to rely on the limited knowledge and scattered database in formulating policies and taking major decisions on human security.

This study, therefore, attempts to fill this gap and strives to draw attention of the policy makers to the role of environmental parameters in maintaining and enhancing human security. The study has attempted to examine the issues related to environmental security in the Himalaya in the context of newly emerging international discourses and concerns. It seeks to provide a new and innovative framework of understanding and dealing with the concerns of human security. Such a framework can provide space for exploring the possibility of arriving at a collective security on a national and regional basis, away from the state centric and threat perception dominated determinants of security.

Ensuring human security through environmental interventions would bring about comprehensive human development, which may transform the entire security parameters. This may in-turn lead to a gradual transformation of the traditional perception of security with military perception to a more liberal and holistic framework of human security that would also underpin socio-economic and environmental indicators besides military security. The concept of environmental security broadens the traditional concept of national security to include geo-environmental process and resources of environment. This partly emerges from the fact that environmental change could be a potentially key variable in both triggering and affecting conflict. The proponents linking environmental problems to non-traditional security concerns strongly argue that environmental degradation often undercuts economic potential and human well being which in turn helps fuel political tensions and conflicts. They also advocate that environmental security issues not only raise awareness of environment threats but would also spur collective action for better compliance with international environmental agreements. This could lead to the national and international responses essential to achieve sustainable development. This, however, requires changing the mindset, courage and political will.

The study is divided into six chapters. Chapter one attempts to explore and explain the evolution of the idea and concept of human security in security and development discourse. It attempts look into various dimensions of human security and seek to explain its relevance in the larger security and development debate. It further aims to examine and explore the significance of environmental parameters in the overall human security problematique. The chapter reviews some of the prominent discourses, summits, conferences and seminars pertaining to major mountain regions across the globe.

Chapter two attempts to locate the geo-environmental and socio-cultural setup of the Himalayan region. It strives to explore the natural and human diversities across the region and seeks to link their bearing on the regional human security pattern.

Chapter three surveys and discusses some of the major geo-environmental/geomorphic processes and consequent human insecurities in the region and its surrounding geographical milieu. It attempts to list down and illustrate some of the important natural challenges and critically examine their impact on the overall human security.

Chapter four identifies, quantifies and offers a general discussion on some of the major forces that have been largely debated as human made environmental challenges and which often threaten human security in the Himalaya and its geographical milieu. While doing so, it also attempts to critically review some of the debatable theories/findings put forward by scholars/organisations and examine their relevance with the present reality in the area seeking help of recently available data.

Chapter five examines Sikkim and Eastern Nepal in the context of the arguments put forth in the first four chapters. It seeks to relate the relevance of macro situation at a more local level and vice-versa.

The concluding chapter summarises the significance of environmental issues and their implication on the human security of the Himalaya. It attempts to interrogate the prevailing outlook of security paradigm across the Himalaya. The chapter argues for a need to evolve a holistic human security outlook based on environmental parameters and human welfare.

security that is centred above all on the sanctity of the individual may be called human security (Bajpai 2003:196)'.

Though the contents as generally defined in the present discourse on human security have been the central themes of development and nation building process, they are yet to be discussed in the framework that usually charactarise human security debate. The recent line of thinking and discourse on human security issues can be related to the growing dissatisfaction with the prevailing idea of security and development during the 1960s, 1970s and 1980s. They were the economists who, in the 1960s, led with the critiques on the dominant models of economic development. Since the 1950s there have been a series of attempts to formulate alternative development theories and strategies. Among many others, they include, Neo-classical 'trickle down' growth theory, the employment strategy, the anti poverty oriented strategy, and basic needs approach. In International Relations (regarded as a habitat of security studies), the multinational World Order Model Project (WOMP) launched an ambitious effort to envision and construct a more stable and just world order and as part of this endeavour drew attention to the problem of individual well being and safety, around the mid seventies.

Perhaps the most important forerunners of the idea of human security were the reports of a series of multinational independent commissions composed of prominent leaders, intellectuals and academics (Bajpai 2003: 197) of the 1970s. In the early seventies, the Club of Rome group produced a series of volumes on the world problematique that were premised on the idea that there is 'a complex of problems troubling men of all nations: poverty...degradation of the environment, loss of faith in institutions, uncontrolled urban spread, insecurity of employment, alienation of youth, rejection of traditional values, and inflation and other monetary and economic disruptions' (Meadows *et al.* 1972:10).

The end of cold war saw the introduction of new lines of thinking in security matters. If earlier attempts to explore the aspects of human security were the precursors, it was beginning of the 1990s that witnessed an explicit human security perspective getting articulated among works of the scholars across disciplines, particularly International

Relations. The first concrete contribution in consolidating the structure of human security issues was nontheless, the first human development report published in 1990 by United Nations Development Programme (UNDP) under the leadership of Mahbub-ul-Haq. The human development thesis explicitly put at the centre of its formulation the notion that development thinking and policies must focus on the welfare of individuals rather than simply on macro economy. This thesis tends to present a more comprehensive theoretical and practical approach to human security debate. The second important intervention on human security was that of the Canadian government and various Canadian academics who led a 'middle powers' initiative (Bajpai 2003:199).

According to Human Development Report (1994), 'For most people, a feeling of insecurity arises more from worries about daily life than from the dread of the cataclysmic world event. Human security is a child who did not die, a disease that did not spread, a job that was not cut, an ethnic tension that did not explode in violence, a dissident who was not silenced... Human security is not a concern with weapon; it is a concern with human life and dignity (UNDP 1994:22)'. The report identified the following four essential characteristics of human security:

It is a universal concern and is relevant to people everywhere, in rich and the poor nations
Its components are interdependent,
It is easier to ensure through early prevention, and
Human security is people centric in nature.

It is important to be clear, nonetheless, that 'human security and human development are two different entities. Human development is a broader concept defined as a process of widening the range of people's choices. Human security means that people can exercise these choices safely and freely and that they can be relatively confident that the opportunities they have today are not totally lost tomorrow. But they are interlinked in more than one ways' (UNDP 1994:23). It has two important components: freedom from fear and freedom from hunger. These components can further be categorised into seven major security heads (UNDP 1994: 24-25).

CHAPTER 1
Introduction

1.1 Introduction

This chapter attempts to explore and explain the evolution of the idea and concept of human security in security and development discourse. It attempts look into various dimensions of human security and seek to explain its relevance in the larger security and development debate. It further aims to examine and explore the significance of environmental parameters in the overall human security *problematique*. The chapter reviews some of the prominent discourses, summits, conferences and seminars pertaining to major mountain regions across the globe.

1.2 The Idea and Concept of Human Security

Security is multi dimensional, which could be spelled out in different forms and understood with varying connotations, but if one tries to understand it within the holistic frame with reference to man-nature-technology-development relationship then one could clearly provide an analytical framework integrating all other aspects within the ecological framework. An ecological frame of reference provides a systematic understanding of various components of national and regional security and help building durable and meaningful strategies for interdependence, cooperation and development. The triangular relationship between nature, institutions and technology helps in understanding realistically the question of development, issues pertaining to regional inequalities and in appreciating regional overtones, threats to national integration, regional tensions and regional conflicts. It provides a necessary plank for a balanced regional approach to reduce tensions among neighbours and to develop supranational and unified approach to coexist with environmental compulsions.

Human security as an idea has been in existence since very long. As long ago as 1705, a German philosopher, Leibniz, expressed need for the State to provide common security to its people. French philosopher Montesquieu also echoed the same sentiment when he said that true political freedom could only be achieved when people are secure (Hussein 1998). The concept, however, remained suppressed for long and especially during the Cold War period. This was particularly so as there was an over emphasis given to the State centric geopolitical and military aspects of security that dealt with war, violence and conflict. The assumptions was that such line of security would ensure safety and security of the State and thereby its people. In the classical formulation, security is about how States use force to manage threats to their integrity, their autonomy and their domestic political order, primarily from other States (Bajpai 2003). Such State centric formulation has been challenged and criticised on variety of grounds.

Over the last few decades or so changes witnessed in the national, regional and international arena like human rights violations, environmental degradation, poverty, political instability, terrorism, ethnic & religious violence, gender inequity etc have led security thinkers to realise that conventional or traditional security discourse appears inadequate to capture these emerging sources of insecurity. These newer sources of insecurity had profound consequences for the individual human being, society, State and inter-State relationship. These tend to pose threats not only to the State but also to the community and human individual. It is now widely recognised that State security may not lead to human security. With the end of cold war, governments, international organisations, non-governmental organisations and ordinary citizens have been attempting to explore the questions of human security as never before and also to act as agents in enlarging the scope of safety and freedom of the people.

It is fruitful to bear in mind that in contemporary world the discourse on human security has led to complex debates on the issue. Political scientists, sociologists, economists, environmentalists, political geographers, security & defense experts and others have been trying to study the issue of human security from different perspectives and direction in order to conceptualise the term in a better way. How safe and free are we as individuals, is a core question behind the whole debate of human security dynamics. And broadly, 'a conception of

1. Economic security,
2. Food security,
3. Health security,
4. Environmental security,
5. Personal security,
6. Community security, and
7. Political security

Security of environmental resources is one of the most important facets of human security dynamics. From time immemorial human beings have been relying on the healthy environment. However, intense urbanisation, rapid population growth, unplanned development etc have over the years led to indiscriminate destruction of environmental resources thus putting the planet under intolerable strain.

> 'Many environmental threats are chronic and long lasting. Others take on a more sudden and violent character... Many chronic natural disasters in recent years have also been provoked by human beings. Deforestation has led to more intense droughts and floods. And population growth has moved people into areas prone to cyclones, earthquakes or floods. Poverty and land shortages are driving people onto much more marginal territory and increasing their exposure to natural hazards. The result: disasters are more significant and more frequent' (UNDP 1994:29).

Following the debates and discussions of 1990s various initiatives at academic and governmental levels have come up in the last few years. Such efforts have, to a large extent, helped the debate on human security to foster and take a more concrete shape. The globalisation and the subsequent reforms across the globe have further made the discourse on human security both lively and intensive. The increasing sensitisation of the civil society at the macro and micro levels is notable in recent times. In India the first National Human Development Report was brought out by the Planning Commission in 2002. This apart, about ten states of India have already worked out their respective human development reports in the last one and half decade and some of them are in the process of preparing their second reports. Further, a number of premier research institute like Jawaharlal Nehru University, National Council for Applied Studies, Delhi Policy Group, Centre for Policy Research, Indira Gandhi Institute of Development Research among many others have been conducting research projects on human security related issues in the country and its neighbouring geographical milieu.

1.3 Environment and Human Security Linkages

> 'There can no longer be the slightest doubt that resource scarcities and ecological stresses constitute real and imminent threats to the future well being of all people and nations. These challenges are fundamentally non-military and it is imperative that they be addressed accordingly' (World Commission on Environment and Development 1987: 330)

Scholars have long been attempting to explore linkages between environment and security. Researches on this theme have been diverse and extensive for centuries. The recent scholarship on the subject can be divided into two general approaches. The first is the domain of environmental determinism. Environmental determinism considers the extent to which environmental factors have shaped the course of human history over the millennia. Scholars of this school of thought argue that contemporary expression of insecurity, violence and conflict have deep and permanent environmental root (Fagan 1990, Ponting 1991, and Diamond 1997).

The second approach focuses on aspects of environmental possibilism. It considers human as an agent of environmental changes through his knowledge and technology. This approach became prominent in the 1970s and has gained considerable attention after the end of cold war. Its major concern is on the immediate and foreseeable security implication of human generated environmental change such as land degradation, deforestation, global warming, pollution, depletion of biodiversity and such other forms of environmental degradation (Deudney and Matthew 1999, Gleditsch 1997, Homer-Dixon 1996, 1999, Homer- Dixon and Blitt 1998, Lipschutz 1989, Lowi and Shaw 2000, Ullman 1983).

According to this school, some of the compressed forms of environmental change already pose direct threats to national interests, regional stability, and the welfare of human kind. Other forms amplify and complicate problems such as poverty, mass migrations, ethnic rivalry, civil violence, and interstate tension and conflict. Still others loom on the not too distant horizon, gathering critical mass and poised to push human being's capacity to adapt to - and perhaps moved beyond - its limits (Matthew, 2002). There are instances when studies have found out that human generated environmental degradation is pervasive, severe, transnational and worsening in nature (UNEP 1997, Wilson 1992).

Advocates of the second approach contend that such forms of environmental degradation adversely affect human welfare as well as social infrastructure all over the world. There are ample studies to suggest that environmental degradation to humanitarian tragedies, intra-State violence, and regional instability. Scholars have gone further to posit that environmental degradation can act as a potential source of serious inter-State conflict in the near future.

In fact, some human generated environmental problems are serious and need proper investigation, although claims about the over-all environmental condition of the planet and its relevance to human species remain highly contested (Matthew 2002, Lomberg 2000).

The advocates of second approach from the three distinct perspectives- Statist view, Humanist view, and Ecologist view - have attempted linkages of environment with security.

The Statist view is concerned with the relationship between new forms of environmental changes and the objectives and practices of traditional national security communities. It is basically worried as to how to protect the sovereignty, territory, culture, and citizens of the two hundred sovereign States in the international system from environmental threats. Some very specific statist concerns may be specified as follows (Matthew 2002:9):

1. How does the State protect access to environmental goods beyond its borders?
2. How does it protect itself from negative externalities such as trans-boundary air pollution or sudden population flows?

3. Does environmental change generate social instability, conflict, and violence? If so, how can State officials predict where and when environmental change will create a situation in which they may have to use force?
4. Do national militaries contribute to environmental change and, if so, can they be greened?
5. Can security assets, such as spy satellites, be used to address environmental problems?

The Humanist view on the other hand is more interested on the welfare of humankinds. 'Instead of two hundred entities to protect, it assumes over six billion individuals in need of security' (Matthew 2002: 9). According to this view, we live in the age of gobalised space where knowledge and technology have eroded or weakened many of the geographical and cultural barriers, which had previously divided humankinds. This has made sovereign State less useful as the primary or sole unit of analysis. Globalisation has brought about tremendous horizontal interaction. It has dramatically expanded opportunities to move and exchange information, ideas, goods, services and other dynamics and as a result made ways to generate wealth, promote mutual understanding, respect and reduce tensions and violence. However, globalisation has also made it more difficult for national governments to provide protection services to their citizens. Across the globe, individuals are insecure in a number of ways that were of little significance in the past. Individuals are insecure from forces that are sub-national, national and international and both natural and human made. Security threats often elude State control thus leaving individuals and groups vulnerable to high levels of insecurity.

Advocates of Humanist view further claim there is a close connection between the productive technologies that have exploited and degraded nature and the economic, political, and cultural structures that have exploited and degraded large segments of humankind. They say understanding and awareness of environmental changes give us an opportunity to rethink our relationship with nature and with other humans. Therefore, the objective of world politics should be to maximise human security. This is 'essential for a healthy existence, and to ensure that everyone lives in societies that respect human dignity and maximise opportunities to live safe and healthy lives' (Matthew 2002: 9).

The gist of Humanist perspective of security in the context of environmental dynamics is that:

1. We should think in terms of human rather that state security because of dramatic changes that have rendered the state less effective as the agent of security in recent times,
2. We should think security in very comprehensive terms because individuals and groups are rendered insecure in a variety of ways. There has been a considerable decline in the threats of inter-state war in the last 60 years while others that are usually ignored or that never existed before like unknown threats like fatal diseases, organic pollutants, loss of biodiversity etc have become primary sources of human insecurity across the globe.

The Ecologist view moves further beyond from 200 political entities and over 6 billion human species to cover importance and value of trillions of living organisms inhabiting planet earth. Its primary assumption is that we have been recklessly transforming and destroying nature on a grand scale. Its leading objective is to secure environment from the unprecedented threats posed by uncontrolled human activity. Its basic message is that by following nature and adapting ourselves to natural parameters and thresholds we will not only cease those activities that are destructive to our life support system, but we may also recover some of the rich purpose of life- spirituality, beauty, truth and simplicity- that has been lost in our consumer societies (Capra 1996, Sessions 1995).

According to Ecologist perspective of security, the whole is greater than its parts and must be at the centre of analytical and normative thinking and policymaking. To quote Capra:

> 'The paradigm that is now receding… consists of a number of entrenched ideas and values, among them the view of the universe as a mechanical system… the view of the human body as a machine, the view of life in society as a competitive struggle for existence, the belief in unlimited material progress…The new paradigm may be called a holistic worldview, seeing the world as an integral whole rather than a dissociated collection of parts' (Capra 1996: 6).

To a great extent, the various perspectives of environment and security linkages highlight different rather than alternative values and aspirations. Few people are likely to choose the condition of the environment, the condition of humankind or the state, as the single and unconditional reference point for all reasoning and action. We are more complex than that and we realise both the appeal of each perspective and the reality of compromise. Legitimacy and tensions among various perspectives add complexity to the task of linking environment and security. Where does the linkage begin or end? Perhaps the most accurate answer is that in the web of life there is no beginning or end (Matthew 2002).

Table 1.1 SELECTED DESCRIPTIONS OF HUMAN SECURITY

Human Security in Major Reports of International Institutions	
Human Development Report United Nations Development Programme 1994	The UNDP 1994 Human Development Report articulated a universal, preventive, 'people centred' approach to human security that focused on 'freedom from fear and freedom from want'. The Report defined human security as: 1) Safety from chronic threats such as hunger, disease and repression. 2) Protection from sudden and hurtful disruptions in the patterns of daily life- whether in jobs, in homes or in communities.
Human Security Now 2003 Commission on Human Security	The Commission on Human Security clarified the concept of human security while retaining its people-centred focus, and its concentration on threats from both poverty and violence. 1) The Report defined the objective of human security as 'to protect the vital core of all human lives in ways that enhance human freedom and human fulfilment'. 2) Human Security is realised by joint strategies of *protection*- crafting institutions that protect and advance human security- and *empowerment*- enabling people to act on their own behalf.
Millennium Report The United Nations Kofi A. Annan 2000	Human Security in its broadest sense, embraces far more than the absence of violent conflict. It encompasses human rights, good governance, access to education and health care and ensuring that each individual has opportunities and choices to fulfil his or her own potential. Every step in this direction is also a step towards reducing poverty, achieving economic growth and preventing conflict. Freedom from want, freedom from fear and freedom of future generations to inherit a health natural environment- these are the interrelated building blocks of human- and therefore national security.
Responsibility to Protect 2002 International	Human security means the security of people- their physical safety, their economic and social well-being, respect for their dignity and worth as human beings, and the protection of their human rights and fundamental

commission on Intervention and State Sovereignty	freedoms.
World Development Report The World Bank 2000/2001	Today, security comprises two interrelated concepts: the state's role in protecting its borders from external threats and its role in ensuring 'human security' for its citizens under the broader umbrella of human rights- meaning that every person is entitled to be freedom of operation, violence, hunger, poverty, and disease and to live in a clean and health environment.
	Human Security in Nations and NGOs
Canadian Department of Foreign Affairs	Human security is a people centred approach to foreign policy which recognises that lasting stability cannot be achieved until people are protected from violent threats to their rights, safety or lives.
Global Environmental Change and Human Security Project	Human security is achieved when and where individuals and communities: 1) have the options necessary to end, mitigate, or adapt to threats to their human, environmental, and social rights; 2) actively participate in attaining these options; and 3) have the capacity and freedom to exercise these options.
Japanese Ministry of Foreign Affairs 1999	Human Security comprehensively covers all the menaces that threaten human survival, daily life and dignity...and strengthens efforts to control these threats.
	Human Security in current literature
Lloyd Axworthy 1999	Safety for people from both violent and non-violent threats.
Fen Hampson *et.al* *Madness in the Multitude* 2002	The concept of 'security' can be defined as the absence of threat to core human values, including the most basic human value, the physical safety of the individual. They identify core human values as physical security and the protection of basic liberties, economic needs and interests.
Jessica Mathews 'Power Shift'	Human security 'is creeping around the edges of official thinking, suggesting that security be viewed as emerging from the conditions of daily life- food, shelter, employment, health, public safety- rather than flowing downward from a country's foreign relations and military strength.'
Rob McRae in *Human Security and the New Diplomacy* 2001	The concept of human security is, in principle, quite broad. Its takes the individual as the nextus of its concern, the life as lived, as the true lens through which we should view the political, economic and social environment. At its most basic level, human security means freedom from fear.

Caroline Thomas *Global Governance, development and human security* 2000	Human Security describes a condition of existence in which basic material needs are met and in which human dignity, including meaningful participation in the life of the community can be met.

Source: adopted from Alkire 2003: 48

1.4 Mountain Environment and Human Security Concerns[1]

Mountains form one of the most important bio-geographical resource zones of the world. They are remote areas covering 52 per cent of Asia, 36 percent of North America, 25 per cent of Europe, 22 per cent of South America, 17 per cent of Australia, and 3 per cent of Africa making up, in total, 24 per cent of the earth's continental surfaces (Bridges 1990:260). They encompass some of the most awe-inspiring landscapes, a great diversity of species and habitat types and distinctive, tenacious and often disadvantaged human beings. They directly support the 22 per cent of the world's people who live within mountain regions (UNEP-WCMC 2002:8). A further 40 per cent live adjacent or very close to mountain areas (CEE 2002) and are benefited from mountain resources in more than one ways. Well over half the global population depends on mountain environments for a wide range of goods and services including for water, food, hydro-electricity, timber, biodiversity maintenance and mineral resources besides availing opportunities for recreation and spiritual renewal. Up to 80 per cent of the planet's fresh surface water comes from the mountains (Price 2002:72). Hence, mountains are very significant to human in a variety of ways. Scholars have often argued that the future security of the planet's growing human population rests in great measure on mountain watersheds.

Mountains are, however, fragile resource zones and are highly susceptible to both natural forces and anthropogenic factors. Mountain people faces an environment where everyday

[1] The section will not go into the details of physical geography and human dynamics of mountain environments. A standard textbook on world geography can be referred in this regard. Further, pressures on mountains both natural and human made have also been dealt briefly. Detailed study on physical and human geography and the resultant pressure on mountains are examined in subsequent chapters when cases from the Himalaya are taken up.

physical demands are great, natural hazards are significant and agricultural production is constrained. Only about 3 per cent of land ranked as highly suitable for rain-fed agriculture is within mountains, highlighting the restricted livelihood opportunities available to many mountain people (UNEP-WCMC 2002:8). Further, difficult access with socio-economic and political marginalisation often compounds the problems. In recent times many anthropogenic activities have been aggravating the natural setup of mountains. Studies across the globe have found that the health of the world's mountains is in dire need of relief from modern anthropogenic activities that are causing lasting environmental damage and human insecurities (Eckholm 1975, Ives and Pitt 1988, Ives and Messerli 1989, Agenda 21: Chapter 13, 1992, Jodha 1995, 2005, UNEP-WCMC 2002, UN 2002). According to analysis of the United Nations University, pressures from tourism, development, pollution, deforestation, climate change, and other forces is permanently eroding the landscape of many mountain ranges, with serious implications for society (National Geographic News 2002: February 1). Some of the major consequences of these processes include water shortages and increased natural disasters such as landslides, avalanches, catastrophic flooding, soil erosion; loss of genetic diversity; armed conflicts; wildfires; high winds; and extremes of temperature and radiation among others.

> 'War and natural disasters have long plagued mountain regions. Researchers have determined natural disasters in mountain regions worldwide were responsible for almost 1.6 million lives lost between 1900 to 1988, the foremost causes being floods and earthquakes. Other figures show that combat in mountain regions – some 105 wars and conflicts between 1945 and 1995 – resulted in 11.1 million casualties, including 7.8 million civilians' (UN News Release 2002: January 27).

Restoring mountain ecosystems, improving mountain people's livelihoods, managing watersheds – and other aspects of environmental stewardship in mountain areas – will require long-term local and regional cooperative programmes between communities, private and public stakeholder associations, policy-makers and development financiers. Keeping in view the plight of the mountains across the globe in recent times, The United Nations designated 2002 as the International Year of the Mountains to draw attention to ecological degradation of mountains and promote policies that help protect the critical resources and services they provide. Further, in view of their fragility and their overall significance as regulator of global ecological balance, scholars have argued that mountains deserve the level of concern afforded to other global ecosystems such as wetlands, forests and coral reefs.

The problems and constraints characterising mountain areas are varied and complex, requiring multidimensional interventions. Some of the major problems[2] that have direct bearing on the human security in mountain areas and their geographical milieu may be listed and briefly discussed below:

1.4.1 Degradation of Environmental Resources

Traditionally mountains were identified as backward, inaccessible, and remote geographical locations inhabited by semi-civilized tribal people. Mountains were physically isolated from the mainstream society and economy and consequently from overall development paradigm. Hence, mountain regions and the people living therein were physically, socially, economically, and politically isolated and excluded. As a result they were marginalised from the mainstream development processes. Although such features are still true in many mountain regions of the world, there are, nevertheless, plenty of instances where processes of development have gradually penetrated into these marginal locations in recent times exposing them to variety of modern forces. These so-called modern forces include tourism development, communication and other infrastructure development, unplanned growth of population both through natural process and migration from the lowlands, advent of modern technological tools, rise in consumerism, commercialization of mountain culture and economy, transfer of mainstream culture to mountains and gradual death of traditional/cultural institutions, and such other agents of modernity. The onset of globalisation in the last couple of decades further accelerated the process of integration of mountain economy and society to the mainstream. Consequently, the fragile environment of mountains and resource bases therein got exposed to various uninvited forces that were not

[2] These problems are mainly human-made that have over the years exasperated or accelerated the natural processes like floods, landslides, soil erosion etc. operating in mountain system.

congenial to the health of mountain ecology. More so, the unplanned way in which the modern development arrived in mountains was far from acceptable to the intricate ecosystem operating therein.

1.4.2 Conflict and War

One of the greatest challenges of human security in mountain regions is the chaos created by conflict and war. Physical isolation excludes the mountains and populations therein from development, resulting in political and economic marginality often resulting into socio-cultural and ethnic conflicts in many cases. In 1999, 23 of the 27 major armed conflicts in the world were being fought in mountain regions (Diouf 2002). Such locations as Afghanistan, Kashmir, Caucasus, and 'Kurdistan' are prominent in this regard but the so-called defensive stances, guerrilla warfare, the drug wars, and the systematic repression of mountain ethnic minorities (Ives 2002) are no less elements that have severely tested the human security. Where there is armed conflict, lives become painful to the common people, as they cannot carry out fundamental life-sustaining tasks. The local ecology degrades due to conflicts with far reaching impacts making extremely difficult for the rural mountain people to practice agriculture. Often, soldiers or those who dominate the conflict claim what little food exists. In some cases, agricultural lands may be seeded with land mines, making the recovery from war a prolonged fight for survival. Unless the disaster of mountain warfare is effectively tackled, the prospect for sustainable mountain development over much of the mountain world is exceedingly grim.

1.4.3 The Issue of Sustainable Livelihood

Subsistence agriculture was the mainstay of mountain communities for long. However, with the advent of modern development paradigm and penetration of market forces things are changing for bad in several pockets of mountains. People living in and around urban centres have access to many of the modern technologies and other parameters of development. Gradually, their perception about life has been changing. They have already started to think in a more commercial ways than their forefathers who otherwise thought at subsistence levels. In remote, rural and inaccessible areas too situation is changing with time. With the rapid growth of people there are no adequate food supplies. Agriculture is yielding less due to several natural and man-made challenges. Land, water and forest resources are getting scarcer with increased intensification of resource use. Further, 'human pressures on mountain resources has led to both intra and international conflicts between highland and lowland, perhaps most notably in south Asia where subsistence farmers in the Nepal Himalaya have been blamed by India and Bangladesh for flooding, sedimentation and stream channel shifting in the Ganges River Plain and Delta' (Ives and Messerli 1989: 295)[3].

1.4.4 Institutional and Policy Gap

For long mountains were not seen by the governments as a separate and unique geographical unit of the earth needing different institutions and policies to govern them. Institutions and development policies of the mainstream 'prime locations' were extended to the 'marginal locations' like mountains and consequently several environmental and socio-cultural problems were invited. Although developed world recognised the prevailing lacuna in their governance much earlier and have been trying to address the same through alternative institutions and policies measures mountains of less developed countries are still at the mercy of mainstream institutions. Development polices and programmes have consistently failed to identify and address needs of the mountains and aspirations of the people therein. Even when attentions have been given, mainstream approaches have at several cases proved inappropriate and thus have resulted many adverse impacts on the socio-economy and environmental set-up of the region. It is important for the development planners and policy makers to understand that mountains demand an individual approach. This becomes essentially imperative because the effects of slopes and elevation of mountains add a unique dimension to the challenges in addition to such constraints present in the lowlands.

[3] This issue has been discussed in greater detail in chapter 4.

1.4.5 Inadequate Knowledge Base

Understanding of mountains and the intricate linkages between physical and socio-cultural dynamics are still limited to indigenous people of the mountains and few others outside the mountains. There is an appreciable gap in knowledge bases with respect to the socio-economic characteristics, traditional-institutional and ecological processes operating in mountain areas. Further, no serious and systematic attempt has been made to understand the various fallouts of modern development in mountain regions, like climate change, pollution, armed conflict, population growth, resource degradation, changes in agricultural patterns and practices, mining, unplanned tourism development, urbanisation and associated infrastructure development etc. and their impact on the overall environmental and human security. Chapter 13 of Agenda 21 (1992)[4] has identified persistent knowledge gaps in the understanding and delivery of sustainable mountain development as an area of great concern. Therefore, a far greater effort needs to be invested in order to understand various challenges faced by mountains in near future. Further, there is need for a more robust and science based research than a mere media reporting and popular write-ups based on assumptions and suppositions in order to have sufficient and authentic database for effective policy formulation.

[4] Agenda 21 is a 40-chapter statement of goals and potential programmes produced by delegates at the 1992 UN Conference on Environment and Development, known as the Earth Summit, in Rio de Janeiro. By devoting Chapter 13 to mountains, Summit participants placed mountains on an equal footing with climate change, desertification and other issues of global importance. It can be downloaded from http://www.un.org/esa/sustdev/documents/agenda21/english/agenda21chapter13.htm

Table 1.2 IMPORTANT PARAMETERS OF HUMAN SECURITY/INSECURITY SHARED BY MOUNTAIN REGIONS AT GLOBAL LEVEL

Sl. No.	Parameter	Global Value (%)
1	Area defined as mountains of global land*	27.2
2	Population distribution	21.9
3	Endangered Languages worldwide that occur in mountain regions**	28.0
4	Terrestrial precipitation worldwide falling in mountain region***	24.0
5	Forests worldwide occurring in mountain regions	23.0
6	Susceptible area worldwide that occurs in mountain regions****	31.0
7	Fires worldwide that occur in mountain regions	24.0
8	Severe climatic change# simulated worldwide	23.0
9	Area converted to agriculture worldwide that occurs in mountain regions	16.0 (to cropland) 21.0 (to grazing)
10	Suitable area (for agriculture) worldwide that occurs in mountain regions	03.0
11	Deforestation (1992-2000)@	01.3
12	High impact land worldwide (from infrastructure development) in mountain areas for the year 2035	24.0
13	Area within the radius of a war worldwide that occurs in mountain regions##	32.0
14	Area worldwide with three or more severe pressures that occurs in mountain regions	24.0
15	Protected area worldwide that occurs in mountain regions$	32.0

* Also includes Antarctica; ** here defined a 1-100 speakers; ***Antarctica not included
**** Destructive` earthquakes (level VIII or greater on the modified mercalli scale)
# Severe climate change is defined as areas where either temperature increases by more than 2.5° C or precipitation decreases by more than 50mm/yr by 2055m averaged for the five GCMs.
@ Data refers to percent changes in mountain areas only.
A war is defined as a conflict in which at least 1000 battle deaths a year occurred for at least 1 year between 1946-2001.
$ The percentage of protected area that occurs in mountain regions is slightly larger that the percentage of the total global area defined as mountains (27%).
Source: Compiled from: UNEP-World Conservation Monitoring Centre, *Mountain Watch*, 2002 (various chapters)

1.5 Literature Review

Concerns of the destruction of environmental parameters have been there since time immemorial. Documentation of the depletion of soils and forests in ancient Greece are found in Plato's works. More recently, Dickens and Engels eloquently wrote on the wretched human conditions spawned by the Industrial Revolution. The surge in concern about environmental quality and human welfare has, however, been uniquely widespread and impassionate in the last four decades or so. The United Nations Conference on the Human Environment, held in Stockholm in 1972, provided a focal point for gathering environmental concerns of the 1960s. One of the most significant outcomes of this conference was the establishment of United Nations Environment Programme (UNEP) to sponsor environmental activities at the global levels. Events since 1972 have brought many people's ideas-both about the nature of the challenges and about the nature of required responses-down to earth (Eckholm 1982: 5).

In the year 1980 a report was released by the major global conservation coalition, the International Union for Conservation of Nature and Natural Resources (IUCN), in cooperation with the World Wide Fund for Nature (WWF) and UNEP. The report, called *World Conservation Strategy,* came up with a new[5] and sophisticated approach to environment and development and attempted to provide guidelines for the management of the earth's living resources. It went far beyond the usual conservation manifesto. It led stress to ensure the sustainable utilisation of species and ecosystems, which support millions of rural communities as well as major industries. It further declared, the combined destructive impacts of a poor majority struggling to stay alive and an affluent minority consuming most of the world's resources were undermining the very means by which all people can survive and flourish.

Eckholm (1982) while examining the global environment since Stockholm Conference (1972) observed that famine in the third world amid the spread of desert like conditions

[5] Most of the earlier conservationists talked about the protection of endangered animals and establishment of parks and preserves. They hardly talked about other associated ecological dynamics including human.

during a lengthy African drought in the early 1970s; disastrous increases in erosion, landslides, and flooding down stream of denuded hills in large areas of Africa, Asia, and Latin America; shortages and soaring prices for the firewood on which half of humankind depended for cooking and warmth were the symptoms of the tragic cycle of degeneration undermining the livelihoods of worlds poor. He further recorded that rapid population growth and lack of economic opportunities have pushed ever more people into marginal areas like desert fringes, mountain slopes, rain-forest lands not suited to farming and where resource destruction might be the only feasible way of eking out a living. He warns that unless governments have the political will to confront established interests and the political capacity to follow with effective programmes, the new rhetoric will remain hollow.

It was in the autumn of 1987 that for the first time the concept of environmental security was officially mentioned in the International Conference on the Relationship between Disarmament and Development, convened by the United Nations General Assembly in New York. The final document adopted by consensus by the representatives for 150 participating States, says:

> 'Recently non-military threats to security have moved to the forefront of global concern. Underdevelopment and the declining prospects for development as well as mismanagement and waste of resources, constitutes challenges to security. The degradation of the environment presents a threat to sustainable development...Mass poverty, illiteracy, disease, squalor and malnutrition affecting a large proportion of the world's population often becomes the cause of social strain, tension and strife' (Gaan 2000:9).

The report, *Our Common Future*, by the World Commission on Environment and Development commonly called the Brundtland Report (1987) stressed the influence of environmental degradation on the relationship among States.

World Bank *et al.* (2005) stressed the urgent need to look beyond aid projects, debt relief and trade reform and focus on local natural resources to address the crisis of poverty in all parts of the globe. The report found that environmental organizations did not address poverty and development groups did not consider environment enough in the past. The model presented in the report detailed how natural resources – soils, forests, water, fisheries – managed at the local level were frequently the most effective means for the world's rural poor people to create wealth for themselves.

In the last two decades, scholars of International Relations have increasingly been trying to show a clear-cut connection between environmental security, human well-being and national security. They have argued that environmental issues should have a status as military problems have. The assumption that environmental degradation might cause conflict, and often on large scale warfare between states, became important part of the discussion of security experts after the demise of the cold war (Dalby 2003). Considerable scholarly empirical research and debate were triggered in various places in this connection.

According to Norman Myers (1986), national security is not just about fighting forces and weaponry. It relates to watershed, croplands, forests, genetic resources, climatic and other factors that rarely figure in the minds of military experts and political leaders, but increasingly deserve, in their collective, to rank alongside military approaches as crucial to a nation's security.

Rifkin (1991) pointed out the environmental threats facing the planet are not simply the result of scientific miscalculation. Nor are they merely the consequence of ill-conceived management decisions. Ironically it is the notion of security upon which our entire modern world view is based that has led us to the verge of ecocide. In less than a century the practice of geopolitics has pushed the world to the brink of both nuclear Armageddon and environmental catastrophe forcing us to reconsider the basic assumptions of security that animate the modern world view.

Thomas Homer Dixon's team (1998, 1999) of researchers posited a series of complex linkages between environmental scarcities and social responses, which when coupled with other political factors such as weak states with inadequate capacities for resource management, inappropriate infrastructure provision or conflict resolution would likely lead to overt conflict.

Lothar Brock (1991) defined environmental security as the avoidance of negative linkages between the environment and human activities. According to him, this includes the avoidance of warfare, war over natural resources and also environmental degradation, which is also a form of war.

El-Ashry (2000) defined environment security as the state of dynamic equilibrium between the appetite of mankind and resources of nature. He further stated, environmental security depends on millions of actions and interactions in hundreds of thousands of jurisdictions no single authority can single handedly control. Environmental forces transcend borders and oceans to threaten the health and welfare of the people.

Dalby (2003) went further ahead to tell 'discussion of environment and security are ineluctably part of the larger constructions of geopolitics and as such need to be examined in this discursive context' (p 5073). In this connection Dalby argued 'the scale and context under which conflict might occur and the multiplicity of factors that might be considered environmental resources by many diverse cultures and economies make generalisations very difficult' (p5074).

The context of environmental insecurity and resultant conflict may either be scarcity or abundance. Empirical evidences highlight the probability of both the situations as valid. Michael Klare (2000, 2001, 2001a) argued that resource issues would likely affect world affairs significantly in the years ahead. This impact might not always take the form of discord and conflict, but would certainly demand growing attention from policymakers. Whether in the economic, environmental, or politico-military area, resource concerns are certain to rise on the international policy agenda. The earlier arguments of Michael Clare assumed that conflicts occur due to the absence of supplies of key resources like oil. He, however, updated his lines of argument more recently when he emphasised on the scarce water as the focus of conflict in a number of situations.

Abundance and struggle for the control over resources leads to conflicts. According to Dalby (2003) abundance is understood as a problem rather than scarcity. Further, Dalby argued that if there was violence over the control of resource like oil supplies because it was abundant, it was because they were in demand and hence relatively scarce elsewhere. It is precisely these facilities where the resource is geographically abundant there are the location of military activity. In this context Hamlet Bareh, (1987) gives the example of how khasi tribe as a pioneer tribe and a specialists in rice farming in Vietnams Red River Delta came into conflict and were forced to move up towards Yunnan, China, and across northern Burma, into Assam and Ganga basin when conquered by the Vietnamese. Further, as the Gangetic agrarian societies expanded their territorialism Khasis along with other minor tribal groups again came into conflict and were forced to submit, assimilate or move.

The scale of environmental conflict is the other important bone of contention in the debate of environmental security. The scale can be either intra-national (sub-national/local) or inter-national. In this connection the studies of Homer Dixon *et al.* (1998, 1999) concluded that environmental violence was likely to be small scale, diffused and mostly on a sub national scale although with the ever-present possibilities of international dimensions where displaced population crossed state boundaries. They suggested that intra-ethnic disputes were the more common out come of environmental insecurities.

However, Dalby (2003) suggested that both the context and scale of environmental insecurities are geographically and politically located. He further made it clear that the links between resources, environments and conflict are clearly numerous, and their construction in political and academic discourse is unlikely to follow any single formulation, nor is there any reason to think that conflict and resources can be connected by a unidirectional causation.

The relevance of environmental problems to the pursuit of security makes it abundantly clear that environment is no longer be regarded a 'low politics' area, but is of utmost importance as a cross cutting issue to be dealt with by all parts of societies and their governments.

1.6 Environment and Human Security Discourse in the context of Mountain Areas

Discourse among the scholars with respect to environmental concerns across the mountains and overall ecological balance and consequent impact on the well being of human goes back to 1970s. It was in the conference of Munich in December 1974 that Professor Jack Ives and his colleagues for the first time highlighted problems that the world's mountains faced over the years, in particular the Himalayas. The conference led to three major outcomes that paved the way for a more concrete discourse on the mountain issues in the years to come. The first was an alarmist report (Losing Ground, 1976)[6] authored by the New York Times science editor, Eric Eckholm. The second outcome was the establishment and publication of a journal *Mountain Research and Development* in 1981. It still continues to serve as an important forum for physical and social scientists and the third outcome was the establishment of International Center for Integrated Mountain Development (ICIMOD) in Kathmandu in 1982.

The 1980s saw considerable amount of academic literature on the ground with regard to mountain environment, more so on the environmental issues of the Himalaya. Further, in May 1986, The Mohonk Mountain Conference was held in order to debate on the 'Himalaya-Ganges Problem'. The main objective of the conference was to discuss and debate on the prevailing environmental paradigm on the Himalaya and it's down stream impact. The conference led to the publication of '*The Himalayan Dilemma: Reconciling Development and Conservation*' (1989) under the authorship of Ives and Messerli[7]. The book asked for a more focused and rigorous empirical research in order to substantiate many environmental issues that had been raised in the context of mountain areas, and specifically the Himalaya. It further cautioned the governments and policy makers not be lured by the often opportunistic media reports and popular write-ups most of which were based on assumptions and emotions.

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[6] His thesis demonstrated relationship between population growth, deforestation, soil erosion, and down stream impacts. The thesis propagated by this report and many such publications that were in the line of this thesis gave birth to the 'Theory of Himalayan Environmental Degradation'.

[7] A large number of research studies have come up since then. Majority of the studies have criticised the theory.

The Rio Summit, 1992, dedicated a chapter (chapter 13) on its Agenda 21 to discuss pertinent environmental problems characterising mountains with the consequent ecological and human implications. The chapter titled, 'Managing Fragile Ecosystems: Sustainable Mountain Development' states:

> 'Mountains are an important source of water, energy and biological diversity. Furthermore, they are a source of such key resources as minerals, forest products and agricultural products and of recreation. As a major ecosystem representing the complex and interrelated ecology of our planet, mountain environments are essential to the survival of the global ecosystem. Mountain ecosystems are, however, rapidly changing. They are susceptible to accelerated soil erosion, landslides and rapid loss of habitat and genetic diversity. On the human side, there is widespread poverty among mountain inhabitants and loss of indigenous knowledge. As a result, most global mountain areas are experiencing environmental degradation. Hence, the proper management of mountain resources and socio-economic development of the people deserves immediate action'[8].

Two programme areas were included in the chapter to further elaborate the problem of fragile ecosystems with regard to all mountains of the world. These are:

a. Generating and strengthening knowledge about the ecology and sustainable development of mountain ecosystems;
b. Promoting integrated watershed development and alternative livelihood opportunities.

Further, the Global Mountain Forum was established in year 1995 through international collaboration from non-government organisations, universities, governments, multilateral agencies, and the private sector. It promotes global action toward equitable and ecologically sustainable mountain development. This is sought through information sharing, mutual

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[8] It can be downloaded from http://www.un.org/esa/sustdev/documents/agenda21/english/agenda21chapter13.htm (accessed 21 April 2007)

support and advocacy. In order to achieve these objectives the Mountain Forum uses modern and traditional communications, supports networking and capacity building and encourages members to be proactive in advocating sustainable development of mountain areas (www.mtnfourm.org, accessed on 22 September, 2006).

In 1996, the President of the Kyrgyz Republic at the international conference 'Mountain Research – Challenges for the 21st Century' for the first time spoke up his mind to propose 'mountains' as a theme for an international year. Two years later, the UN General Assembly adopted resolution 53/24, in which it proclaimed 2002 as the International Year of Mountains. The resolution encouraged Governments, the United Nations system and all other actors to take advantage of the Year to increase awareness of the importance of sustainable mountain development. In the same resolution, the General Assembly invited FAO to serve as the lead agency for the Year, in collaboration with governments, UNEP, UNDP, UNESCO and other relevant organisations of the United Nations system and NGOs.

The UN report (2002) identified mountain ranges around the world where conditions are most troubling. The Himalaya-Karakorum-Hindu Kush range—extending from the borders of Myanmar and China across northern India, Bhutan, Nepal, Pakistan, and Afghanistan—are at the top of the list. According to Professor Jack Ives, author of the report, 'the most severe examples of environmental and socioeconomic degradation—now near total disaster—are the Hindu-Kush in Afghanistan, the Karakorum and Western Himalaya and the disputed territory of Kashmir'. Ecological destruction, poverty, and the repression of ethnic minorities, Ives warns, are feeding conflicts in Himalayan countries that threaten to turn the Asian mountain range into 'the next Afghanistan'.

The year 2002 saw series of conferences, seminars, consultations and research studies at local, national, regional and global levels. As the culminating event of the International Year of Mountains, the Bishkek Global Mountain Summit was held towards the end of the 2002. The summit gave birth to The Bishkek Mountain Platform[9]. The objective of the Platform is

[9] Details of the platform available at: http://www.mountainpartnership.org/news/stories/2002/bshkekmtplat.html#top [accessed on 15 January 2007]

to continue with existing initiatives and to develop substantive efforts beyond the year by mobilising resources, giving orientation and guidance, and promoting synergies. In particular, it will provide a framework for stakeholders and others to contribute to sustainable development in the world's mountain regions. It will enable them to act together at all levels from local to global to improve livelihoods of the mountain people, to protect mountain ecosystems and to use mountain resources more wisely. The Platform furthermore, serves as a contribution to debate in the General Assembly of the United Nations and to the achievement of the Millennium Goals[10].

In September 2002, the World Summit on Sustainable Development (WSSD) was held at Johannesburg, South Africa. The summit highlighted the need to reflect back on the pertinent environmental issues characterising the major resource zones of the world. It agreed that the protection of the environment and socio-economic development are fundamental to sustainable development that was brought out under the Rio Principles. The summit agreed on a series of commitments that were backed by specific government announcements on programmes and by partnership initiatives. In his speech at the conference, Mr. Kofi Annan[11] said, 'we have to go out and take action. This is not the end. It is the beginning'. This conference addressed mountains on a wide front, tackling environmental degradation, poverty, inequities adversely affecting women, indigenous peoples and mountain communities, diversification of economic investments and new ways of sharing benefits. The report of the Summit spelt out the plan of action in paragraph 40 of its 'Plan of

[10] -To eradicate extreme poverty and hunger: the stated overall goal is to reduce the proportion of people living on less than US$l day to half the 1990 level by 2015 - from 29 percent of all people in low and middle income economies to 14.5 percent. If achieved, this would reduce the number of people living in extreme poverty to 890 million (or to 750 million if growth stays on track)

-To achieve universal primary education

-Promote gender equality and empower women

-Reduce child mortality

-Improve maternal health

-Combat HIV/AIDS. malaria. and other diseases

-Ensure environmental sustainability

-Build a global partnership for development.

[11] Then Secretary General of the United Nations

Implementation' for the sustainable development and sufficient human security in mountains regions. 'Mountain ecosystems support particular livelihoods and include significant watershed resources, biological diversity and unique flora and fauna. Many are particularly fragile and vulnerable to the adverse effects of climate and need specific protection... (Paragraph 40)[12]'.

The United Nations Environment Programme (UNEP)-World Conservation Mountain Centre brought out a succinct report in 2002 putting light on the plight of the mountains of the world and supplemented its arguments with several case studies. The aim of the report as highlighted in its executive summery is to 'support the implementation of policy initiatives focusing on sustainable development of mountains, including Chapter 13 of Agenda 21 and the Plan of Implementation of the World Summit on Sustainable Development (WSSD) (p8). The report provides the first systematic assessment of mountain ecosystems, using a geographic information system (GIS) analysis of global data, presented as a visual, map-based overview of:

- the ecological and social values of mountain ecosystems;
- current and potential pressures facing mountain environments and people;
- tools and approaches for sustainable development in mountain areas.

The UN General Assembly on its fifty- seventh session (January 2003) via agenda item 86 passed a resolution[13] acknowledging the achievements of the International Year of Mountains 2002 and taking note of various mountain initiatives taken so far for the sustainable development of the mountain regions. It further designated 11 December as International Mountain Day.

In 2003 the Food and Agriculture Organisation (FAO) submitted a report to the UN General Assembly. The Secretary General formally transmitted report to the General Assembly on

[12] Full text available at: www.johannesburgsummit.org [accessed 8 march, 2007]
[13] http://www.mountainpartnership.org/partnership/p-what.htm#globalagenda [accessed 8 march, 2007]

fifty-eighth session of the assembly, on 11th July 2003. The report[14] titled 'International Year of Mountains, 2002' described achievements made at the national, regional and international levels throughout 2002, with emphasis on activities that ensured the International Year of Mountains, 2002, was more than a communications event but a catalyst for long term, concrete action for sustainable mountain development. It also highlighted the challenges that lie beyond the year and provides suggestions for considerations by the General Assembly as to how countries might continue to promote and effectively implement sustainable development in mountain regions around the world.

Mentioned should be made here that a section of mainstream mountain researchers (Ives and Messerli 1989, Thompson and Warburton 1985a, 1985b, Ives 2005 and others.) in the last couple of decades have increasingly challenged many of the theses of mountain degradation propounded by some scholars (like Eckholm) and international aid agencies (like World Bank, FAO, World Resource Institute, WWF, UNEP etc). Further, many of the popular statements made by media and NGOs in the context of falling environmental situation of the mountains have not been quite accepted by them. They have criticised the alarmist and exaggerated approach of these institutions and have lamented that their stories are based not on rigorous research and scientific facts but on assumptions, suppositions and emotions. According, to them mountain environment is degrading but not at the alarmist rate as put forth by international aid agencies, media reports, a section of scholars, and some NGOs. It has more to do with the environmental geopolitics and vested interests rather than highlighting the genuine environmental problems faced by the poor mountain minorities and solving them, they say.

1.7 Relevance of the Research Study

In the post cold war era environment has emerged as a major area of concern as a potential cause of conflict in terms of socio-cultural and political conflict. It is argued that environmental degradation would lead to warfare, as scarcity would drive desperate people to

[14] The report can be downloaded from http://www.mountainpartnership.org/partnership/p-what.html#globalagenda [accessed 2 April, 2007]

fight for the remaining resources. The ever increasing environmental problems and the consequent human threats need an attention with respect to which the conventional outlook of national security has been incongruent over the years. The study of the link between environmental degradation/environmental scarcity and the consequent human and national security has become important with many civil and political strives occurring within and among the nations. Ensuring human security through environmental interventions would bring about comprehensive human development, which may transform the entire security parameters. This may in-turn lead to a gradual transformation of the traditional perception of security with military perception to a more liberal and holistic framework of human security that would also underpin socio-economic and environmental indicators besides military security.

Although there have been some attempts to explore aspects of environmental security, literature in this regard continue to remain limited, scattered and unorganised. No serious, systematic and focused research has been attempted on this vital aspect of human security concerns. In short, there is a notable gap with respect to theoretical, conceptual and applied research on environmental security. As a consequence, the policy makers have to rely on the limited knowledge and scattered database in formulating policies and taking major decisions on environmental security issues. The concept of environmental security broadens the traditional concept of national security to include natural resources and related aspects of environment. This partly emerges from the fact that environmental change could be a potentially key variable in both triggering and affecting conflict. The proponents linking environmental problems to non-traditional security concerns strongly argue that environmental degradation often undercuts economic potential and human well being which in turn helps fuel political tensions and conflicts. They also advocate that environmental security issues not only raise awareness of environment threats but would also spur collective action for better compliance with international environmental agreements. This could lead to national and international responses essential to achieve sustainable development.

How we draw knowledge and make policy have been the subject of vigorous debate and analysis across the globe. The Himalayan region- where scientists, statesmen and citizens confront a unique set of environmental challenges and political legacies- provides a powerful case study (Blaike and Muldavin 2004) in this regard.

1.8 Plan of the Study

1.8.1 Aims and Objectives

The primary aim of this study is to explore the alternatives and possibilities of enlarging the scope of traditional security perceptions and its deterministic matrices. It has the following objectives:

1. to examine major environmental forces in the Himalayan region and their bearing on the human security in the region;

2. to highlight the necessity of evolving alternative security paradigm in the Himalayan frontier based on environment and human wellbeing.

1.8.2 Hypotheses

The study is based on the following hypotheses:

1. Geo-environmental complexities in the Himalaya negatively impact human security in the area and its surrounding geographical milieu;

2. Environmental degradation in the Himalaya has amplified human insecurity in and around the region.

1.8.3 Methodology and Database

The region under study has been dissected both latitudinally and longitudinally on the basis of the available literature. Criteria as followed in the disciplines of Geography and Geomorphology are followed in this regard. It is important to understand at the outset that the geographical boundary of the Himalaya is still a disputed concept. Some scholars have maintained that some part of Northeastern Pakistan and some part of southern Tibetan Plateau in China as units of Himalaya while some others do not agree with such delineation. Similarly, some parts of northern Assam do display the features of Himalayan geomorphology and geology. However, their political/administrative boundaries are difficult to delineate and the quantification of the problems therein is hardly possible as data are not available. This is so, because they do not fit into any clear-cut administrative/political units. Therefore, while this study takes the instances from these regions, wherever the material is available, it does not quantify the indicators from these regions. Further, keeping in view the historical, socio-economic and political diversities of the Himalaya the study lays more importance on the regional/political divisions over physiographic classifications and a comparative study of Sikkim and Eastern Nepal is attempted.

The study is managed mainly by drawing knowledge, experiences and practices of various formal and informal institutions engaged in environment and related issues. The information is gathered with the help of interactions with different institutions, policy makers, private sector actors and grass root organisations. Further, both published and unpublished reports, papers and articles available with various government and private agencies have been extensively utilised in the study besides the secondary published material. In order to authenticate the secondary data, field visits were made both in Sikkim and Eastern Nepal. The study is mainly guided by geographical/spatial considerations.

CHAPTER 2
Himalayan Geo-Environment and Human Dynamics

2.1 Introduction

The basic purpose of this chapter is to offer a brief overview of general geography of the Himalayan region. Regrettably, there is no recent systematic treatment and hence is difficult to produce a justified regional breakdown (Ives and Messerli 1989). The chapter, nevertheless, attempts to briefly indicate the region's complexity by summarising some of the important attributes of physical and human geography. By doing so, the chapter is not attempting geography *per se* but is trying to provide selected background material to support the discussion that forms the central part of this study.

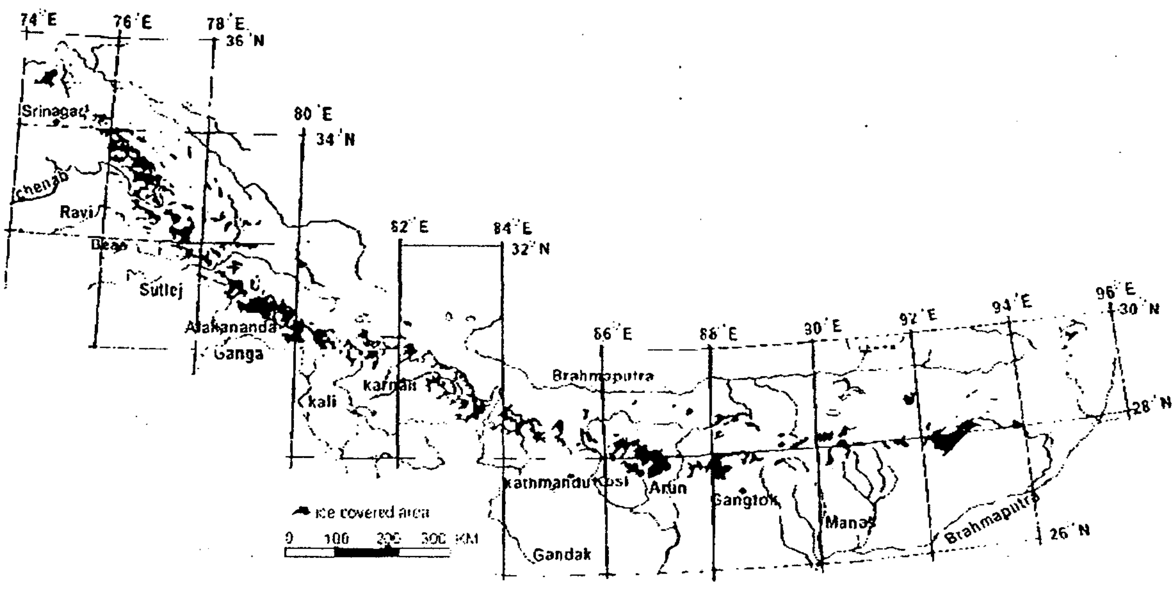
2.2 Geographical Location

Geographical location of the Himalaya has to be seen in the context of its geological[1] and geomorphological attributes. Taking into account its geological character and the geomorphic processes operating therein 'the Himalayan arc extends between latitudes 26° 20' and 35°40' North, and between longitudes 74°50' and 95°40' East' (Ives and Messerli 1989, Ives 2004, Rao and Saxena 1994). It is that great ranges of mountains that separate India, along its north-central and north-eastern frontier, from China (Tibet). The Himalaya extend from the Indus Trench below Nanga Parbat (8,125 m) in the west to the Yarlungtsangpo-Brahmaputra gorge below Namche Barwa (7,756 m) in the east, a west-northwest to east-southeast distance of about 2,500 km and a width of 200 – 300 km (ibid). Tentatively, such a

[1] The geographical boundary of the Himalaya is still a disputed discourse. We will consider only that part of the mountains that qualify the geological considerations applied to the Himalaya. Hence, other mountains that share their boundary with the Himalaya will not form the integral part of our study, although we may refer to them as and when we feel necessary.

definition[2] includes, politically, the independent kingdoms of Nepal, Bhutan and Indian states of Jammu and Kashmir, Himachal Pradesh, Uttaranchal, Sikkim, Darjeeling region of West Bengal, Arunachal Pradesh and some hill districts of northern Assam. The region directly provides life-support base for over 65[3] million mountain people. Furthermore, Himalayan environment indirectly affects the densely populated Indo-Gangetic and Brahmaputra plains.

Map 2.1 GEOGRAPHICAL LOCATION OF THE HIMALAYA



Source: Adopted from WWF 2005: 29

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[2] Mention should, however, be made here that the Himalayan environment supports and affects a much larger geographical area, covering India, Pakistan, Afghanistan, Nepal, Bhutan, Bangladesh and Burma, than its actual geographical stretch.

[3] As of Mid-2006.

2.3 The Geology[4]

The Himalaya is a complex of sub-parallel structural units produced by the northward thrust of the Indian tectonic plate beneath the Central Asian plate. A unique geo-feature of the planet, Himalaya is considered to be the youngest mountain system (Rao and Sexena, 1994) on the planet. The Himalaya is the representative of the recent-most epoch in the orogenic history of the earth causing uplift of Archaean to Mesozoic accumulations in the geosyncline (about 25-60 million years ago) (Singh 1971:5). According to the modern theory of plate tectonics, its formation is a result of a continental collision or orogeny along the convergent boundary between the Indo-Australian Plate and the Eurasian Plate. The collision began in the Upper Cretaceous period about 70 million years ago, when the north-moving Indo-Australian Plate, moving at about 15 cm/year, collided with the Eurasian Plate. By about 50 million years ago this fast moving Indo-Australian plate had completely closed the Tethys Ocean, whose existence has been determined by sedimentary rocks settled on the ocean floor and the volcanoes that fringed its edges. Since these sediments were light, they crumpled into mountain ranges rather than sinking to the floor. The Indo-Australian plate continues to be driven horizontally below the Tibetan plateau, which forces the plateau to move upwards.

The Indo-Australian plate is still moving at 67 mm/year, and over the next 10 million years it will travel about 1,500 km into Asia. Further, it is also argued that its movement is not simply due north but it is turning slightly in an anti-clockwise direction (Ives 2004). About 2 cm/year of the India-Asia convergence is absorbed by thrusting along the Himalaya southern front. This leads to the Himalaya rising by about 5 mm/year, making them geologically active. The movement of the Indian plate into the Asian plate also makes this region seismically active, leading to earthquakes from time to time. Seismological studies delineate the Himalayan zone including Assam as highly sensitive (Singh 1971:5). Susceptibility of geologic hazards, [however], varies considerably within the region (Rao and Saxena 1994: 44).

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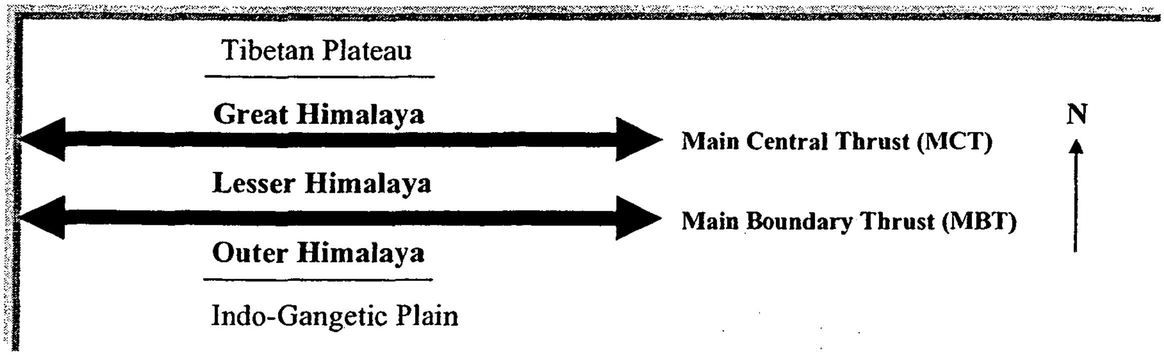
[4] Detail examination of geological history of the Himalaya is beyond the scope of this study.



Source: developed by the author

2.4 Physiographic Division

The Himalaya is not a single continuous chain or range of mountains but a series of more or less parallel or converging ranges intersected by numerous valleys and extensive plateaus. One of the most striking aspects of the Himalayan orogeny is the lateral continuity of its major tectonic elements. Similar to the geographical boundary, the physiographic divisions of the Himalaya too are not without dispute. Scholars across the disciplines have approached the physiography of the Himalaya differently at different points of time. However, geographers were among the pioneers to attempt physical divisions/regionalisaton of the Himalaya. Nevertheless, even within the subject of geography, scholars are far away from arriving at consensus with regard to the standard and universal physiographic divisions of the Himalaya. More recently, we have been gradually deviating from engaging ourselves with the everlasting problems of spatial distribution of geographic phenomena. In lieu of that, we are concentrating more on the examination of the processes, both natural and anthropogenic, operating within.

For the sake of understanding of the general physiography of the Himalaya[5] this study follows the divisions as delineated by R.L. Singh (1971: 6-7). Singh divides the Himalaya

[5]The purpose here is not to document different types of regionalisation attempted by scholars but to understand the general physical divisions of the Himalaya so that it becomes easier to understand the problems when environmental security issues are dealt in subsequent chapters.

into three major tectonic units on the basis of its geological and geomorphological characteristics. *Shiwaliks*, *Himanchal* and *Himadri* represent them, extending almost uninterrupted throughout its length.

2.4.1 Sub-Himalaya or Outer Himalaya or *Shiwaliks*

The Sub-Himalaya forms the foothills of the Himalayan Range and is essentially composed of Shiwalik (Miocene to Pleistocene molassic) sediments derived from the erosion of the Himalaya. They are basically the newer and river borne deposits brought down by the rivers coming from the Himalaya (Ganges, Indus, Brahmaputra and others.) and represent the most recent phase of the Himalayan orogeny. The system roughly has the appearance of hogback with a steeply sloping southern and a gently sloping northern face. The wide longitudinal valleys in between the lesser Himalaya and the Shiwaliks are called *'Duns'* in western and central Himalaya and *'Dwars'* in eastern Himalaya. The region is characterised by fault scarp, anticlinal valleys and synclinal ranges. The width of the sub-Himalayan tract varies between 5-30 km and elevation between 300-1000 m.

South of the foothills lies the Terai and Duars plains. The southern part of the Terai and Duars plains is heavily farmed. The northern part was forest inhabited by wild animals until about the 1950s. Most of the forests of this region have been destroyed, and much of the land has been reclaimed for agriculture.

2.4.2 Lesser Himalaya or *Himanchal*

The Himanchal forms the central chain and composed mainly of highly compressed and altered rocks varying from Algonkian or pre-Cambrian to Eocene in age. It is formed basically of detrital sediments from the passive Indian margin intercalated with some granites and acid volcanics. These low-grade sediments are thrust over the Sub-Himalaya along the Main Boundary Thrust (MBT). The Lesser Himalaya often appears in tectonic windows (Kishtwar or Larji-Kulu-Rampur windows) within the High Himalaya Crystalline Sequence. Its asymmetrical structures at places provide it a more or less hogback look. In general, the alternating ranges and valleys acquire an elevation of about 5000 m and 1000 m respectively.

It differs from the Himadri in its more regular and lower elevations. It has a width of about 80 km and borders the Great Himalayan range on the south. Some of the ranges of the Middle Himalaya include the Nag Tibba, the Dhaola Dhar, the Pir Panjal, and the Mahabharat.

Except for the major valley centers such as Srinagar, Kangra and Kathmandu, and hill towns such as Simla, Mussoorie, Darjeeling and Gangtok, the region is moderately populated. Within the Lesser Himalaya the intervening mountain ranges tend to separate the densely populated valleys.

2.4.3 Great Himalaya or High Himalaya or *Himadri*

It forms the backbone of the Himalayan orogeny and encompasses the areas with the highest topographical relief. This range has a granitic core flanked by metamorphosed sediments. Along with the Karakoram Range, Himadri has the credit of having the world's 14 highest peaks ranging between Janu (7710 m) and the Everest (8848 m). As the highest zone, it consists of a huge line of snowy peaks with an average height exceeding 6100 m. The width of this zone is about 24 km. Spurs from the Great Himalaya project southwards into the Middle Himalaya in an irregular fashion. To the north of the Great Himalaya stretch out several ranges such as the Zaskar, Ladakh, and the Kailas. The Karakoram Range lies on the Tibetan side of the Great Himalaya.

The Himadri is one of the few remaining isolated and inaccessible areas in the world today. Some high valleys in the Great Himalaya are occupied by small clustered settlements. Extremely cold winters and a short growing season limit the farmers to one crop per year, most commonly potatoes or barley.

2.5 Regional Divisions

Apart from the above tectonic/longitudinal subdivisions, the Himalaya also exhibit notable regional geographical characteristics. Following regions can, hence, be identified based on its regional heterogeneity[6].

The Kashmir Himalaya with its borders touching Afghanistan in the northwest, Pakistan in the west and China in the north and east represents the westernmost part of the Himalaya and occupies a strategic location. It is situated between 32°17' and 36° 58' north latitude and 73° 26' and 80 °30' east longitude. The major world powers keep up their deep interest in the region mainly because of its strategic location and notorious reputation as one of the most conflict ravaged region on the planet. The Kashmir region as a whole covers an area of 222,800 sq km but with the declaration of Cease-Fire (1-1-1949), 83,808 sq km of the area has gone under the illegal and forcible possession of Pakistan, and since 1962, 41,500 km^2 of the area has been occupied by China through aggression (Singh 1971:348).

Himachal Himalaya corresponding to the state of Himachal Pradesh has an area of 55,673 sq. km. It is situated between 30° 22' 40" to 33° 12' 40" north latitude and 75° 45' 55" to 79° 04' 20" east longitude. It lies to the south of Kashmir, to the north east of Punjab plain, to the north west of Uttaranchal and to the west of Tibet. Being a border state of India it is an area of high strategic importance.

Uttaranchal Himalaya corresponds to the newly carved Indian state of Uttarankhand. Himachal Pradesh borders it in the west, Uttar Pradesh in the south and Nepal in the east. Starting from the foothills in the south, the region extends up to the snow-clad peaks of the Himadri, marking the Indo-Tibetan boundary. It covers an area of about 51,125 sq km.

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6 This study is based on the regional heterogeneity of the region rather than tectonic sub-divisions as environmental problems are more pronounced at regional levels governed by different regional administrative unites and characterised by heterogeneous social groups with different levels of development and consequent impact on the environment.

Table 2.1 REGIONAL DIVISIONS OF THE HIMALAYA

Regional Division	Sub-Division	Geographical Extent	Area (Sq Km)
Western Himalaya	Kashmir Himalaya	32°17' to 36°58' north and 73°26' to 80°30' east	222,800
	Himachal Himalaya	30° 22' 40" to 33° 12' 40" north and 75° 45' 55" to 79° 04' 20" east	55,673
Central Himalaya	Uttaranchal Himalaya	28° 53' 24" to 31° 27' 50" north and 77° 34' 27" to 81° 02' 22" east	51,125
	Nepal Himalaya	26° 12' to 30° 27' north and 80° 4' to 88° 12' east	147,181
Eastern Himalaya	Sikkim Himalaya	27° 5' to 28° 9' north and 87° 59' to 88° 56' east.	7,096
	Darjeeling Himalaya	26° 31' to 27°13' north and 87° 59' to 88° 53' east	3,149
	Bhutan Himalaya	26°45' to 28°10' north and 88°45' to 92° 25' east.	47,000
	Arunachal Himalaya	26°30' to 29°30' north and 91°30' to 97° 30' east.	83,743

Source: compiled by the author

Nepal is a landlocked and isolated landscape located on the centre of the Himalaya. It is bordered on the west, south, and east by India, and on the north by the Tibet region of China. It comprises a total of 147,181 sq km of land.

Darjeeling Himalaya roughly corresponding to Darjeeling district of West Bengal has a geographical area of 3,149 sq km. It is bounded in the north by Sikkim and Bhutan and in the west by Nepal; on the south lie the district of Purnea and West Dinajpur while on the east, Bangladesh and the Jalpaiguri district bound it.

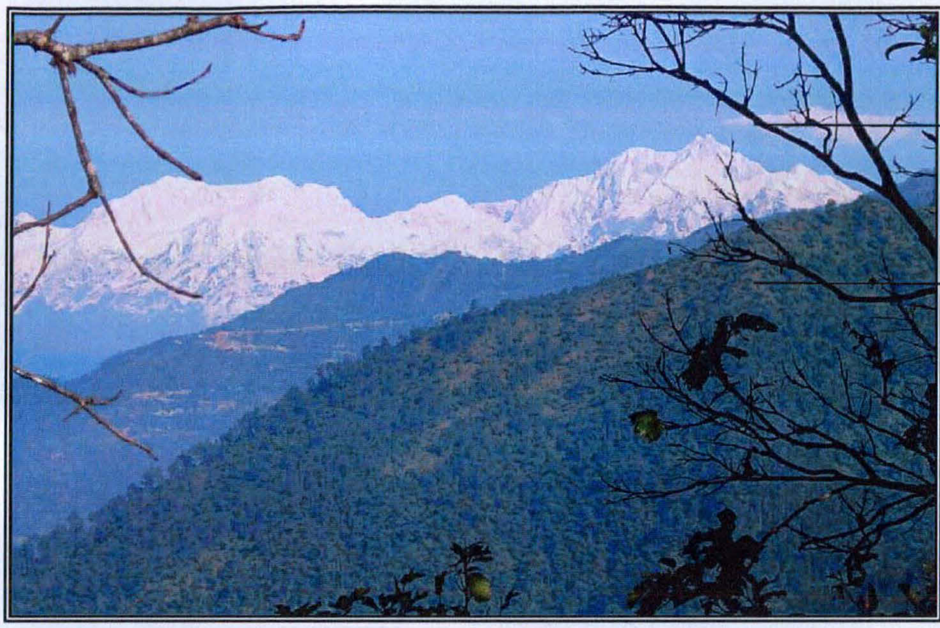

Plate 2.1: General View of Darjeeling-Sikkim Himalaya
[Photo: Vimal Khawas, Oct. 2006]

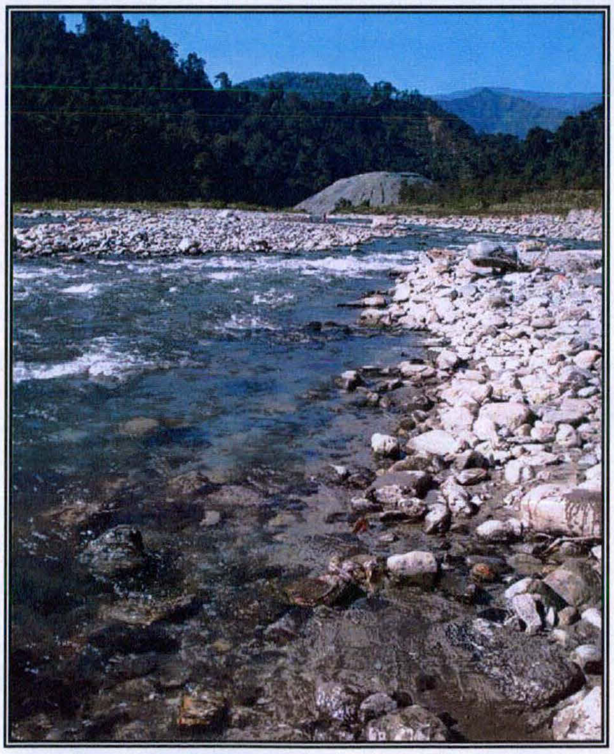

Plate 2.2: River Relli flows down the Darjeeling Himalaya
[Photo: Vimal Khawas, Oct. 2006]

Sikkim is a part of Eastern Himalaya and lies between latitudes 27° 5' north to 28° 9' north and longitudes 87° 59' east to 88° 56' east. It is wedged between Nepal in the west and Bhutan in the east and China in the north and northeast. In the south it shares its Indian border with the state of West Bengal. It has a total area of 7,096 sq km.

Bhutan Himalaya is situated on the eastern slope of the Himalaya. It is bordered by Tibet on the north and east and on the south, west and east by Assam, Sikkim and Arunachal Pradesh of India, respectively. The landscape consists of a succession of lofty and rugged mountains and deep valleys. It covers an area of 47,000 sq km.

Arunachal Himalaya is situated in the northeastern part of India with an area of 83,743 sq. km. It represents the easternmost section of the Himalaya. It has a long international border with Bhutan to the west (160 km), China to the north and north-east (1,080 km) and Myanmar to the east (440 km). It stretches from snow-capped mountains in the north to the plains of Brahmaputra valley in the south. It is situated between latitude 26° 30' and 29° 30 ' north and longitude 91° 30' and 97° 30' east.

2.6 Ecological Setup and Environmental Resource Base

The Himalaya has with it the most striking and distinctive features on the earth's surface and effects to varying degree the climate, water resource, soil condition, biodiversity, economy and overall life and prosperity of the countries encompassed.

2.6.1 Climate and Natural Vegetation

Himalaya exhibits one of the most complex climatic patterns and it is virtually far from possible to come to a clear pattern of climatic set up in the region. Owing to its extreme diversity in its various sub-ecological locations, elevation, and topography the region is featured by extreme variants of climate. Two main climatic characteristics of the region are the seasonal rhythm of weather and the vertical zoning. The climatic conditions vary from hot sub-humid tropical in the southern low tracts to temperate, cold alpine and glacial in the northern high mountains.

The temperature of the region varies spatially- both vertically and horizontally. April-May provides the highest temperatures, with maximum exceeding 40°C at many lowland stations (Ives and Messerli 1989) while mean monthly temperature is lowest in January (Singh 1971) deeping over –20°C in much of the higher Himalaya. The lowest recorded temperature in this connection has been recorded in Leh with –28.3° C while exceptionally high temperature has been recorded in Jammu with 47.2° C (Singh 1971). As a whole, climate ranges from subtropical in the southern foothills, with average summer temperatures of about 30° C and average winter temperatures of about 18° C; warm temperate conditions in the Middle Himalayan valleys, with average summer temperatures of about 25° C and cooler winters; cool temperate conditions in the higher parts of the Middle Himalayas, where average summer temperatures are 15 to 18° C and winters are below freezing; to a cold alpine climate at higher elevations, where summers are cool and winters severe (Karan [undated]). At elevations above 4880 m the climate is very cold with below freezing temperatures and the area is permanently covered with snow and ice (Karan [undated]).

Of the total annual precipitation, 70-85 percent falls during June-September, depending upon location (Ives and Messerli 1989). According to available records the highest precipitation occur between the Annapurna massif (Ibid) and the eastern Himalaya. The highest amounts are recorded north of the Bay of Bengal in Darjeeling-Sikkim, Assam Hills and Arunachal Pradesh.[7] With increasing distance along the Himalayan front toward the west-northwest, total annual precipitation decreases and the occasional winter westerly disturbances become more important (Ives and Messerli 1989). The lower valleys and gorges are very dry and local agriculture is dependent upon snowmelt and glacial-melt irrigation commonly called *Kuhl* in Himachal Pradesh. Summer monsoon influences here are slight or absent. This over-all trend was noted by Troll (1938, 1939) while mapping altitudinal vegetation transects in the Nanga Parbat area (Ives and Messerli 1989). Troll's work was greatly expanded by Schweinfurth (1957), who produced the first composite vegetation map for the entire Himalaya. This map, a fundamental research resource to this day, reflects the parallelism between the climate and vegetation trends from north to south and from east to west (Ibid).

[7] Excluding the Northeastern hills.

This same pattern is also important in terms of the region's glacio-hydrology and the associated variation in water source and availability throughout the year (Young 1982, Ives and Messerli 1989). The eastern Himalaya, in general, provides moisture surpluses from direct runoff of the abundant summer monsoon rainfall; the snowmelt contribution is comparatively insignificant. With increasing distance toward the west-northwest, melt water becomes critically important. A particularly heavy summer monsoon, for instance, which produces excess water (and flooding) in the eastern half of the region, may only serve to lower the summer flow of the western rivers since the increased cloud cover (with little or no rain/snow) will serve to reduce incoming solar radiation and thus limit melt water production (Ives and Messerli 1989). A general lack of systematic studies in glacio-hydrology is observed to be a serious deficiency in view of the great importance attached to hydroelectric and irrigation potentials of the region.

The importance of the Himalaya in directing overall climatic pattern in and around the sub-continent may briefly be summerised as follows: It has a profound effect on the climate of the Indian subcontinent and the Tibetan Plateau. It prevents frigid, dry Arctic winds from blowing south into the subcontinent, which keeps South Asia much warmer than corresponding temperate regions in the other continents. It also forms a barrier for the monsoon winds, keeping them from traveling northwards, and causing heavy rainfall in the Terai region. The Himalaya is also believed to play an important part in the formation of Central Asian deserts such as the Taklamakan and Gobi deserts. Further, due to the presence of mighty mountain ranges, the western disturbances that appear from Iran during winter are prevented from traveling any further, resulting in snow in Kashmir and rainfall for parts of Punjab and northern India. Despite being a barrier to the cold northerly winter winds, the Brahmaputra valley receives part of the frigid winds, thus lowering the temperature in the Northeastern Indian states and Bangladesh. These winds also cause the north-east monsoon during this season in these parts.

Table 2.2 BIOGEOGRAPHY OF THE HIMALAYA

<table>
<tr><th>Biotic Province</th><th>Biomes</th><th>Forest Types</th></tr>
<tr><td>Western Himalaya</td><td>Tundra Zone
Alpine Zone
Temperate Zone
Sub-Tropical Zone</td><td rowspan="3">Cold Temperate and Alpine Forest (2400-3600 m)
Warm Temperate Forests (1500-2400)
Sub-Tropical Forests (750-1500 m)
Tropical Forests (up to 900 m)</td></tr>
<tr><td>Central Himalaya</td><td>Alpine Zone
Temperate Zone
Sub-Tropical Zone</td></tr>
<tr><td>Eastern Himalaya</td><td>Alpine Zone
Temperate Zone
Sub-Tropical Zone</td></tr>
</table>

Source: Adopted (with some modifications) from Bir 1993, Khoshoo 1993

Distribution of natural vegetation in the Himalaya has to be seen in the context of its biogeography. Rodgers (1985) classified the Himalaya as a boreal zone and identified several biomes within it. Accordingly, five major types of forest can be identified across the biomes of the Himalaya. They are Alpine forest, cold temperate forest, warm temperate forest, sub-tropical forest, and tropical forest. With the increase in elevation and microclimate, change in the vegetation type is observed. Further, as one moves from the west towards eastern flanks of the Himalaya, differentiation in nature and pattern of the vegetation is observed.

Natural vegetation belts range from tropical monsoon rain forest (Shorea robusta = sal forests) in the south, through a series of forest belts, to the upper timberline at approximately 4,000 4,500 m (Ives and Messerli 1989). Above this a rhododendron-shrub belt gives out onto alpine meadows, a sub-rival belt of extensive bare ground and scattered dwarf plants, mosses, and lichens, and finally, at 5,000-5,500 m, permanent ice and snow with steep rock outcrops (Ibid). Ives and Messerli (1989) following Joshi (1986) and Numata (1981) give the following generalised pattern of vegetation belts for the central part of Nepal.

Table 2.3 GENERALISED PATTERN OF VEGETATION BELTS FOR THE CENTRAL PART OF NEPAL

Vegetation Belt	Altitude
Nival belt	Above 5,500 metres
Alpine belt	4,500-5,500
Rhododendron-Juniperus belt	3,700 -4,500
Betula-Abies belt	2,900-3,700
Acer belt	2,500-2,900
Quercus belt	1,900-2,500
Schima belt	1,000-1,900
Shorea robusta belt	0-1,000

Source: Ives and Messerli 1989

The western Himalayan ranges are much wider and colder with drier climate, while the eastern ranges are among the wettest regions in the world (Khoshoo, 1993) with tremendous biodiversity. Consequently, the western ranges have vegetation that is cold loving and drought resistant. Large gregarious populations of conifers like chir and blue pines, deodar, fir and spruce feature the region. As we move toward the east conifers are not a dominant species, although they have their presence. Rhododendrons dominate the plant life of the region (Ibid). The difference in the distribution of vegetation across spaces of the Himalaya is the result of a number of factors. For instance, the western ranges lie at 36-degree north latitude and are an area of low rainfall affecting the tree line that is at 3600 m altitude. At the other extreme the eastern ranges lie at 27-degree north latitude and are among the wettest regions in the world. Tree line is higher at 4570 m (ibid). As a result, the western Himalaya is species deficient while eastern Himalaya is species rich. The average figure of total forest cover in the Himalaya (including Nepal, Bhutan and India) in relation to its geographical area comes to around 35 per cent[8].

2.6.2 Water Resource

The Himalaya is often regarded as 'water tower' of South Asia. It is the storehouse of fresh water and source of mighty rivers like Indus, Ganges and Brahmaputra. These antecedent

[8] The figure is adopted after examining the forest related data of the relevant countries.

rivers that originate from the great glaciers of the Himalaya and Trans-Himalaya travel south of the Himalaya cutting across deep gorges, valleys, and hills defying the Himalayan orogeny. Numerous smaller rivers and streams join them, majority of which are glacier fed, perennial and antecedent in nature. They form three major rivers systems of South Asia namely, Indus river system, Ganges river system and Brahmaputra river system.

The Ganges system includes the catchment of the enormous Ganga river system that embraces much of the Himalaya, as far as West Bengal in the east, a densely populated Gangetic plain of India, and a part of Bangladesh. The western-most section of the Himalaya is drained by the Jhelum, Chenab, and Sutlej, major tributaries of the Indus, as well as by the upper Indus itself. The Brahmaputra is the Hindu name for that section of the other main trans-Himalayan river (Yarlungtsangpo-Brahmaputra) from the point where it enters Indian Territory. It rises high on the Tibetan Plateau in longitude 82° east, remarkably close to the main headstream of the Indus, and flows eastward for more than 1,200 km north of the Himalayan crest-line before making its spectacular turn to cut through the mountains in one of the world's most impressive gorges (Ives and Messerli 1989). It enters India through Arunachal Pradesh and flows roughly westward across Assam and Bangladesh before turning south again to produce a network of distributaries that merge with those of the Ganges, and eventually enters the Bay of Bengal through the great delta.

The Himalaya has approximately 23000-km^2 areas under glaciers making it one of the largest concentrations of glacier-stored water outside the Polar regions (Sharma 2004:322). It stores about 5000 km^3 of permanent snow and ice (Upadhyay 1995). While glaciers cover 10-20 per cent of the total surface area of high mountains in Himalaya, 30-40 per cent has seasonal snow cover (ibid). Hence, the melt water has a great contribution to overall water yields in the river systems. However, the importance of melt water contribution diminishes from cold and arid western Himalaya to warm and humid eastern counterpart. Accordingly, the contribution of snow to the runoff of major rivers of the Eastern Himalaya is about 10 per cent (Sharma 1993, 2004) and more than 60 per cent in the Western Himalaya (Vohra 1981, Sharma 2004). The more availability of water in mountains due to orographic lifting of moisture is evident in terms of higher specific water yields for mountain watershed compared to whole river basins (Table 2.5). The melt water forms important source of water in the north Indian rivers during critical summer months. The distribution of runoff produced from ice, snow and rain is such in the Himalayan Rivers that flow is observed in them round the year. The water yield from the high Himalayan catchments are roughly double the yields from the same size of catchments in peninsular India due to additional snow and ice melt contributions (Sharma 2004).

Table 2.4 WATER RESOURCE OF MAJOR RIVER SYSTEM IN THE HIMALAYAN REGION

Category	Indus	Ganges	Brahmaputra
Water resource potential (km3)	73.3	525	537.2
Utilisable surface water (km3)	46.0	250	24.0
Groundwater potential (km3)	25.5	171.7	27.9
Per capita annual availability of water (m3)	1757	1473	18417
Per hectare of culturable area annual availability (m3)	7600	8727	44232

Source: CWC 1993

Table 2.5 SPECIFIC WATER YIELD FROM MOUNTAINOUS AND WHOLE RIVER BASIN (MM)

River Basin	Mountainous watershed	Whole basin
Indus	460	163
Ganges	975	473
Brahmaputra	1039	922

Source: Alford 1985

2.6.3 Land/Soil Resource

The diversity in its geological, physiographic, climatic and vegetation characteristics have given rise to a variety of soil types in the Himalaya. The formation of soils is the result of climatic factors and geomorphic processes supported by geo-lithology. The soil cover becomes thinner as we move higher in elevation towards alpine climate. Hence, thick soil covers are confined only to valley bottoms and terraces. As per the soil maps on 1:250,000 developed under a national project on Soil Resource Mapping of different states of India, majority of the Himalayan soils belong to Entisols and Inceptisols (Table 2.6). The former are dominant in the Western and Central Himalayan belt while both are more balanced in their distribution in the Eastern Himalaya. In Northeastern Hills (Purvachal) the latter are found extensively. The Ultisols too occupy a considerable area of Purvachal.

Table 2.6 SOILS OF THE HIMALAYAN REGION (AREA '000 HA)

States	Alfisols	Entisols	Inceptisols	Ultisols	Miscellaneous
Jammu &Kashmir	100.0 (0.5)	7572.6 (34.1)	147.2 (6.4)	-	47.7 (0.2)
Himachal Pradesh	238.0 (0.4)	2584.3 (51.3)	1099.9 (19.8)	-	400.0 (0.8)
Uttaranchal	8.8 (0.2)	3026.3 (56.5)	1623.2 (30.3)	-	11.1 (0.21)
Sikkim	-	231.7 (42.5)	239.8 (42.9)	-	816.5 (14.6)
Arunachal Pr.	25.1 (0.3)	2981.2 (35.6)	3123.6 (37.3)	1189.1 (14.2)	1055.1 (12.6)

Source: NBSSLUP 2004

2.7 Cultural Setting

Complicated, as the physical geography of Himalayan region is, the present-day cultural setting, economic and ethnic patterns resist easy description. This in turn is partly due to the influence of the physical base and partly a result of the very long and complicated history (Ives and Messerli 1989). However, human settlement and economic pattern in the Himalayan region are greatly influenced by the physiography/topography and climatic condition. The climatic provision is, in fact, one of the main factors that have directed population settlements across the region since historic past. Extreme climatic condition has in many cases imposed restrictions on the living conditions and movement / communication of the people.

Knowledge with regard to the pattern and extent of prehistoric settlement in the Himalaya, based upon archaeological evidence, remains very sparse. Consequently, attempts to reconstruct the social and intellectual forces that have shaped contemporary society in northern India and the Himalaya rely heavily upon the great body of Sanskrit epic literature, the earliest fragments of which date from 1200 BC (Ives and Messerli 1989). Much of this literature is derived from an oral tradition that had been continually modified over several thousand years before being committed to writing (O'Flaherty 1975, Ives and Messerli 1989).

The history of India, especially the Hindu epics and Puranas tell us that the original inhabitants of the Himalaya were the Kinnars, Kilinds, and Kiratas. History[9] also mentions the names of Khasas and the Darads inhabiting the Himalayan region. The evolution of present human settlements across the Himalaya is, however, not easy to reconstruct as the information in this regard is scarce and often fragmented. However as of today, three different macro social groups, mainly, form the Himalayan population. They are the Negroids, Mongoloids and the Aryans. Ives and Messerli (1989) thus summarises:

> 'This somewhat fragmentary 'history' of settlement can be summed up with the statement that the northwestern part of the region evolved under Muslim influence, the southern flanks of the centre and east under Hindu influence, and the northern fringe under Buddhist influence. This broadly sweeping overlay conceals innumerable small ethnic groupings and says little about the independent entities such as Hunza, the great complexity of settlement of the Arunachal Pradesh Himalaya, and the several dozen distinct ethnic and linguistic groups of the Hengduan Mountains, which were eventually infiltrated along the main valleys by Han agricultural settlers and traders'.

Looking from south to north, the Hindus of Indian origin mainly dominate the Sub-Himalayan and Middle Himalayan valleys. While in the Great Himalayan region, it is mainly the Tibetan Buddhists who dominate the scene. From west to east the geographical distribution of the population may be summarised as follows- in places like eastern Kashmir and Nepal it is mostly Hindu population that dominate the area. However, in central Nepal, both Indian (mainly Hindu) and Tibetan cultures have blend together, producing a mixed culture of Indian and Tibetan traits. In the eastern Himalaya human diversity is much pronounced. Darjeeling-Sikkim region is a mixture of both Hindu and Tibetan culture while Bhutan has historically been a region of Tibetan culture. The Arunachal region of eastern Himalaya, along with some of its neighbouring hills, reflects the religion and culture similar to those living in Yunnan province in China while some of the northeastern states of India practice religion and culture of northern Myanmar. Further, a notable proportion of

[9] Readers may refer to Ives and Messerli 1989 for detailed history of the region.

(converted) Christians also live in Darjeeling Hills, Arunachal Pradesh and neighbouring North-East Indian Hills. Muslims are mostly seen in western Kashmir and their culture is similar to the population of Pakistan, Iran and Afghanistan.

Human population of the Himalayan region, as of today, crosses 65 million[10]. They are mainly scattered across the lower and middle Himalayan region. The present ethnic pattern of the human settlement in the Himalaya has to be seen in the context of different political entities therein. Table 2.7 summarises general ethnic composition of the Himalaya.

Table 2.7 MAJOR ETHNIC COMPOSITIONS IN THE HIMALAYA

Region	Major Ethnic Community
Bhutan	Bhote, Ethnic Nepali, Indigenous and migrant groups
Nepal	Chettri, Brahmin, Magar, Tamang, Newar, Kami, Yadav, Muslim, others
Jammu and Kashmir	Dogra, Gujjar, Gaddi, Kashmiri Pundit (Brahmin), Sunni- Shia- Hanji and Dard Muslims, Baltis, Ladakhi, others
Himachal Pradesh	Rajput, Brahmin, Ghirat, Mahajan, Sood, Chahang, Saini, Air, Darni, Lohar, Tarkhan, Nai, Dusali, Doomna, Chamar, Julaha, others
Uttaranchal	Kol or Kolta, Rajputs, Brahmin, Jaunsari, Bhotia, Buksha, Tharu, others
Darjeeling	Lepcha, Ethnic Nepali, Ethnic Bhutia/Tibetan, others
Sikkim	Lepcha, Ethnic Nepali, Ethnic Bhutia/Tibetan, others
Arunachal Pradesh	Monpa, Sherdukpen, Memba, Khamba, Khampti, Singpho, Adi, Aka, Apatani, Bangni, Nishing, Mishmi, Miji, Tangsa, Nocte, Wancho, others

Source: compiled by the author

Majority of the indigenous groups living in remote valleys and slopes of the Himalayan region have generally conserved their traditional cultural identities and institutions. However, often scattered and gradual improvements in communication and transportation system are slowly improving the lifestyle of the people living in many locations, mainly urban areas, of the Himalaya. Penetration of modernisation and associated forces has led to the gradual but steady deterioration of traditional-cultural and social systems in such locations.

[10] Calculated by the author (see table 4.1)

Plate 2.3: Bhujel Women of the Himalaya
[Photo Vimal Khawas, October 2006]

Plate 2.4: Pradhans/Newars of the Himalaya
[Photo Vimal Khawas, October 2006]

2.8 Economic Arrangement

Agriculture and animal husbandry is the mainstay of the Himalayan population engaging large chunk of them in this sector. Agriculture is the primary driver of the economy[11]. Over 85 per cent of the population is directly or indirectly dependent on agriculture for its livelihood. The varied topographic and agro-climatic conditions permit the cultivation of a wide variety of crops and fruits ranging from sub-tropical to cool temperate. The cropping pattern reflects the varying conditions of altitude, climate and soil on the one hand and on other the various agronomic and cultural practices and traditions evolved over the centuries such as elaborative terracing, crop rotation and very efficient traditional irrigation system[12]. The region is also ideal for horticulture and fruit orchards.

The Himalayan region has been the source of several species of cereals, pulses, fruits, oil yielding plants, spices and tuberous vegetables and sugar yielding plants and their wild relatives. Added to it is a whole range of medicinal and aromatic plants some of which have gone into commerce and have their centre of origin in the Himalaya. Bamboo wealth of the Himalaya, particularly eastern region, needs special mention. Many species of bamboo extend up to western Himalaya, except Kashmir Valley. The Himalayan region harbours many wild and domesticated animal species whose abode falls on this region.

Agriculture is concentrated mainly on the Siwaliks and on the valleys of the Middle Himalaya. At some cases, however, patches of agricultural land have also been carved out in the high mountain areas. Rice is the principal crop in the well-watered valleys while maize is also an important rain-fed crop on the hillsides. Other cereal crops are wheat, millet, barley, and buckwheat. sugarcane, tea, oilseeds, and potatoes are other major crops. Mixed farming is widely practiced in the Himalayan region. The general crop production association under mixed farming across diverse locations and elevations in the Himalaya are: 'barley-wheat-

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[11] Jhum, the local word for shifting cultivation in Eastern Himalaya, which was widely practised in Arunachal Pradesh among the tribal groups, has come to be less practiced.

[12] Such irrigation system is called *Kuhl* in Himachal, *Gul* in Uttaranchal and *Kulo* in Darjeeling-Sikkim. Further, in regions like Uttaranchal and Himachal Pradesh it also provides water for small water mills.

pulses, wheat-maize-rice, wheat-rice-ragi, maize-wheat-rice, maize-millet-rice, rice-millet-rice' (based on available Himalayan literature).

Table 2.8 ECONOMIC ARRANGEMENT IN THE HIMALAYA

Region	Major Economic Activity	Other Sources of Economy
Jammu & Kashmir	Agriculture and allied activity (about 70%)	Household industry, Manufacturing, Tourism
Himachal Pradesh	Agriculture and allied activity (about 90%)	Forest, Hydropower, Tourism
Uttaranchal	Agriculture and allied activity (more than 80%)	Forest, Hydropower, Tea, Tourism, Small scale & cottage industry,
Darjeeling	Agriculture and allied activity (about 26%)	Tea, Tourism, Forest
Sikkim	Agriculture and allied activity (more than 85%)	Hydropower, Tea, Tourism, Forest,
Arunachal Pradesh	Agriculture and allied activity (more than 90%)	Forest, Hydropower, Tourism, Cottage industry & handicrafts
Nepal	Agriculture and allied activity (more than 91%)	Forest, Hydropower, Tourism, Manufacturing, Household Industry.
Bhutan	Agriculture & allied activity (93%)	Forest, Hydropower, Tourism

Source: compiled by the author

However, Food production in the Himalaya has not kept up with the population growth. Agriculture is handicapped by steep and hilly terrain, climatic hazards, small and scattered holdings, thin stony soils, limited irrigation and small cultivated area. The scope for increasing cultivated area is not much. Physical environment restricts the cultivated land to a large extent in the area hence exhibiting acute shortage of arable land. It has further infused a high degree of adaptive skill and uncommon physical vigour among the people to cope with the inhospitality of the environment. To secure agricultural land, rugged terrains are arduously terraced even on such steep slopes where the land should be left under pasture or forest. 'Since alternative sources of livelihood other than agriculture are limited, the peasantry has to eke out its existence under difficult conditions where nature is a stern mother' (Singh 1971: 412).

Table 2.9 ARABLE LAND AND MAJOR AGRICULTURAL ACTIVITY

Region	Arable Land (%)	Major Agricultural activity
Jammu & Kashmir	5.0	rice, maize, wheat, millet, pulses, fruits, vegetable, saffron, animal husbandry
Himachal Pradesh	10.0	wheat, maize, rice, barley, pulses, millet, gram, potato, fruits, ginger, vegetables, *kuth*, sugarcane, medicinal herbs, animal husbandry, poultry, fish culture
Uttaranchal	14.4	millet, wheat, rice, ginger, sugarcane, fruits, vegetables, animal husbandry
Darjeeling	25.0	rice, maize, wheat, barley, millet, potato, fruit, vegetable, flowers, medicinal herbs, ginger, cardamom, livestock.
Sikkim	11.0	rice, maize, cardamom, wheat, barley, millet, potato, fruits, vegetables, medicinal herbs, ginger, livestock.
Arunachal Pradesh	2.5	barley, wheat, maize, soybean, paddy, potato, millet, oilseeds, fruits, vegetables, spices, sugarcane
Nepal	20.2	rice, maize, wheat, barley, millet, oilseed, potato, jute, tobacco, cotton, indigo, opium, vegetable, fruits, medicinal herbs, livestock.
Bhutan	3.4	rice, maize, buck-wheat, root crops, citrus fruits, cardamom, spices, animal husbandry, poultry.

Source: compiled by the author

Besides, animal husbandry engages a sizeable proportion of the population in the Himalaya. This is particularly because of the fact that in a predominantly agrarian economy animal husbandry plays a vital role for supporting agricultural operations, for supplement food and for providing means of transport and sources of manure. Across the societies of the Himalaya large number of cattle, sheep, and goats are kept. However, they do not receive adequate nutrition (Singh 1971).

Table 2.10 CROP WISE AREA, PRODUCTION AND YIELD (1999-2000) IN ARUNACHAL PRADESH

Crop	Total Area (%)	Total Production (MT)	Yield (Qtl / Hect)
Rice	50.9	134807	11.0
Maize	14.8	48346	13.6
Millet	8.2	17123	8.6
Wheat	1.6	5096	13.0
Pulses	2.7	6634	10.1
Total food crops	78.2	211979	11.2
Potato	2.1	32434	65.4
Ginger	1.8	34890	79.3
Oil seeds	11.5	27228	9.8
Turmeric	0.2	1473	36.5
Chilli	0.6	1696	11.3
Sugarcane	0.3	16219	20.0
Seasonal vegetables	5.3	37060	20.0
Total commercial crops	21.8	151000	28.7

Source: Department of Agriculture, Government of Arunachal Pradesh

Table 2.11 ECOLOGICAL SUB-REGION, ALTITUDE AND MAJOR CROPS GROWN IN UTTARANCHAL HIMALAYA

Ecological sub-region	Altitude (m)	Chief Crops
Lower Dun, Terai	300-600	wheat, rice, and sugarcane
Upper Dun, Bhabar, Lower shivaliks	600-1200	wheat, rice, mandua, jhangora, chaulai, and maize
Middle Garhwal-Kumaon	1200-1800	wheat, rice, mandua, jhangra, *cheena* (panicum miliaceum), potato, and barley
Upper Garhwal-Kumaon	1800-2400	wheat, barley, potato, chaulai, *cheena*, phaphra (Fagopyum tataricum)
Cold Zone	2400-3600	SUMMER: wheat, barley, potato, phaphra, chaulai, *kauni, ogal, kodo* (fagopyum esculentum), *uva* (hoyceleum himalayanse)

Source: Sati 2005:84

Table 2.12 IRRIGATED AREA IN THE HIMALAYA

Region	Net cultivated area (sq. km)	Irrigated area (%)
Uttaranchal	662.4	33.9
Himachal Pradesh	580.0	17.9
Nepal	-	38.2
Bhutan	-	25.0

Source: compiled by the author

Himalaya, although has with it sufficient resource potential, is one of the least industrialised regions in the world. Very small percentage (less than 10 %) of Himalayan population is engaged in industrial and its associated sector. Remoteness, unfavourable geographical conditions, inadequate transportation and related infrastructure facilities, and unique historical forces have played prominent role in the regard.

The region has a large hydel power potential but we have not been able to tap this resource adequately. Further, although in recent times several hydel projects are under their ways there have often been stiff resistance from environmental groups and academia in view of the unsustainable ways water resource is tapped.

Table 2.13 HYDEL POWER POTENTIAL OF HIMACHAL HIMALAYA

Name of River Basin	Hydel Power Potential (MW)
Chenab	760.0
Ravi	499.8
Beas	3009.1
Sutlej	3465.6
Yamuna	795.1

Source: Singh 1971:427

Apart from that, small-scale and rural industries have developed in several parts of the Himalaya and have the potential to grow in future. Rich and diversified histories of the region and the resultant socio-cultural mosaic have led the way to diversify traditional rural cottage industries. Several kinds of handicrafts and such other cultural items contribute significantly to the economy of the region[13].

Tourism is yet another area where Himalaya has a comparative advantage. It is a growing industrial sector and it is growing relatively faster. However, it is surprising to know that the region remained isolated for long. Tourism is not a very old phenomenon in the area. It picked up only after the 1950s but it picked up relatively fast. This sector is yet to be properly regulated and efficiently diversified. Of late massive mass tourism pouring across spaces of the Himalaya coupled with weak arrangements for regulatory mechanism and inadequate institutions have been the serious cause of concern. Diversification of the sector into nature tourism, eco-tourism, adventure tourism, cultural tourism, religious tourism, etc is a welcome step if rationally planned and scientifically managed.

As a whole, the economy of the Himalaya is poor with low per capita income. Most of the population is dependent on agriculture, primarily subsistence agriculture as modern industries are lacking. Agricultural land is mainly concentrated in the foothills and valleys. Food production in the Himalaya has not kept up with the population growth (Karan [undated]). Recently, however, trade and commerce had played a vital role in the lives of the people living in frontier villages of the region[14]. Although strategic importance of the northern frontiers has accelerated the development of transportation and communication in the region after 1962[15] the isolation in most of the parts is yet to be broken. Commercial crops including horticulture and floriculture have been stimulated wherever modern roads and such other infrastructure facilities have reached.

2.9 Conclusion

To sum up the discussion, the Himalayan geography, to varying degree, affects the climate, biodiversity, water resources, soil condition, socio-cultural pattern, economy and overall life and prosperity of the countries encompassed and their immediate surroundings. As a major

[13] A visit to Delhi *Hat* of New Delhi provides one a good example in this connection.

[14] Mainly in Himachal Pradesh, Ladakh, Kumaon and Garhwal.

[15] The Indo-Chinese War of 1962 accelerated the strategic importance of the Himalaya.

resource-zone of South Asia it provides numerous goods and services to the people of both the uplands and the lowlands and thus performs the role of prime source of regional environment and human security. The importance of Himalaya in the context of regional environmental security and the resultant human-wellbeing is beyond ordinary human perception. The region is crucial for the people living both inside the region and vast lowlands spreading across South Asia as it acts:

1. As a regulator and monitor of the regional environment
2. As a centre of ecosystem and biological diversity
3. As perennial sources of rivers and streams
4. As a great interceptor of monsoon wind causing heavy rainfall
5. As the home and storehouse of a vast number of economically important plants, animals and micro organisms
6. As an invaluable gene pool which facilitates evolution of new species of plants and animals
7. As a defence barrier against aggression by enemies
8. As a great storehouse of materials for education and scientific research
9. As an object of unexcelled scenic beauty
10. As an ideal region for the purpose of mountaineering as a sport
11. As a cradle of very rich ancient culture and civilisation
12. As an ideal hermitage of spiritual contemplation and deeper pursuits

The goods and services provided by the Himalaya to those living in the region as well as to populations in lowlands may be listed as follows-

<u>Goods</u>

1. Water (for consumption, irrigation, energy production);
2. Food (crops, domesticated and wild animals);
3. Wood (for energy and construction);
4. Non-timber forest products (fibres, foodstuffs, medicinal plants);
5. Minerals.

Services

1. Maintenance of soil fertility and structure, and associated limitation of soil erosion (particularly of local benefit);
2. Downstream movement of soil nutrients (upstream loss, downstream gain);
3. Avoidance/mitigation of damaging impacts of disastrous events, such as floods, landslides, avalanches (of both local and downstream benefit);
4. Provision of landscape as amenity (mainly of benefit to extra-regional tourists and recreationists, but also to local amenity migrants and those depending on tourist economy);
5. Biodiversity (of local benefit, but also of extra-regional value in terms of existence value and genetic potential);
6. Cycling and storage of carbon and soil nutrients (of importance at the global scale).

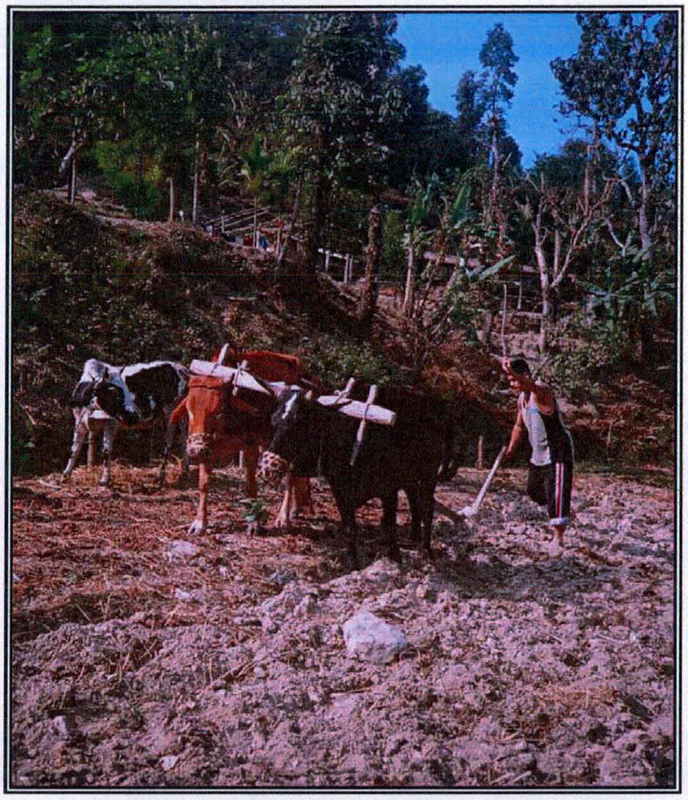


Plate 2.5: Ploughing the Terraced Field
[Photo: Manita Khawas, January 2005]

Plate 2.6: Thrashing the Harvested Paddy
[Photo: Vimal Khawas, December 2002]

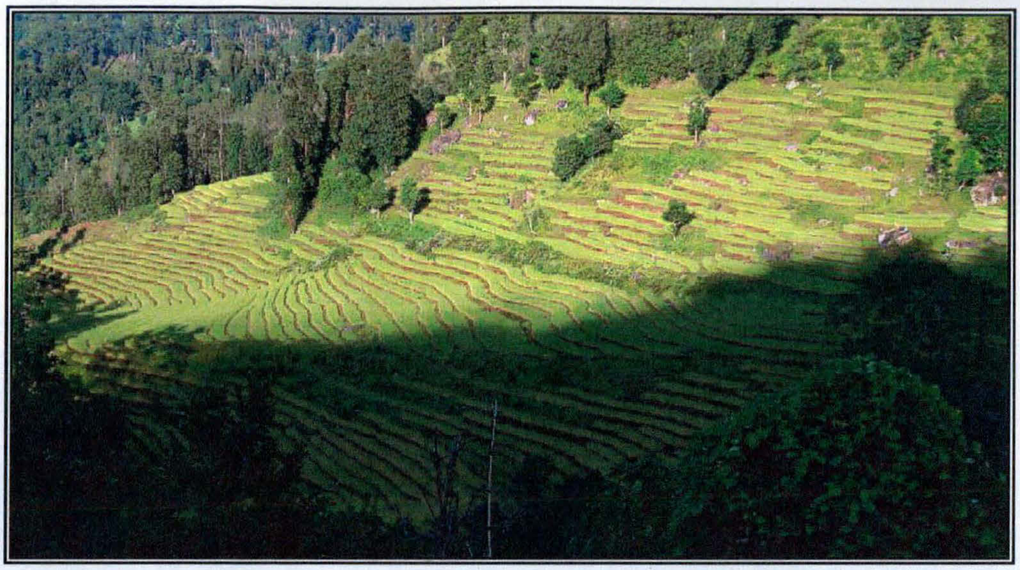


Plate 2.7: Paddy cultivation on Irrigated Terraces
[Photo: Vimal Khawas, Oct. 2006]

Plate 2.8: Mixed farming on Un-Irrigated Terraces
[Photo: Vimal Khawas, Dec. 2002]

Plate 2.9: Ripening Oranges
[Photo: Vimal Khawas, Oct. 2006]

Plate 2.10: Ginger cultivation on Un-Irrigated Terraces
[Photo: Vimal Khawas, Oct. 2006]

CHAPTER 3
Geo-Environmental Processes and Human Security Problematique

3.1 Introduction

The Himalaya is a complex of sub-parallel structural units produced by the northward thrust of the Indian tectonic plate beneath the Central Asian plate. A unique geo-feature of the planet, Himalaya is considered to be the youngest mountain system (Rao and Sexena, 1994) on the planet. It is a representative of the recent-most epoch in the orogenic history of the earth causing uplift of Archaean to Mesozoic accumulations in the geosyncline (about 25-60 million years ago) (Singh 1971:5). According to the modern theory of plate tectonics, its formation is a result of a continental collision or orogeny along the convergent boundary between the Indo-Australian Plate and the Eurasian Plate. The collision began in the Upper Cretaceous period about 70 million years ago, when the north-moving Indo-Australian Plate, moving at about 15 cm/year, collided with the Eurasian Plate. By about 50 million years ago this fast moving Indo-Australian plate had completely closed the Tethys Ocean, whose existence has been determined by sedimentary rocks settled on the ocean floor and the volcanoes that fringed its edges. Since these sediments were light, they crumpled into mountain ranges rather than sinking to the floor. The Indo-Australian plate continues to be driven horizontally below the Tibetan plateau, which forces the plateau to move upwards.

The Indo-Australian plate is still moving at 67 mm/year, and over the next 10 million years it will travel about 1,500 km into Asia. Further, it is also argued that its movement is not simply due north but it is turning slightly in an anti-clockwise direction (Ives 2004). About 2 cm/year of the India-Asia convergence is absorbed by thrusting along the Himalaya southern front. This leads to the Himalaya rising by about 5 mm/year, making them geologically active. The movement of the Indian plate into the Asian plate also makes this region seismically active, leading to earthquakes from time to time. Seismological studies delineate the Himalayan zone including Assam as highly sensitive (Singh 1971:5). Susceptibility of geologic hazards, [however], varies considerably within the region (Rao and Saxena 1994: 44). Additionally, Himalayan belt is prone to various types of natural disaster due to its inherent geo-environment and geomorphic processes operating therein. Further, several studies and field experiences (Eckholm 1975, Ives and Messerli 1989, Ives 2004, WWF 2005) point out that unscientific anthropogenic activities have been aggravating the natural state of affairs inflicted by physical forces. It is argued that recent patterns of development across the Himalayan belt have inflicted severe pressure on the carrying capacity of this fragile resource zone, thereby, posing a direct challenge to the development planners and policy makers[1].

The basic objective of this chapter is hence to explore and discuss major geo-environmental/geomorphic processes and the consequent human insecurities in the region and its surrounding geographical milieu. The chapter attempts to list down and elucidate some of the important natural challenges and critically examine their impact on the overall human security.

Some of the major geo-environmental challenges that often have an effect on human security in the Himalaya and its geographic milieu may be briefly listed and discussed below.

3.2 Active Geology and Unstable Structure: High Seismicity

As noted in the preceding paragraphs, the high seismicity of the Himalayan region is rooted in its recent orogenic evolution as a result of which it is still rising. The Himalayan province on the whole is geo-dynamically very active and is prone to violent crustal movements causing earthquake (Valdiya 1998, Bahadur 2004). The snapping and attendant slipping of rocks on faults and thrusts has given rise to frequent earthquakes. The southernmost unit of the Himalaya called the Shiwalik sediments form low elevation hills that rise in front of the

[1] Details of anthropogenic activities and their consequent impact on the environment and human security are discussed in chapter four.

Indo-Gangetic plains. The Main Boundary Thrust (MBT) separates the Outer Himalaya from the Lesser Himalayas in the north. Further north, the Main Central Thrust (MCT) separates the Lesser Himalayas from the Great Himalaya. These two thrusts dip steeply at 30 to 40 degree respectively near the earth's surface but flatten out at depth (Bahadur 2004). These thrusts/faults are responsible for distribution of seismicity throughout the Himalaya with a fairly high concentration of seismicity between MBT and MCT. There are seismic gaps where major earthquake has not occurred during the past 100 years and are considered as high potential areas for occurrence of future earthquakes (Ibid). Most of the damaging earthquakes in the Himalaya have shallow focal length while others range from a few km to 100 km (Srivastava 1998, Bahadur 2004).

Earthquake has been one of the most common and damaging natural disasters that often hit the regions across the Himalaya. Seismologists have categorised the Himalaya in Seismic Zones IV and V – highly prone to earthquakes. Four major earthquakes of magnitude higher than 8 have, so far, occurred in the region and its immediate surrounding. They include Shillong (1897), magnitude 8.7; Kangra (1905), magnitude 8.4; Bihar (1934), magnitude 8.1; and Assam (1950), magnitude 8.7 (Bahadur 2004). The Kashmir earthquake of 8 October 2005, measuring a magnitude of 7.6 on the Richter scale brought havocs and perils in areas of active faults. The quake inflicted lasting environmental and human insecurities in much of the Western Himalayan region. Experts regard it as a major earthquake similar in intensity to the 1935 Quetta earthquake, the 2001 Gujarat Earthquake, and the 1906 San Francisco earthquake. As of 8 November 2005[2], the Pakistani government's official death toll was 73,276, while officials say nearly 1,400 people died in India-administered Kashmir and four people in Afghanistan. According to Bilham 'regions of the Himalaya that have recently experienced magnitude 7.8 earthquakes - like the Kangra district a hundred years ago - may not be immune to a future larger earthquake (Science Daily 2005: December 8)'. Bilham *et al.* (2001) further note:

> The population of India has doubled since the last great Himalayan earthquake in1950. The urban population in the Ganges Plain has increased by a factor of ten since the 1905 earthquake, when collapsing buildings killed 19,500 people. Today, about 50 million people are at risk from great

[2] http://en.wikipedia.org/wiki/2005_Kashmir_earthquake (accessed December 11, 2006)

> Himalayan earthquakes, many of them in towns and villages in the Ganges plain. The capital cities of Bangladesh, Bhutan, India, Nepal, and Pakistan and several other cities with more than a million inhabitants are vulnerable to damage from some of these future earthquakes. The enforcement of building codes in India and Pakistan mitigates the hazards to this large population, but a comparison between fatalities in the 1819 Katchch and 2001 Bhuj earthquakes is not encouraging. The population of Kachch has increased by a factor of ten. Two thousand fatalites occurred in 1819, compared to the 18,000 confirmed and possibly 30,000 unconfirmed fatalities this year. The implemented seismic code apparently did not lessen the percentage of the population killed. Like the Himalayan earthquakes, the Bhuj event occurred in an identified zone of heightened seismic hazard. Projecting these figures to just one of the possibly several overdue Himalayan earthquakes (for example a repeat of the Kangra 1905 event) yields 200,000 predictable fatalities. (Pp 1443-44)

It is feared that construction of large dams across the Himalaya may induce occurrence of a large earthquake. Further, construction of unsafe buildings and houses pave the way for increased casualties and loss of properties. According to Bilham 'the Kashmir earthquake was the deadliest earthquake ever in the Indian subcontinent, mostly because of the poor construction quality in the area. Most of the buildings that collapsed had been constructed in the past two decades' (Science Daily 2005: December 8). The threat of great earthquakes has to be respected by appropriate earthquake resistant designs and proper environmental management.

The IUCN[3] team (2005) while assessing the impact of Kashmir Earthquake (2005) found no reliable scientific evidence of environmental (mis)-management as a cause for the earthquake. The team, however, indicated that the extent and scope of the damages and losses of human lives are undeniably, to a certain extent, man-made and have (among others)

[3] **The World Conservation Union (IUCN):** Created in 1948, IUCN-The World Conservation Union brings together 82 States, 112 government agencies, 850 plus NGOs, and some 10,000 scientists and experts from 181 countries in a unique worldwide partnership. IUCN's mission is to influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable. IUCN is the world's largest environmental knowledge network and has helped over 75 countries to prepare and implement national conservation and biodiversity strategies. IUCN is a multi-cultural, multilingual organization with some 1000 staff located in 62 countries. Its headquarters are in Gland, Switzerland.

links with environmental management. For example, the team found strong evidence that slopes with a good forest cover provided better protection for buildings and roads from the landslides caused by the earthquake than denuded slopes.

The team suggested the need to assess the environmental risks after the earthquake that could inflict further environmental and human losses if not taken care adequately. Potential risks that need to be assessed according to the IUCN include- Landslides/Mudslides, Flashfloods, Water Contamination, Debris and Waste, Health Risk, Ecosystem Depletion, Loss of Cultural Heritage and Threatened Livelihood Options. 'These damages need to be valuated in economic terms. Additional environmental damages will occur in the aftermath of the earthquake. Some of them may only be visible after a year or later. The most important need is to look for and identify environmental risks, which could cause further damages and losses, if not taken care of adequately' (IUCN 2005:4).

Further, the team suggested the course of action while planning relief and rehabilitation measures. It highlighted the need to differentiate between:

1. Short term (urgent, vital, life-saving)
2. Medium term (temporary solutions, over the winter), and
3. Medium to long term (reconstruction/rehabilitation, measures for human well-being, environmental considerations).

Some of the important short term considerations as advised by IUCN (2005) include:

1. Assessment of immediate environmental damages and risks, such as landslides, flashfloods, water contamination, debris disposal, identification of hazardous material sites etc. and intervene as soon as possible (army, government authorities).

2. Compilation and sharing of information about the damages and losses and different ongoing and planned relief operations: Who is working? Where? What is their focus?

Table 3.1 MAJOR EARTHQUAKES IN THE HIMALAYA AND ITS GEOGRAPHICAL MILIEU

Sl No	Year	Date	Place	Magnitude	Fatalities
1	1720	July 15	Delhi	-	-
2	1819	June 16	Kachchh	7.7±0.2	2000
3	1737	September 30	Calcutta	-	<3000
4	1803	September 01	Kumaon	8.0?	-
5	1833	August 26	Kathmandu	7.7±0.2	500
6	1869	January 10	Cachar	7.5	-
7	1885	May 30	Sopor, Kashmir	7 .0	3000
8	1897	June 12	Shillong	8.1±0.1	1542
9	1905	April 04	Kangra	7.8±0.2	19500
10	1918	July 08	Srimigal, Bengal	7.6?	-
11	1930	July 02	Dhubri,Assam	7.1	-
12	1934	January 15	Bihar/Nepal	8.2±0.1	10500
13	1943	October 23	Assam	7.2?	26
14	1947	Jul 29	Assam	7.7?	100
15	1950	Aug15	Arunachal Pr.	8.5	1542
16	1956	Jul 21	Anjar	7	113
17	1967	Dec10	Koyna	6.5	177
18	1970	Mar 23	Broach	5.4	30
19	1975	Jan 19	Kinnaur	6.2	60
20	1988	August 06	Manipur	6.6	35
21	1988	Aug 06	Udaypur	6.4	6500
22	1991	Oct 20	Uttarkashi	6.6	769
23	1993	Sep 30	Latur	6.3	7610
24	1997	May 22	Jabalpur	6.0	39
25	1999	Mar 29	Chamoli	6.8	103
26	2001	Jan 26	Bhuj	7.6	>20000

Source: Bilham *et al.*2001: 1444

Table 3.2 KASHMIR EARTHQUAKE (2005) CASUALTIES

Location	Dead	Injured
Pakistan (NWFP & Kashmir)	73,276	100,000
India (Kashmir)	1,360	6,266
Afghanistan	4	-
Total	74,500+	106,000+

Source: http://en.wikipedia.org/wiki/2005_Kashmir_earthquake (accessed Dec 11, 2006)

3. Coordination of different environmental interventions, to avoid overlaps and ensure more coherent and meaningful response to environmental issues, must be facilitated. Organizations such as the United Nations Environment Programme (UNEP), the United Nations Development Programme (UNDP), the World Conservation Union (IUCN), the Worldwide Fund for Nature (WWF), the World Bank (WB), the Asian Development Bank (ADB), Department For International Development (DFID) and CARE should find a way to coordinate their efforts more effectively.

4. Rapid Environmental Assessment of the environmental damages caused by the earthquake and for short and medium term relief period (from now up to three months; maximum six months); to avoid further damages and losses related to the disaster and the relief operations and rehabilitation.

5. Development of relief guidelines to assist relief agencies. Undertake relief operations with minimal damage to the environment (to be developed; guidance from existing United Nations High Commission for Refugees (UNHCR) and other agencies guidelines).

6. Proper management of temporary camps, admittedly not easy, but essential in minimizing environmental and health risks to the affected population (location, energy and sanitation).

For the medium term course of action the team suggested the following vital considerations:

1. Develop rehabilitation/reconstruction guidelines: Assist the Government and other international and local organizations in undertaking rehabilitation and reconstruction trying to minimise damage to the environment. These guidelines will be in continuation of the relief guidelines developed earlier.

2. Develop strategy and plans for reconstruction/rehabilitation: This is an essential part of the rehabilitation and reconstruction phase and will be undertaken by the newly created Earthquake Rehabilitation and Reconstruction Authority (ERRA). All efforts should be made to get environmental aspects incorporated in the strategy and subsequent plans.

3. Review and adopt Disaster Management Strategy: The disaster management strategies and plans of the Government need to be reviewed and revised based on the lessons learnt from the recent tsunami experiences[4]. Once reviewed, it should be adopted and put into implementation. The review should also identify areas where environmental aspects can be incorporated in the strategy.

4. Review policy / legislation: Undertake the review of the relevant laws and policies to identify those which may not support an appropriate disaster response. In addition, building codes and disaster management systems should be reviewed, to prepare for any future disasters. Based on observations, recommend better construction practices and develop and implement building codes (environment-friendly, energy and timber saving).

5. Develop proper reconstruction schemes (individual or collective): The new settlements or housing schemes planned for the devastated areas are to be safe, energy efficient,

[4] On December 26, 2004, a massive earthquake occurred under the Indian Ocean just off the coast of Indonesia. The 9.0 magnitude quake created a series of tsunamis that caused great destruction and loss of life throughout the Indian Ocean basin, within several hours of the initial event. The earthquake has been titled the Sumatra-Andaman Islands Earthquake and is the highest magnitude earthquake in the region in over 40 years. Over 227,898 people were confirmed dead making this the fourth largest death toll from an earthquake in recorded history.

culturally harmonious and environment friendly. In this context, all care should be taken to avoid ecosystem degradation. The restoration should be planned as a whole in order to make the best present and future use of available resources through a comprehensive and integrated approach to development in the affected areas.

6. Adoption of optimal Land Use Policy: Surveys and assessments need to be carried out to come up with a rational land use policy. To the extent possible, actions contrary to the inherent capability of land should be avoided.

7. Restoration of cultural heritage sites: the cultural heritage sites that are destroyed in the earthquake should be restored. Similarly, historical religious sites, such as tombs and mosques, that often suffers damage need to be restored.

8. Assess damages to the affected protected areas and put into place a recovery plan: In addition, management of land outside protected areas should be carried out in such a way that adequate populations of indigenous wild plants and animals can survive in the protected areas and parks.

3.3 Extreme Climate

The Himalaya exhibits one of the most complex climatic patterns and it is virtually far from possible to come to a clear pattern of climatic set up in the region. Owing to its extreme diversity in its various sub-ecological locations, elevation, and topography the region is featured by extreme variants of climate. The two main climatic characteristics of the region are the seasonal rhythm of weather and the vertical zoning. The climatic conditions vary from hot sub-humid tropical in the southern low tracts to temperate, cold alpine and glacial in the northern high mountains. The temperature of the region varies spatially- both vertically and horizontally.

The Himalayan region is characterised by extreme cold and arid winter conditions in the West to warm and humid summer in the east with alterations of dry and moist conditions in wide range of altitudes having different microclimates. The lowest temperature in this connection has been recorded in Leh with -28.3^{o} C while exceptionally high temperature has been measured in Jammu with 47.2^{0} C (Singh 1971). However, the understanding of climatic extremes such as cloud bursts, hail storms, droughts etc., which play a crucial role as an environmental constraints at micro levels, is not well understood (Bahadur 2004). Further, due to poor accessibility, lack of proper recordings and quantification of these events, it is impossible to predict these events with any confidence. Cloudbursts cause heavy damage and slope failures while hailstorms or droughts inflict great losses to agriculture.

Cloud burst is one of the major natural hazards in the Himalaya. It refers to sudden and violent rainfall, followed by flash floods and is generally reported during monsoon period. Such events are related to extreme hydrometeorolgical conditions leading to debris flow, landslide and eventually the blockade of river channels, consequently wreaking havoc downstream. It strikes at random and at heightening speed, generally lasts for a limited time, and leaves behind a trail of devastation. Cloudbursts occur due to heavy rain-shower due to intense convectivity activity and occurrence of thunderstorms. These storms are only 15-30 km across and generally escape observation from widely established meteorological network. The Alaknanda flood of 1970, considered as the worst disaster of its kind in northwest India of the last century was triggered by a cloudburst followed by flash flood in the downstream. The flash floods of Bhagirathi in 1978, Sutlej in 1993 and 2000 and Teesta in 1968 are other examples of similar events inflicting far reaching human insecurities along the Indian Himalayan belt.

> The two severest rainstorms in Central (Indian) Himalaya occurred in September 1880 and September 1924. Widespread flash floods and landsides accompanied both the events and parts of Nainital were washed away in 1880. The 1880 rainstorm was of two-day duration while that of 1924 was for three days. The former with its centre at Nagina is considered to be one of the severest of its kind in the world. Nagina in Binjor district, located in the plains adjoining the Garwal-Kumaon Mountains recorded 820 mm rainfall on September 18, 1880. This has not been exceeded so far. The 1924 rainstorm, with its centre 64 km east of Roorkee, lasted three days and was the severest on record to have affected western Uttar Pradesh. Hundreds of people and thousands of heads of cattle were washed away in Dehra Dun, Saharanpur, Ambala and Karnal districs. The mountainous portion of the Ganga basin up to

Hardwar also received 350 mm rainfall in the there days of storm. (Extracted from CSE 1991: 33)

The 1968 rainfall and the consequent food in Darjeeling Himalaya remains the biggest in recent history. In October 1968, rainfall between 600 mm and 1200 mm fell in the Darjeeling Himalaya during a three-day period at the end of the monsoon when the ground was already saturated. It is estimated that some 20,000 landslides took place during the period. The 50 km road between Siliguri and Darjeeling was cut in 92 places and approximately 20,000 people were killed, injured or displaced. Numerous bridges were washed away and rail traffic was closed for 32 days. (Extracted from CSE 1991: 38-39)

Table 3.3 MAXIMUM OBSERVED 24-HOUR RAINFALL AT SELECTED MOUNTAIN STATIONS

Station	24 hour rainfall (mm)
Cherrapunji	1036
Dibrugarh	745
Darjeeling	640
Almora	221
Dehradun	152

Source: Bruiznzeel and Bremmer 1989 as cited in Bahadur 2004:113

Table 3.3 shows the most significant climatic extremes of heavy rainfall, which are the root cause of devastating floods in the Himalaya. Maximum observed 24-hour rainfall totals are given which follow the same patter in terms of spatial variation of intensity. The rainy season in the entire belt of the Himalaya symbolises calamity and chaos to the inhabitants from Assam to Kashmir (Chadha 1989a:2). In the Hill regions, a cloud burst comes with a speed of thunder, lasts from a fraction of a minute to as long as three hours at a time and leaves behind a trail of devastation worse than that inflicted by the combined effect of rainfall for the rest of the season (ibid:7). We need closer observation network for better definition of storms for predictive purpose (Bhadur 2004). A long-term study predicting the incidence of cloudbursts is necessary (Joshi [undated]).

3.4 Mass wasting

Mass wasting describes a variety of processes through which large masses of earth material move downhill under gravity, either in slow creeping mode or as rapid landsides. Mass wasting is a wide spread constraints faced across the Himalaya. It is the most frequent and widely dispersed manifestation of fragility of the Himalayan terrain and is basically a natural process. However, human activities can substantially aggravate its impact and scale (Bahadur 2004). The most important natural factors (ibid) include-

1. Steep slope with high relative relief,
2. Seismicity,
3. Groundwater flows accentuating landslips,
4. Cloudbursts and intense rainfall events,
5. Nature of the rocks (soft sedimentary, foliated metamorphic or fractured igneous)
6. Toe under-cutting by torrents and floods.

The natural factors are often aggravated by anthropogenic activity such as-

1. Loss of forest cover,
2. Extension of agriculture into steep slopes
3. Open cast mining without environmental control,
4. Road built without regard for geological factors and other forms of poorly planned development.

Two major processes of mass wasting that have been the major causes of human insecurity in the Himalaya include avalanches and landslides. Avalanches are river-like flow of snow or ice descending from mountaintops and are common in the high ranges of the Himalaya. In higher altitudes the snow and avalanches cause a great loss of human and animal lives. According to the scientists, on an average 30 persons are killed every year due to this disaster in the Himalaya (HPDR, 2005). In Ladakh region of Kashmir and Spiti in Himachal Pradesh dozens of people are buried every season in avalanches (Chadha 1989a). Besides claiming lives, avalanches also damage roads and other properties falling in their ways. The villages at higher altitudes and army/paramilitary camps are frequently hit by this natural disaster.

Table 3.4 MAJOR AVALANCHES IN HIMACHAL HIMALAYA

Time	Area	Loss
March, 1978	Lahaul and Spiti	30 people killed
March, 1979	Lahaul and Spiti	237 people killed
- 1998	Shimla	Blocked the districts of Kinnaur, Lahaul & Spiti and Solan
March, 1991	Himachal Pradesh	Road blockage for 40 days
September, 1995	Himachal Pradesh	Devastating Floods

Source: Himachal Pradesh Development Report 2005: 69

Landslides are the most common natural disaster that occurs across the Himalaya causing great human, economic and environmental losses. Large catastrophic landslides also occur specially on the slopes of the main glacially over-steepened valleys and the major river gorges. These hazards present a great risk to the population. Geomorphologically, landslide is nature's way of adjusting slope stability. It is one of the mass wasting processes and is responsible for the degradation of slope and relief. However, across the spectrum of development, the process has been intensified by human interference mainly through deforestation, incorrect construction procedure and unplanned tapping of natural resources. Hence, the degree and frequency of this disaster has notably increased over the period of time.

> In 1893, a largest known landslide dam in the Central Himalaya blocked the Birahiganga to form a colossal 350 m high dam. The lake behind the dam, now known as Gohana Tal (Lake), is 5 km long and 2 km wide and has been sustained for more than 76 years. On 20 June 1970, this lake busted again due to a new cloudburst and the sudden surge of water sent a tidal wave down the valley raising the level of the river by 50 m at Srinagar, a town almost 110 km away. The entire town was washed away. Two days later, when the water reached Hardwar, at the junction with the Ganges, another 125 km away, the floodwater raised the level of the Ganges by nearly four meters. (Joshi [undated])

> On 8 July 1993, a rock fall in the Nathpa area stopped the flow of Sutlej River for 30 minutes, creating a 6 kilometre long temporary lake. The raised river level allowed some water to enter the hydroelectric power installation of the Nathpa Jhakri power plant, halting it for three months and resulting in a revenue loss of millions of dollars. The cost of the removal of the dumped rock fall mass and the treatment of hill slope also ran into the millions. More than 200 people were killed, and many bridge buildings and road suffered damage. (Joshi [undated])

> On July 17, 1986, sixty villages of Chamoli Tehsil were ravaged by landslips and landslides. In this natural havoc more than 14 men lost their lives and more than 200 animals perished in a jiffy. Most of the fertile lands were covered by debris and almost all the weak structures and mud houses crumbled. (Chadha 1989a:2-3)

In this connection, the Darjeeling Himalaya is known to be worst affected by landslides. Even a cursory glance at slide statistics gives us a fearful idea of the enormity of damage done and the ever-present threat to life and property. In the last one hundred year more than 10,000 slides have been registered in the region. Thousands of lives have been lost and the overall economic development of this strategically important region negatively impacted. Few examples of landsides and consequent fatalities in the area may be listed as follows[5]:

1. A storm triggered a landslide that killed 310 people on September 23-24, 1899.

2. Boulders and earth were loosened by heavy monsoon rains and sent tumbling down the Himalayan slopes into the tea-growing region of Darjeeling on September 8, 1980. 250 people were killed and another 30,000 were trapped in high mountain areas.

3. Over 11 people were killed on July 7, 2003 in a slew of landslides in *Ghyabari* area of Darjeeling Himalaya due to heavy and incessant rainfall of over 24 hours. The hill resort of Darjeeling and other far-flung parts of the region were virtually cut off from the rest of the state. Mudslides were also reported on National Highway 31 that connects Sikkim to

[5] Based on literature review.

the rest of the country. Several rivers, including the Teesta and Raidak, flowed above their danger mark.

4. During the monsoon of 2005 Darjeeling Hills suffered heavy landslides. The monsoon landslides across the hills of Darjeeling took the toll of over 15 people besides enormous economic and environmental losses.

5. Incessant rainfall for over five days triggered a mudslide and killed around nine persons and displaced hundreds in *Toongsoong* area of Darjeeling Himalaya on September 24, 2006. A large mass of mud loosened by heavy rainfall descended on houses dotting the slopes causing them to topple over one another and resulting in an immense damage to lives and property. People were evacuated from *Harizan Busty* in Darjeeling town and some parts of *Sukhia Pokhri*, 20 km off Darjeeling Town. Persistent rain caused the entire stretch of Robertson Road to subside, while a huge crack developed on the surface of *Chowrasta* Road.

6. In September 2007 intense monsoon rainfall in the Kalimpong region of Darjeeling Himalaya triggered large numbers of landslides, killing at least seven people. The event brought to the fore the issue of environmental degradation and the consequent landslides in Himalayan environment.

7. With the onset of monsoon the issue of landslides in Darjeeling Himalaya has become a pressing issue for 2008 once again.

Apart from the geological and geomorphogical reasons, high rainfall, scarce natural vegetation and faulty development are attributed as other pertinent forces in this regard. Further, efforts by rescue workers to clear debris are often hampered by inclement weather. Disaster preparedness mechanism in the region is, virtually, in its archaic stage. Government machineries responsible for the purpose remain in their hibernation until the disaster takes place every monsoon. Formulation of professional Disaster Management Team (DMT) is a must in view of the fragility and vulnerability of the region and the resultant environmental and human insecurities.

Mention should, however, be made that there is one glimmer of hope for Darjeeling Himalaya. A significant campaigning group called 'Save the Hills' led by Wing Commander Praful Rao (Retired) has been operating at present in Darjeeling. The objective of the campaign is to raise awareness about issues associated with slope instability in Darjeeling. The group has a very detailed blog in which they document both the magnitude of the challenges and the range of their activities to reduce landslide occurrence and to increase preparedness and resilience. It represents a model of community-level action in response to landslide threats[6].

According to Chadha (1989a), 'The problem of landslides in the Himalaya is complex and defies simple solutions. These occur due to combined effect of intensive human activity, excess rainfall, cloudbursts, flash floods, snow storms, windstorms, fluctuations in the level of subsurface water and slope undercutting by meandering rivers, deforestation and seismicity of the region' (pp 1-2). Landslides cause great loss of life and property and severely degrade the environment.

The occurrence of landslides in mountains cannot be prevented in all cases but their frequency can be reduced by adopting certain scientific measures. Further, taking effective control and preparedness measures for disaster management can reduce the damage. Land hazard zoning characteristics, e.g., proximity of fault, slope angle, dip slope retention, relative relief, height, nearness to ridge tops, lithology and land cover is helpful in making decisions for development projects (Bahadur 2004). Massive afforestation and conservation of the natural vegetation are other important tools to check the frequency and intensity of landslides.

[6] http://savethehills.blogspot.com/ (accessed 15 June 2008)

3.5 Soil Erosion

Rivers, streams and other forms of surface runoff are the primary agents of soil erosion and subsequent degradation of land resource in the Himalaya. Soil erosion causes extensive loss to soil fertility and damage to the land basin. The monsoon is very intense in the Himalaya leading to erosion of much of the Siwaliks in the East from Kosi to Manas in Bhutan (Khoshoo, 1993). There are a number of natural factors that result in large quantities of sediment to be delivered to the rivers of the region for transport (Alford 1992). Though the process of soil erosion is natural and has been continuing in the Himalaya since its origin, recently, due to various human induced activities, its rate has accelerated to dangerous proportions (HPDR 2005). Along with other development activities, deforestation, road construction, forest fires and such other forces are regarded as pertinent reasons for the high soil erosion rate in the Himalaya. The rate of erosion in the catchment area of the Himalayan rivers has increased five fold in the geological timescale, the present rate being upwards of 1 mm per year (Chadha 1989a: 5).

Some of the important forces of soil erosion may be listed as follows:

1. Glaciated nature of the basins
2. Extreme local relief
3. Fractured nature of the rock
4. Efficacy of freeze-thaw weathering cycle
5. Presence of easily erodable glacier debris
6. Frequency and magnitude of landslides, mudflows, and avalanches that deliver sediment to the tributary channel
7. Limited natural vegetation cover, environmental mismanagement and unplanned development

Plate 3.1: Landslide in Suruk Village: Darjeeling Himalaya
[Photo: Vimal Khawas, December 2002]

Plate 3.2: Mudslide that killed nine persons and displaced hundreds in Toongsoong area of Darjeeling Himalaya on September 24, 2006
[Source: The Statesman, 25 September 2006]

The environmental factors in the Himalayan region should be seriously taken as very few of them are amenable to modification using traditional environment management practices (Bahadur 2004). Further, the Himalayan Rivers add fury to the fire. They flow very fast and transport thousands of tonne of sediments every year. Many fast-flowing rivers and streams of the Himalaya erode large amounts of soil in their upper course. Some of the rivers like Teesta are in spate during the monsoon period and cause great loss of life, property and environment. Examples abound across the Himalaya, where river slopes have become naked, huge landmasses of mud have rolled down into rivers damning them and avalanches of mud and water have uprooted the trees on slopes.

Erosion by fast-flowing waters affects the environment in many ways. There is an undercutting of valley sides, which causes the mountainsides to become unstable and ultimately leading to further landslides. During floods, a tremendous amount of erosion occurs on the banks of rivers and streams. Many human and animal lives are also lost every year in the process. One can have an idea about heavy sediment loads carried by the Himalayan Rivers from Table 3.5. The table, however, gives only the suspended sediments, as very little reliable information is available about the quantitative aspects of bed load movement.

Of all the Himalayan Rivers, the Teesta has the highest sediment yield[7]. It, approximately, brings down 98 cum of silt per hectare of its catchment per year giving an annual denudation rate of 9.8 mm per year. And surprisingly, this is among the highest denudation rates estimated for any river valley in the world. Scientists have estimated the average denudation rate for the Darjeeling Himalaya alone in the order of 0.5 mm to 5 mm during a normal year. But during a year of catastrophic floods such as 1968, the denudation rate for that year can possibly go up to 20 mm. It is important to learn that monsoon rainfall is greater in Eastern Indian Himalaya than in its western counter part. Within eastern Himalaya again the rainfall is intense in Sikkim and Darjeeling Himalaya. The reason being: with the Rajmahal hills

[7] For more detail, see CSE (1991). *State of India's Environment: Floods; Flood Plains and Environmental Myths*, New Delhi: Centre for Science and Environment.

situated to the west and the Shillong plateau to the east there is no mountain range to protect the Teesta Valley from the sweeping monsoon winds rising from the Bay of Bengal. As a result the summer monsoon directly hits the foothills and the lesser Himalayan ranges of Darjeeling and Sikkim and gives the Teesta Valley exceedingly high burst of rainfall ranging between 3000 mm to 6000 mm every year.

Table 3.5 SEDIMENT YIELDS OF SELECTED HIMALAYAN RIVERS

River	Station	Sediment yield T/ha/year
Indus	Kotri	5.1
Kabul	Nawshera	2.9
Jinsha	Alexander Bridge	1.7
Chenab	Batang	0.8
Jinsha	Pingshan	19.2
Lan Chang	Jivzhou	2.5
Nu Jiang	Dao Je Ba	1.6
Nian Cu	Jiangza	1.5
Lasha	Lhasa	0.4
Yarlungtsangpo	Nuxia	1.0
Brahmaputra	In Bangladesh	14.5
Ganga	In Bangladesh	15.7
Karnali	Chisapani	67.4
Naryani	Narayanghat	56.8
Bagmai	Chobar	30.3
Kankai	Mainachuli	48.4
Kosi	Chatra	31.3
Tamur	Tribeni	82.2
Teesta	Anderson Bridge	125.1

Source: Bahadur 2004:109

It may be noted that the effects of erosion and sedimentation provide favorable conditions to river shifting. River Kosi has shifted by about 150 km to the west during the last two centuries (Bahadur 2004). According to Hunter's Statistical Account of Bengal, the Teesta was originally a river of Ganga basin. The Teesta River, which at present times flows down from the Darjeeling and Sikkim hills into Bangladesh to meet up with the Brahmaputra used to flow into the Mahananda and the Ganga in Bihar about 220 years ago. In 1787, due to heavy flood and devastating earthquake the Teesta shifted its course to Brahmaputra basin. If such sudden river capture occurs today, it will sweep away thousands of villages in a gigantic flash flood.

3.6 Conclusion

The chapter briefly discussed some of the major natural processes having important bearing on the human security in and around the Himalayan region. The Himalaya is not as strong as it appears to be. Dynamics of change in the entire range is inextricably intertwined with factors such as climate, geology, fauna, flora, water resources etc (Chadha: 1989a).

The region experiences various types of geo-environmental/geomorphic processes and, thereby, is prone to a number of natural hazards. Often these hazards assume the form of disaster due to the region's inherent nature, climatic conditions and lack of adequate disaster preparedness mechanisms consequently inflicting widespread catastrophe and human insecurities in the region. However, more recently, many of the natural processes have been accelerated by the unscientific and unsustainable anthropogenic activities.

Earthquakes ranging in severity, floods or flash flood, and glacial lake outbursts[8] are common among other major natural hazards. Monsoon is the time when water-induced disasters take place in some form or another in various places across the Himalaya. Cloudbursts are generally reported during every monsoon period wreaking tremendous environmental and human devastation downstream.

Most of the rivers in the Himalayan terrain flow through narrow gorges abutting moderate to steep slopes with sharp bands and meet tributaries on steeper slopes. As the rivers flow downstream, the valley becomes comparatively wider and less steep. The occurrence of flash floods, particularly in the narrow river valleys, is one of the most-feared consequences of

[8] Discussion on Glacial Lake Outburst Flood (GLOF) is attempted in chapter four.

major cloudbursts, landslides or glacial lake outburst. Rolling of debris by cloudburst or landslide along the constricted course of the rivers lead to a short-term damming of the river flow, resulting in the creation of temporary lakes, which can last anywhere from a few days to a few decades. When the backwater pressure of the lake exceeds the retention capacity of the barrier, the accumulated water gushes down stream with powerful force inundating otherwise safe settlements. Such flooding has an immense impact on the economy of the region and the safety of the local population.

Majority of the settlements across the Himalaya are located on the middle slopes. Where fluvial terraces exist, people prefer to exploit such areas lying adjacent to the rivers. These areas are considered to be the most fertile locations by Himalayan standards. However, such areas also are most vulnerable to floods caused by the breaching of landslide-induced dams. Evidence of past damming in different river basins of the Himalayan region indicates that the river was blocked many times, particularly at the confluence with tributaries.

A combination of factors appears to contribute to the susceptibility of the Himalayan region to various geo-environmental processes. The fragile geology and torrential rains play a significant role in destabilising the Himalayan terrain. The entire Himalayan belt is, both tectonically and seismically, a very sensitive domain with strong tectonised rocks and fragile mountain slopes vulnerable to the onslaughts of rains. The cumulative effects of past earthquakes in such a zone aggravate these phenomena. 'The studies from Nepal and Pakistan show that the extreme rainfall events have increased in last few years in these countries. Even a cursory examination of the severity of different natural disasters occurring in the Himalayan region indicates that the dwellers of this region are living with the risk. Yet a [comprehensive] mechanism for coping with these risks in the field has yet to be developed' (Joshi, V [undated]).

Plate 3.3: Sediments deposited by River Teesta adjacent to Anderson Bridge
[Photo: Vimal Khawas, January 2007]

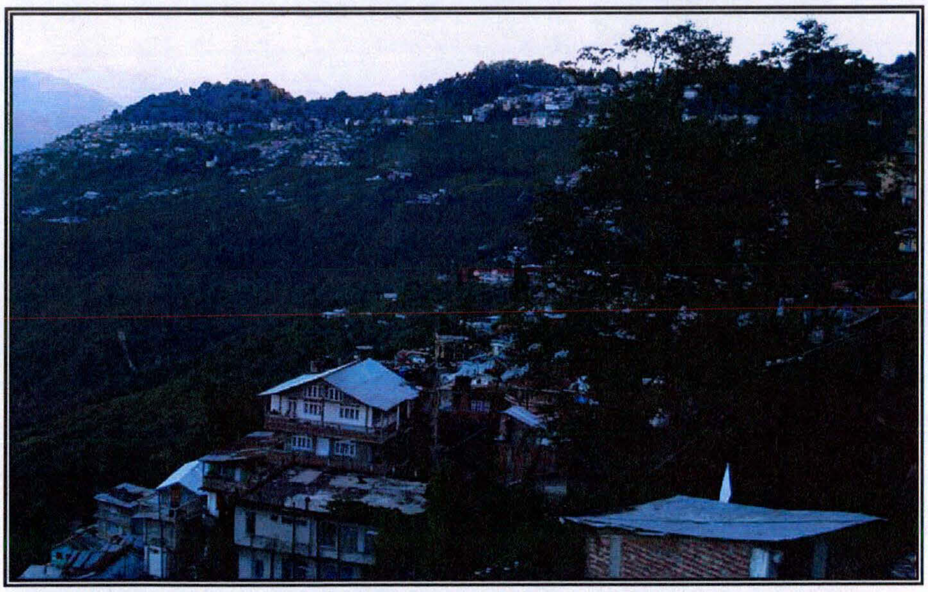


Plate 3.4: Living with risk in the Himalaya
[Photo: Vimal Khawas, October 2006]

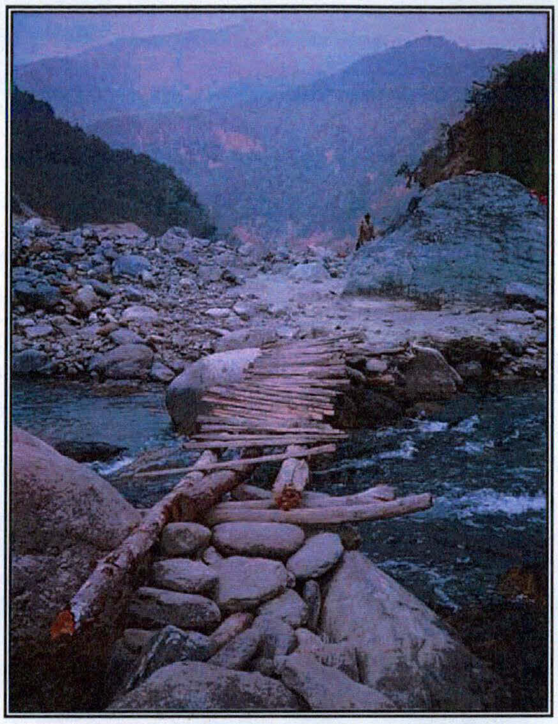


Plate 3.5: Temporary Bridge at Relli *Khola*
[Photo: Vimal Khawas, January 2005]

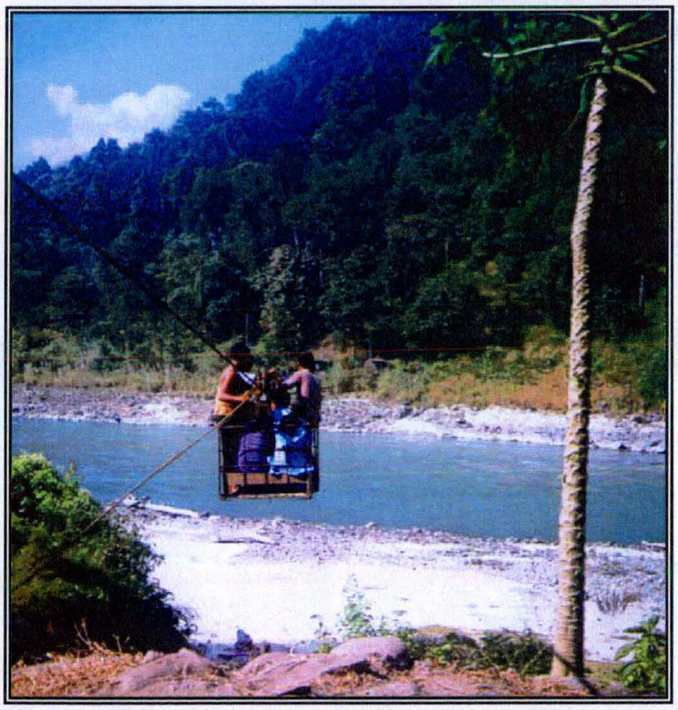


Plate 3.6: Manual Ropeway that connects NH31A with several villages[9]
[Photo: Vimal Khawas, December 2002]

[9] Please also see annexure 4

CHAPTER 4
Himalayan Environmental Degradation and Human Security Debate

4.1 Introduction

Environment and Ecology are closely related to each other. While environment refers to the sum total of conditions, which surround biotic and abiotic factors at a given space and point of time, ecosystem means the interdependent, mutually reactive and interconnected relationship between the organisms and their environment on the one hand and among the organisms on the other.

The status of environment and the level of human security in a particular region have intimate linkages with the level of development in that region. Synergy between environment and economic growth strengthens the process of human security and thereby sustainable human development. The problem however, arises when environmental resources are used more than the rate of their regeneration and the discharges of the economic activities are more than the abating capacity of nature. The result- environmental resources are degraded, depleted and polluted consequently putting limits on human security, sustainable economic growth and development.

The relationship between human and environment has been very close since antiquity. There had been a symbiotic and intimate relationship between man and environment over the ages. Initially human tried to adjust himself/herself with the environment but subsequently sought the adjustment of environment according to her/his needs. We have achieved success in almost every area and this has helped us make our lives more comfortable. However, the path which we sought to achieve our material comforts or what we also call today 'development' has not been in consonance with the environmental and ecological parameters but at the cost of their degradation. This has resulted in the imbalances in the environment and the various ecological systems there-in thereby inviting several human made environmental insecurities. This is a very serious issue both for us and to our coming generations. It is important to understand that human and environment are intimately interrelated and a change in one will negatively affect the other.

The basic objective of this chapter is, therefore, be to identify, quantify and offer a general discussion on some of the major forces that have been largely debated as human made environmental insecurities and which often challenge human security in the Himalaya and its geographical milieu. While doing so, it is also attempted to critically review some of the debatable theories/findings put forward by some scholars/organisations and examine their relevance with the present reality in the area seeking the help of recently available data.

4.2 Growth of Human population

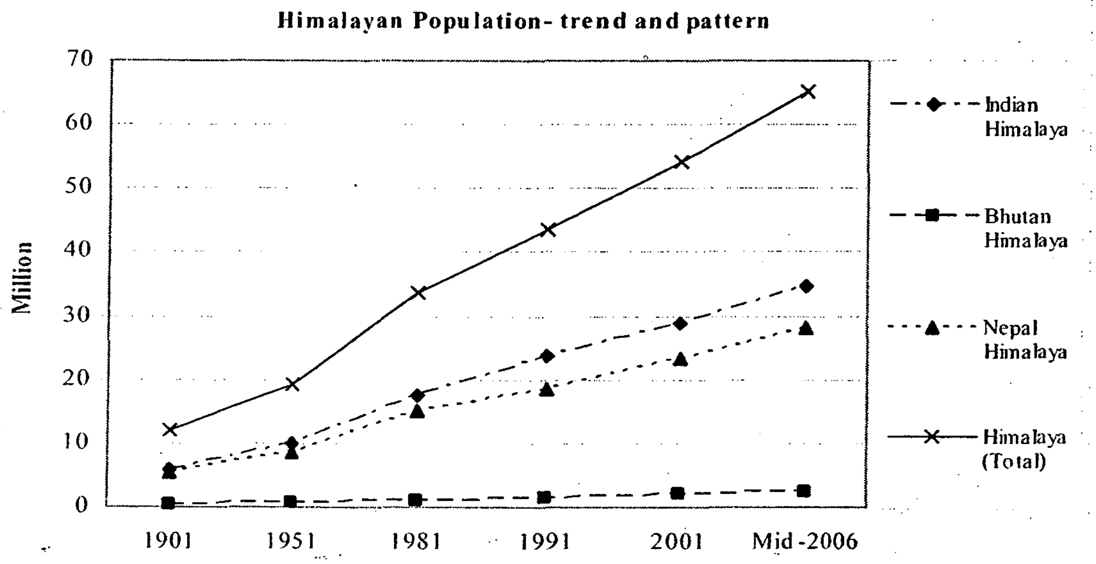
There has been an alarming rise in the size of Himalayan population in the last one-century. At the onset of 20th century the total population was a little less than 12 million. The figure went up to 19.3 million by 1951 adding a net 7.5 million in half century time. Between 1951-81 another 14.4 million souls were added, making a total of 33.7 million. During the period of 1981-2001 the population rose to 54.3 million and by mid-2006 total population of the Himalaya crossed 65 million. Overall, during 1901 and mid-2006 the Himalayan population rose by around 5.5 times. Across region, the population in Indian Himalaya rose by about 6 times from around 6 million to 34.6 million between 1901 and 2006. In Nepal Himalaya the degree of rise has been somewhat similar to its Indian counter part where population rose from 5.6 to 28.3 million between 1901 and mid-2006. A small and relatively isolated Bhutan saw an increase from 0.3 to 2.3 million in its population during the period- a rise of over 7 times. The figure of Bhutan is, however, to be used with caution as we seldom have the official figures. Majority of the population numbers pertaining to Bhutan are the estimates and hence debatable.

Table 4.1 POPULATION PROFILE IN THE HIMALAYA (million)

Region/Year	1901	1951	1981	1991	2001	Mid -2006
Indian Himalaya	5.94	10.07	17.57	23.55	28.86	34.64
Bhutan Himalaya	0.30	0.80	1.16	1.45	2.23	2.28
Nepal Himalaya	5.64	8.47	15.02	18.49	23.21	28.29
Himalaya (Total)	11.88	19.34	33.75	43.49	54.30	65.21

Source: For 1901-1981- Modified since Ives and Messerli (1989); For 1991, 2001- Census of India, Central Bureau of Statistics, Nepal; US Library of Congress (for Bhutan); For Mid-2006- Columbia Electronic Encyclopedia, 2006 (for Bhutan and Nepal); The figure for Indian Himalaya (mid 2006) is a simple projected estimate of the author.

Fig. 4.1 HIMALAYAN POPULATION: TREND AND PATTERN

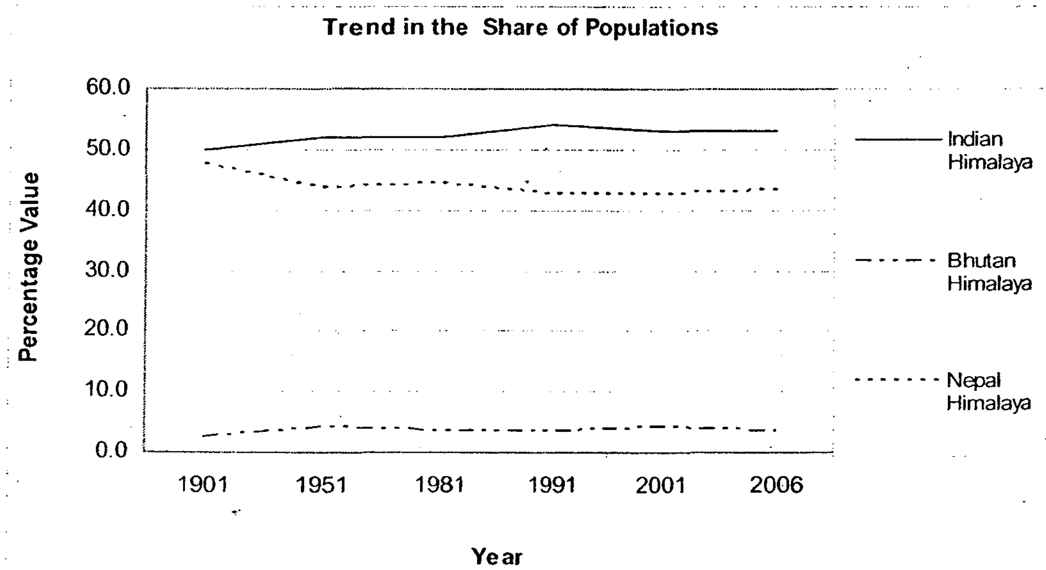


Source: based on table 4.1

The proportion of population shared by different Himalayan political units has not been the same over time- 1901 and 2006. The share of Indian Himalaya has fluctuated between 50 and 54 per cent while in case of Nepal the fluctuation has been between 43 and 47 percentage point. In fact, the share of Nepali population in the Himalaya has witnessed an increase of about 2 per cent in the last 16 years. The share of Bhutan Himalaya has been the minimum and has fluctuated between 3 and 4 per cent. At the other end, the share of land resource falling within Indian Himalaya covers over 70 per cent of the total Himalayan land while

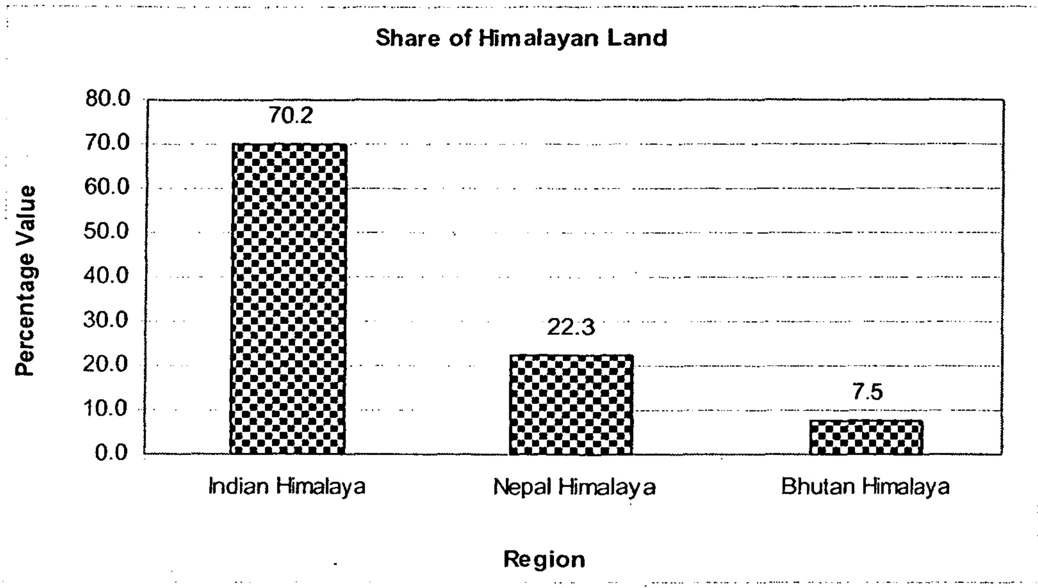
Nepal's share is only a little more than 22 per cent. About 8 per cent of the Himalayan land falls within Bhutan Himalaya. Hence, there is an appreciable mismatch between the share of population and land resource available among three regional political divisions of the Himalaya. The lowest per capita land availability is seen in Nepal Himalaya (0.005 sq km) followed by Indian Himalaya (0.013 sq km), while Bhutan boasts of the largest per capita land availability (0.021 sq km). Per capita land availability in the Himalaya (total) is computed at 0.010 sq km.

Fig. 4.2 TREND IN THE SHARE OF POPULATION



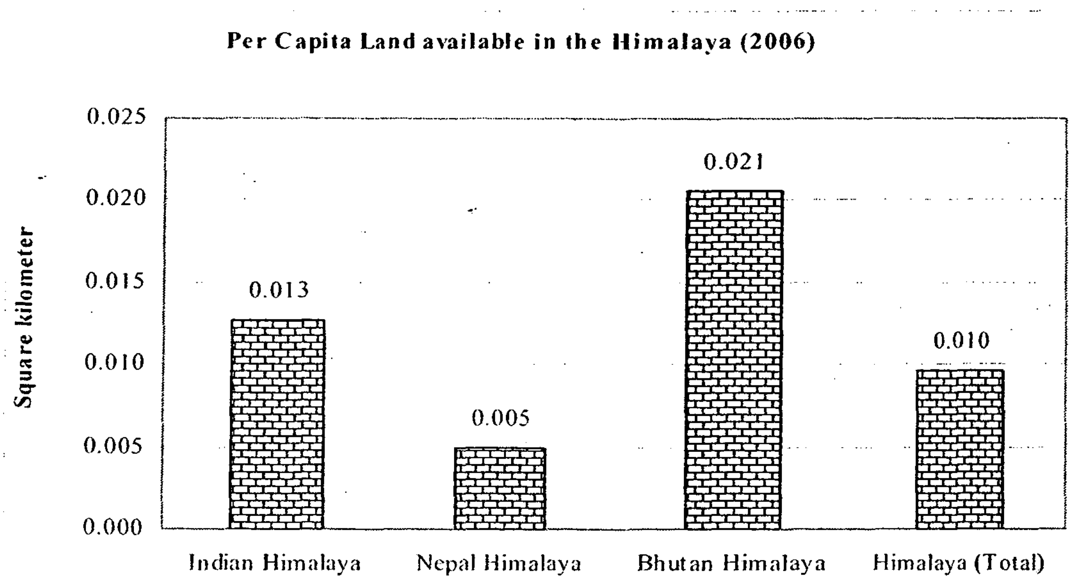
Source: based on table 4.1

Fig. 4.3 SHARE OF LAND RESOURCE AMONG THE HIMALAYAN GEO-POLITICAL UNITS



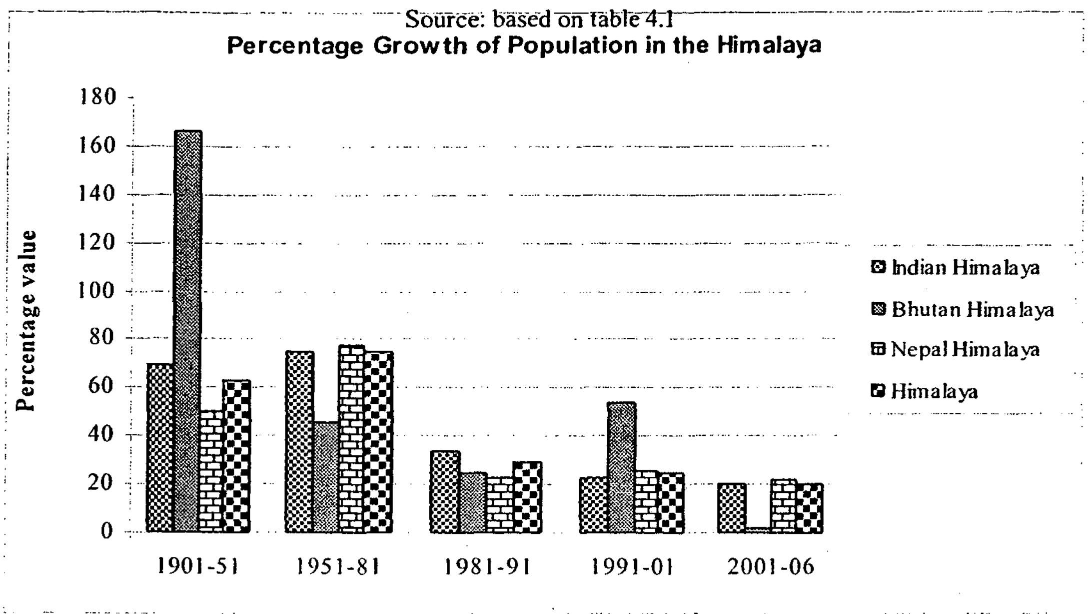
Source: based on various sources

Fig. 4.4 PER CAPITA LAND AVAILABLE IN THE HIMALAYA (2006)



Source: population figures based on table 4.1; data on land obtained from various sources

Fig. 4.5 PERCENTAGE GROWTH OF POPULATION IN THE HIMALAYA



The growth of population in the Himalaya comes to around 449 per cent between 1901 and 2006 while the growth was 93 per cent between 1981 and mid-2006. The decadal growth of Himalayan population between 1991 and 2001 was about 25 per cent while since 2001 till mid-2006 the growth has been 20 per cent. This, roughly, means Himalayan population is growing at the rate of 4 per cent per annum in the last five years. Across the regional divisions of Himalaya, the highest per annum population growth in recent times is seen in Nepal Himalaya (4.4 per cent/year) followed by Indian Himalaya (4.0 per cent/ year) while the Bhutan Himalaya shows the least (0.4 per cent/ year).

Rapid growth of population in the Himalaya highlights an increasing pressure on the resource bases and human security therein and in the adjacent lowlands. Appropriate policy measures and institutions need to be evolved by respective Himalayan political/administrative units in order to check unscientific growth of population.

4.3 Forest Degradation and Loss of Biodiversity

Himalayan forests, the major storehouse of biodiversity in South-Asia are now, allegedly, under threat. Biodiversity is the sum total of species richness (i.e. number of species of plants, animals and micro-organisms) living in a community or an ecosystem (Khoshoo 1993: 16). Today, forests have reduced drastically or completely vanished from many parts of the Himalaya. As back as in the early eighties an average of 1432 persons were relying on each square kilometer of cultivated land in the Indian Himalaya; the same figure for the plains was 483 (Tejwani 1984). Such a situation has over the years manifested itself through encroachments on virgin forestlands and degradation of community lands. The concept of Common Property Resources (CPRs) that was traditionally so relevant in the context of the Himalaya has been increasingly fading away with time. Their destruction is often the result of the limited development options available to the people who are dependent on them. Across the Himalaya, we observe high level of human and livestock population in relation to the available arable land. Forests are the major sources of firewood to the villagers and fodder to livestock.

Almost the entire energy needs of mountain people are met from fuel wood obtained from the felling of trees growing in the forests and near the agricultural field. Unscientific management of land resources further exasperates the situation. The rate of erosion in the catchment area of the Himalayan Rivers has increased five fold in the geological time scale, the present rate being upwards of 1 mm per year (Chadha 1989:5). It may be, however, mentioned that the share of mountain farmers in the overall degradation of Himalayan natural vegetation and biodiversity is minuscule (see among others Ives and Messerli 1989, Ives 2004) as compared to the gigantic share of development paradigm in the area. Unplanned urbanisation, commercial timber extraction, capitalistic development projects, mining & quarrying and such other forces of modern development are among the most pertinent factors that have led to deforestation with serious environmental, social, economic and biological consequences. This is essentially the result of unscientific and lopsided development policies of the respective governments encompassing the Himalaya. In the context of the sorry state of forest resources in Indian Himalayan region some of the veteran scholars may be quoted as under:

> Unfortunately, after independence, particularly after the Chinese invasion, the rhododendron wealth has diminished substantially on account of defence activities where large chunk of mountain slopes had to be cleared. Today if one has to have an idea about diversity of Eastern Himalayan species of Rhododndon, one has to go the Royal Botanic Gardens at Kew and Edinburg, Botanic Garden at Berlin Dahlem and the Royal Horticultural Garden at Wisley. (Khoshoo, 1993:7)

> Faulty policies on land, agriculture, forestry, grazing, animal husbandry, fishing, wildlife and tourism have resulted in habitat loss leading to the loss of biodiversity. Equally important has been the lack of trained manpower, public awareness and lack of financial support. (Khoshoo, 1993:16)

> Right from 1949 onwards, year after year, I have been botanising in the environs of one or the other of the Himalayan hill stations. During the last forty years, vast changes have taken place in the forest or vegetal cover because of devastation brought about by road building activity, construction of hydro-electric dams, expansion of agriculture and horticulture with increasing population and tourist rush as well as deforestation brought about to meet the ever increasing demand for timber, fuel and fodder. Like other naturalists and botanists, I have helplessly watched the changes that are taking place in the Himalayan forest vegetation over the year. (Bir, S.S., 1993:77)

The issue of Himalayan forest degradation and biodiversity therein has attracted global attention ever since Eric Eckholm openly pointed his finger to the poor marginal mountain farmers of Nepal Himalaya and informed the world that they are the principal source of forest degradation and consequent environmental fallouts in his book *Losing Ground* (1976). Subsequently, the World Bank in its report (1979) predicted a total loss of accessible forest cover in Nepal by 2000. Several other reputed institutes, including the World Resources Institute (1985), Asian Development Bank (1982), and Centre for Science and Environment (1982, 1991) spoke with great authority in similar terms[1]. Recently (2006), a group of researchers led by Maharaj Pandit, Senior Visiting Fellow with the NUS University Scholars Programme, as part of their larger research project on the 'effects of large-scale deforestation

[1] The theory termed by Jack Ives as 'The Theory of Himalayan Environment Degradation' dominated environmental debate in major part of the 1980s.

in the tropical biodiversity hotspot' conducted a study on the Indian Himalayan forests. Their study was based on satellite images dating from 1972-1974, 1980-1983 and 1999-2001[2]. A summary of their findings may be relevant to present here:

> By 2000, the region had lost 15 per cent of its forest cover compared with the early 1970s. Only 10 per cent of land area of the Indian Himalaya will be left covered by dense forest by 2100 given the state of current deforestation. The Western Himalaya is expected to suffer higher losses in both total and dense forest cover than the Eastern Himalaya, because of higher human population densities. But Sikkim in Eastern Himalaya is likely to have the least forest cover in 2100 among all the Himalayan states, even though the rate of deforestation is much lower here than any of the Western states. This may be because forest loss and their impact get accentuated due to smaller geographic size of the state. Also, nearly 50 per cent of the geographic area of Sikkim lies above timberline where forest growth is not possible. Dense forest cover in Western Himalaya will decrease from 61 per cent in 2000 to 16.8 percent in 2100; and from 76.2 per cent in 2000 to 38.7 percent at Eastern Himalaya. Almost a quarter of the endemic species could be wiped out including 366 endemic plant species and 35 animal species.

Table 4.2 PROFILES OF FOREST AREA AND COVER

Region	1995		2001		2003	
	Forest Area	Forest Cover	Forest Area	Forest Cover	Forest Area	Forest Cover
Jammu and Kashmir	-	09.2	09.1	09.7	09.1	09.6
Himachal Pradesh	-	22.5	66.5	25.8	66.5	25.8
Uttaranchal	-	44.3	64.8	44.8	64.8	45.7
Darjeeling	-	46.2	-	-	-	-
Sikkim	-	44.1	81.2	45.0	82.3	46.0
Arunachal Pradesh	-	81.9	61.5	81.3	61.5	81.2
Bhutan	64.2	64.2	64.2	64.2	64.2	64.2
Nepal	32.7	32.7	27.3	27.3	25.4	25.4

Source: Computed from the data as available in Forest and Wildlife Statistics 2004, State of Forest Report 1997, State of World's Forest, FAO 2001, 2003

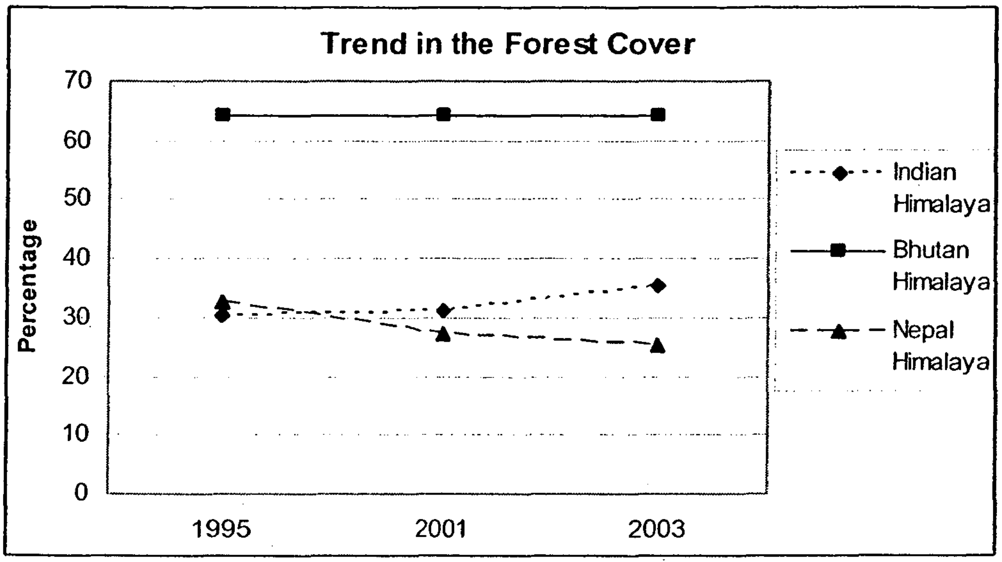
[2] For details, see: http://www.nus.edu.sg/corporate/research/gallery/research75.htm (accessed on 22 December 2006)

Table 4.3 TRENDS IN FOREST COVER (%)

Years	Indian Himalaya	Bhutan	Nepal
1995	30.3	64.2	32.7
2001	31.0	64.2	27.3
2003	35.4	64.2	25.4

Source: Computed from Forest Survey of India, various years and State of World's Forest, FAO 2001, 2003

Fig. 4.6 TREND IN THE FOREST COVER



Source: based on table 4.3

Colossal media reports supporting the situation, often alarmist in nature, makes the state of affair murkier. The ground reality is, however, different. Although, much below the recommended level of 60 per cent of forest covers for hills and mountains, recent figures pertaining to Himalayan forest is not as gloomy as highlighted by many alarmist researchers and popular media. After a wanton forest degradation of the Indian Himalaya during the 20th century, more so during the second half, the forest figures across much of the Himalayan states are improving gradually after the 1990s. This is what the recent government figures highlight, thanks to the Joint Forest Management (JFM) system introduced in the early 1990s. Not surprisingly, the relatively isolated Bhutan has preserved its forest resource well above the recommended threshold level of 60 per cent. This has largely been possible for Bhutan due to its inward looking policies. The concern here, however, is with respect to the ongoing degradation of forest resource in Nepal. The country has seen massive reduction in its forest cover in the last 100 years. The available figures reveal that in Nepal forest cover amounted to over 45 per cent in the early 1960s. It dipped down to about 30 per cent in the 1990s and by 2003 the forest cover of Nepal was just over 25 per cent to its geographical area. Nonetheless, Nepal's forest cover was much more, at the turn of the century, contrary to what World Bank had predicted in 1979. The total forest cover of the Himalaya comes to around 35 per cent.

There is, however, no denial of the fact that Himalayan forest has degraded and depleted over the years. Vested interests and environmental politics kept aside, promoting optimum forest cover in the Himalaya needs serious attention as it is a source of biodiversity- vital medicinal plants, several food crops, animals and such other species of utter importance- many of which are endemic to the region, reduces the risk of breeding exotic pests and diseases, sustains food & water security of the poor mountain people and ensure sustainable geo-environment and thereby sustainable development. Further, Himalayan forests confront the challenges posed by the global warming and consequent climate change. On the other hand, however, unscientific and reckless destruction of forest resources accelerate the process of global worming and further paves the ways to their own degradation and depletion of associated biodiversity. Forest degradation also leads to a variety of other geomorphic problems, including land degradation, soil erosion and landslides. The slopes without vegetation could not be expected to hold soil cover together.

4.4 Global Warming and Climate Change

Global warming and consequent changes in the climatic pattern across the geographies of the planet has been a hot topic in recent times across the disciplines- natural and social sciences- supported by undue hype of popular media. Many scientists firmly believe global warming is hurting our environment. Even politicians and diplomats have become an integral part of the debate. Hence, global worming has acquired global significance and has found its place in the regional and global geo-politics. The then Secretary General of the United Nations, Kofi Annan emphasised at the 'Climate Change Conference in Nairobi' in November 2006 that climate change is not just an environmental problem, but also a health problem, a security problem and an economic problem for all nations[3]. Today it is largely accepted that planet-wide environmental degradation has been occurring due to unscientific anthropogenic activities and such activities are to a large extent responsible for accelerating the process of global warming. The issue of global warming has become a serious concern for all of us. According to the Fourth UN report by the Intergovernmental Panel on Climate Change (2007), humans are very likely to be to blame for global warming and there is virtually no doubt it is linked to man's use of fossil fuels. Ice core samples from the Antarctica have been used as proof of how warming over the centuries has been accompanied by raised CO2 levels.

However, there are many scientists like Ian Clark, Paul Reiter, Gary Calder, Philip Stott) who do not accept the theory that greenhouse gases cause global warming and subsequent global climate change. They state that there is little scientific evidence to support the theory. According to them, global warming could be caused by increased solar activity such as a massive eruption. Ian Clark claims[4], '...warmer periods of the Earth's history came around 800 years before rises in carbon dioxide levels. After World War II, there was a huge surge in carbon dioxide emissions, yet global temperatures fell for four decades after 1940'. According to Philip Stott[5], 'the system is too complex to say exactly what the effect of cutting back on CO2 production would be or indeed of continuing to produce CO2. It is ridiculous to see politicians arguing over whether they will allow the global temperature to rise by 2c or 3c'.

> The UN report by the Intergovernmental Panel on Climate Change was published in February 2007. At the time, it was promoted as being backed by more than 2000 of the world's leading scientists. But Professor Paul Reiter of the Pasteur Institute in Paris said it was a 'sham' as the list included the names of scientists who disagree with its findings. Professor Reiter's

[3] United Nations Climate Change Conference was held at Nairobi from 6 to 17 November 2006. Details at: http://unfccc.int/2860.php (accessed 19 December 2006)

[4] *The Times of India*. "Researchers rubbish greenhouse theory", (Times International), March 7, 2007.

[5] Ibid.

name was removed from an assessment only when he threatened legal action against the panel. According to him, that is how they make it seem that all the top scientists are agreed. It is not true.[6]

The over dramatistion of global warming message has more recently been termed as 'Hollywoodisation of Global Warming'. Scientists like Paul Hardaker and Chris Collier of the UK's Royal Meteorological Society believe that scientists, campaign groups, politicians, and the media were all guilty of making out that catastrophic events were more likely to happen when this could not be proved by scientists. According to Collier, to make the blanket assumption that all extreme weather events are increasing is a bit too early yet. It is, however, firmly believe that global warming is happening and man-made emissions of green house gases are partly to blame. Some scientists also acknowledge that dramatic warnings about climate change have helped generate public debate and support for action to reduce the threat. However, exaggeration of the problems often confuses the public and paves the way for skeptics to argue in a wrong perspective. According to Hardaker, scientists need to be more honest about the uncertainties surrounding climate change prediction to avoid losing pubic trust. Once we begin to exaggerate the science in either direction the debate gets out of control.[7]

4.4.1 Situation in the Himalaya

Since the mid-1970s the average air temperature measured at 49 stations of the Himalayan region rose by 1°C with high elevation sites warming the most (Hasnain 2000, WWF 2005). This figure is twice as fast as the 0.6o C average warming for the mid-latitudinal northern hemisphere over the same time period (IPPC 2001, WWF 2005) Studies in Nepal (Shrestha *et al.* 1999) and Tibetan Plateau (Liu *et al.* 2002) indicate the rising temperature in recent times, with the warming being consistent and continuous after the mid-1970s in Nepal. The average warming in Nepal in its annual temperature between 1977 and 1994 was found to be

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[6] Reported by Julie Wheldon in *Daily Mail*, London [reproduced by *The Times of India*, "Researchers rubbish greenhouse theory", (Times International), March 7, 2007.

[7] See Jowit, J. (2007), "Don't exaggerate climate dangers, warn scientists", *The Hindu*, March 19.

0.06°C/year. Incidentally, in both the countries the rate of warming is found to be more pronounced in the high altitude regions than the lower ones. Similarly, the lowland areas of India do not show significant warming trend (WWF 2005) indicating that the Himalaya is more sensitive and affected by climate change. Similar analysis (Shrestha *et al.* 2000) on precipitation data, however, does not reveal any significant trends in Nepal.

> The mercury is rising in Darjeeling. In one of the most striking revelations of recent times, the Queen of Hills has shown an increase of more than one degree Celsius in its mean annual temperature in the past 100 years. According to Subir Sarkar, the in-charge of North Bengal University weather station, 'hundred years ago, the mean annual temperature of the hill town stood at 13.45 degrees Celsius; at present it is 14.5. The rise has made both the summers and winters a wee bit warmer. The rise in the hills is twice that of the plains. While the global warming is said to be the main and obvious reason for the rise in the mercury level in the hill town, unplanned urbanisation and depletion of forest cover are two local reasons for the rise in the temperature.' [8]

4.4.2 Glacial Retreat

One of the worst damages of global warming as revealed by various scientific studies has been the glacier retreat in the mountain regions and Glacial Lake Outburst Floods (GLOFs). While such phenomena have occurred due to geologic and geomorphic reasons in the past, scholars argue the rate and frequency of their occurrence have amplified severely in the last couple of decades, and sadly is increasing with time. Geoscientists have revealed a general shrinkage of mountain glaciers on a global scale and the trend was found to be more pronounced during the first half of the 20th century. After about 1950 mountain glaciers again started to grow. However, they again started to retreat with accelerating pace since the 1980s. Based on the scientific investigations, there have been forecasts that up to a quarter of the global mountain glacier mass could disappear by 2050 and up to half could be lost by 2100

[8] Reported by Anuradha Sharma Lakhotia, "Darjeeling warming up faster than world", *The Telegraph:* North Bengal and Sikkim, 7 November 2006.

(see WWF 2005). In the Himalayan region also glaciers have been found to be in a state of general retreat since 1850 (Mayewski and Jaschke 1979, WWF 2005).

In Nepal, the Khumbu glacier, a popular climbing route to the summit of Mt. Everest, has retreated over 5 km from where Sir Edmund Hillary and Tenzing Norgay set out to conquer Mt. Everest in 1953 according to research findings. Similarly, several other Nepali glaciers are fast retreating in recent decades (see among others Fujita *et al.* 1998, 2001, Kadota *et al.* 1997, Seko *et al.* 1998, WWF 2005). In India situation is no better. Recent scientific studies show that almost all the major Indian Himalayan glaciers are retreating at an increasing pace (see WWF 2005). Of particular importance is Gangotri glacier as it has attracted massive media attention in recent years. Latest data in this connection shows that Gangotri is retreating at the rate of 23 m/yr. Table 4.4 highlights the situation of some of the major glaciers in Indian Himalaya. According to the recent research findings, since the last inventory of glaciers and glacial lakes in Bhutan by the International Centre for Integrated Mountain Development (ICIMOD) in 2001, 120 additional glacial lakes have formed in the mountains (Penjor 2006: December 03), indicating a rapid pace of glacier retreat in Bhutan Himalaya. It also reveals that glacier retreat or advance is either caused by natural factors or global environmental changes and that local ecology has little control over it. This is so because Bhutan's environment is relatively intact and the region still has over 64 per cent of its geographical area under forest.

Table 4.4 **RETREAT OF IMPORTANT GLACIERS IN THE HIMALAYA**

Glacier	Location	Period	Avg. retreat (m/year)	Source
Kolhani	Jammu & Kashmir	1857-1909	15.0	WWF, 2005:32
Kolhani	Jammu & Kashmir	1912-1961	16.0	WWF, 2005:32
Machoi	Jammu & Kashmir	1906-1957	08.1	WWF, 2005:32
Badashigri	Himachal Pradesh	1890-1906	20.0	WWF, 2005:32
Badashigri	Himachal Pradesh	1940-1963	44.3	Bahadur 2004:53
Chotasigri	Himachal Pradesh	1970-1989	07.5	WWF, 2005:32
Milam	Uttaranchal	1849-1957	12.5	WWF, 2005:32
Pindari	Uttaranchal	1845-1966	23.0	WWF, 2005:32
Gangotri	Uttaranchal	1935-1976	15.0	WWF, 2005:32
Gangotri	Uttaranchal	1962-2000	35.3	Bahadur 2004:53
Gangotri	Uttaranchal	1985-2001	23.0	WWF, 2005:32
Zemu	Sikkim	1909-1965	07.9	Bahadur 2004:53
Zemu	Sikkim	1975-1990	19.8	Bahadur 2004:53
Glacier AX010	Shorong Himal, Nepal	1978-1989	02.7	WWF 2005:16

4.4.3 Glacial Lake Outburst Flood

Glacial Lake Outburst Flood (GLOF) is primarily an outcome of glacial melting. They are catastrophic discharges of water resulting primarily from melting glaciers. According to WWF (2005), many of the big glaciers have melted and retreated rapidly and have given birth to the origin of a large number of glacier lakes. Due to the faster rate of ice and snow melting, caused by the global warming, the accumulation of water in these lakes has been increasing rapidly and resulting sudden discharge of large volumes of water and debris and causing flooding in the downstream. An accelerated retreat of the glaciers in recent times has led to an enlargement of several glacial lakes. As the glaciers retreat they leave a large void behind. The ponds occupy the depression earlier occupied by glacier ice. These dams are structurally weak and unstable and undergo constant changes due to slope failures, slumping, etc. and run the risk of causing GLOFs. Characterised by sudden releases of huge amounts of lake water, which in turn would rush down along the stream channel downstream in the form of dangerous flood waves, GLOF waves comprise water mixed with morainic materials and cause devastation for downstream riparian communities, hydropower stations and other infrastructure. Further, Glacial lake outburst flood (GLOF) causes disasters to life and property along the downstream, results serious death tolls and destroy valuable forests, and farms. In the long run, glacial retreat/melting and GLOFs tend to threaten regional environmental and human security.

> On a clear blue morning of October 7, 1994, Dechen Tshering, a Class X student of Punakha High School, was standing at the confluence of the Pochu and Mochu rivers when he heard a rumbling sound. He didn't give it a second thought assuming that convoys of trucks was passing by but when the water level of the Punatshangchu touched the stones where he had positioned himself he literally flew to safety. All he could see was a river of logs, boxes, haystacks. In minutes the river ravaged everything on its way. It changed course, destroyed parts of the dzong, and flooded the school soccer field and ripe paddy fields with fish," he said. The October flood had claimed more than a dozen lives, damaged acres of farmland, and government and private property worth millions of ngultrums. The flood was caused by a glacial lake that had burst high up in Lunana[9] nine days walk from Gasa dzong.[10]

Some of the worlds largest documented historical GLOFs occurred in Karakoram-Himalaya. The damming of upper Shyok River by chongkumdan glacier formed a lake. A sudden outburst from this lake occurred in 1929 and the flood wave traveled down the Shyok River into Indus creating a rise of 8 m, 740 km downstream from ice dam. In Nepal, thirteen GLOFs are observed since 1960 for 30 years duration giving a very high frequency of natural hazards (Yamada 1993, Bahadur 2004). In 1985, a bursting lake in Nepal destroyed 14 bridges and caused US$1.5 million damage to a power plant. According to the United Nations, nearly 50 high Himalayan lakes could flood their banks in the next 5 to 10 years, sending water crashing down the mountains and threatening thousands of lives (Koppel 2002: April17). GLOFs are not a new phenomenon across the Himalaya but their occurrence has become more frequent in the past couple of decades. UNEP scientists, working with the

[9] located in Bhutan.

[10] Reported by Ugyen Penjore. "Glaciers are retreating", *Kuensel*, 03 December 2006.

International Center for Integrated Mountain Development in Kathmandu, Nepal, have found at least 44 lakes in Nepal and Bhutan that were filling so rapidly they were in danger of bursting their banks (ibid). GLOFs are poorly documented but observed to create floods raising water levels up to 100 m (Bahadur 2004). It is considered necessary to have scientific GLOF analysis for design flood of projects in glacier dominated watersheds.

Table 4.5 STATUS OF GLACIAL LAKES IN NEPAL AND BHUTAN

Country	Glacial Lakes		
	Number	Area (km2)	Potentially Dangerous
Bhutan	2674	106.78	24
Nepal	2323	75.70	20

Mool *et al.* 2001:364

Table 4.6 LIST OF GLOF EVENTS RECORDED IN NEPAL

Year	River Basin	Name of Lake
450 yrs ago	Seti Khola	Machhapuchhare
1935	Sun Koshi	Taraco, Tibet
1964	Arun	Gelaipco, Tibet
1964	Sun Khola	Zhangzangbo, Tibet
1964	Trishuli	Longda, Tibet
1968	Arun	Ayaco, Tibet
1969	Arun	Ayaco, Tibet
1970	Arun	Ayaco, Tibet
1977	Dudh Koshi	Nare, Tibet
1980	Tamur	Nagmapokhir, Nepal
1981	Sun Koshi	Zhangzangbo, Tibet
1982	Arun	Jinco, Tibet
1985	Dudh Koshi	Dig Tsho, Nepal
1991	Tamo Koshi	Chubung, Nepal
1998	Dudh Koshi	Sabai Tsho, Nepal

Source: WWF 2005:25

Plate 4.1: Glacial Lake: Bhutan
[Source: *Kuensel,* 2006: 3 December]

Plate 4.2: Chandra Taal: Himachal Pradesh
Photo: Manish Thakre 2003]

While majority of the scholars link the retreat of glaciers and consequent GLOFs with the process of global warming, there are scientists who do not agree with this theory. In this connection it would be informative to look into the observations made by Jack D. Ives, a noted geomorphologist, communicated to this writer[11], in the context of Khumbu glaciers in Nepal Himalaya-

> ....it has been well documented that the Khumbu glaciers are thinning and retreating and that potentially hazardous glacial lakes are forming. At issue, however, is the degree of hazard, and this appears to have been grossly over-estimated. We must also ask how the occurrence of a natural event (ie jökulhlaup or glacial outburst floods) can be seen as "destroying the environment?" Jökulhlaup are known to have occurred in many glacierized mountain areas and have been documented in the Alps, Alaska, the Canadian Rockies, Karakoram, and Pamir, amongst others. In Iceland, where the actual term *jökulhlaup* originated, there is a reliable record of destruction of farms and villages extending over several hundred years. Thus, they are not specific to current global warming. So how can a natural process "destroy the environment?"
>
> More significantly, what can anyone, or any institution, do to protect Mount Everest from global warming? The BBC News/South Asia (18 November 2004, online) cautioned that Mount Everest "could one day become nothing but rock," implying that all its ice and snow would melt. That would require such a large increase in temperature that the entire population of the subcontinent (at least) would likely have died from heat prostration long before Mount Everest were stripped of its ice and snow. In other words, by the time the mountain had been reduced to a bare rock far more serious extra-Himalayan problems would have diverted attention.
>
> Of more immediate concern, however, is that this form of over-dramatic activism runs the risk of substantial misrepresentation. It may also deflect from some of the actual problems facing the Sagarmatha National Park and World Heritage site. These include:

[11] The observation is also published in *Mountain Research and Development*. 2005, 25 (4): 391-394

1. Severe damage to the upper timberline belt vegetation and the alpine meadows by large numbers of trekkers and their porters;
2. An excessive number of mountaineering expeditions permitted by the government;
3. Inefficient park management too closely controlled from Kathmandu;
4. Environmental damage perpetuated by the Nepalese military;
5. The Maoist Insurgency;
6. Over-dramatized reporting that may undermine the credibility of environmentalists.

Regardless of the above discussion, before any action is undertaken, the local people, the Sherpas, who have managed to survive quite successfully for several hundred years, need to be consulted. What are their views? How do they rank the problems, both environmental and socioeconomic, that they face? And can they advise all the many friends of the Khumbu worldwide if and how assistance can be provided?

According to Milap Chand Sharma, geomorphologist in Jawaharlal Nehru University, who has done extensive research on glacial geomorphology of the Western Himalaya, 'glaciers are the most sensitive parameters of temperature change, both positive and negative. However, global warming is not the reason of glacial retreat. It is a simple cyclic episode' (Down to Earth 2006, 15 December: 30). Further, recent analysis of temperature trends in the Western Himalaya over the past century by the scientists at England's Newcastle University have indicated that global warming could be causing some glaciers to grow (BBC News 2006: 24 August; The Australian 2006: 04 September). They found warmer winters and cooler summers, combined with heavier snow and rainfall could be causing some mountain glaciers to increase in size. The findings are significant, because temperature and rain and snow trends in the area impact on water availability for several million mountain population. Their research focussed on the Upper Indus Basin. The findings are published in the *American Meteorological Society's Journal of Climate* (BBC News 2006: 24 August; The Australian 2006: 04 September). It is also that, recent scientific studies in Bhutan have found out that 106 new glaciers have formed in Bhutan since the last inventory of glaciers in 2001 (Penjor 2006: Decmber 3)

Our goal here is not to support or oppose any scientific perspective. Whether glacial retreat and GLOF observed in the Himalayan headwaters are natural cyclic episodes or results of global warming are matters of scientific debate. What matters is the fact that the air temperatures are rising, glaciers are retreating and there are increasing episodes of GLOF.

1. Climate change is having a strong affect on the Himalayan glaciers; most of the Himalayan glaciers are retreating at a faster rate.

2. As the glaciers retreat, lakes can form between the piles of rocks and stones (moraine ridge) that mark the earlier end of the glacier, and the new end of the glacier which is now higher up the valley. The debris acts like a dam ridge, but the wall is often loose and can break suddenly, leading to an outburst of water (glacial lake outburst flood or GLOF). ICIMOD identified nearly 15,000 glaciers and 9,000 glacial lakes, more than 200 of them potentially dangerous, in a survey of glaciers and lakes in Bhutan and Nepal, and selected (HKH) basins in China, India, and Pakistan.

3. If the glaciers continue to shrink, this could have a profound impact on the water flowing through the nine major river basins originating in the Hindu Kush-Himalayan region. The total amount of water in the rivers might increase as the glaciers melt, but when the total amount of ice in the glaciers drops below a critical level, the flow is likely to decline. The seasonal changes in the flow will also be affected. Some changes in the patterns of water flow have already been observed in some rivers of the Himalaya.

4. The permanent snowline has already moved higher, but as yet there are no scientific observations available that can be used to calculate the real reduction in snow and ice cover in the region.

5. Floods and droughts are likely to increase both because of the loss of glacier area, and because of increases in extreme rain and snowfall events.

These trends pose serious threats to the livelihoods and security of the people living in the Himalaya and its geographical milieu. Simplistic response measures like checking local deforestation and overgrazing are not sufficient. As the Bhutanese case points out, glacial retreat and GLOF are occurring even in regions with high forest and vegetative cover with stable land use patterns. From a human security point of view, it is important to ask: What are the impacts of retreating glaciers and drying up of mountain streams to the Himalayan farmers and pastoralists? How can they adapt to these changes more efficiently? How do we inform and prepare the more vulnerable communities about the risks of GLOF?[12]

4.5 Forest Fires

The Himalaya is one of the most vulnerable geographical units of the world susceptible to forest fires. Every year wildfires destroy considerable forest resources in the region. Forest fires occur due to a variety of reasons and may be both natural and human made. Many forest fires start due to natural causes such as lightning which set trees on fire. However, rain extinguishes such fires without causing much damage. Nevertheless, the forest or pasture may be deliberately set on fire by mountain people to induce succulent grass growth for domestic animals. In addition to this, natural vegetative systems sometimes get extensively damaged when fires spread uncontrollably from burning operations carried out in the adjoining agricultural fields. Another common practise is the burning of wild grass or undergrowth to search for wild animals. Unextinguished campfires of trekkers, shepherd camps or roadside charcoal panners may also spread and cause forest fires. Unextinguished cigarette butts and matchsticks are other important causes of accidental forest fires, especially in areas of dry forests. Besides, lightning or sparks from electric poles in dry areas also causes fires. Up to 90 per cent of the Himalayan forest fire is caused by reckless anthropogenic activities (Bajracharya [undated], Chetri 1994, HPDR 2005).

Forest fires occur annually in all the major physiographic/climatic regions of the Himalaya. With the recent large-scale expansion of chirr pine forests in many areas of the Himalaya the frequency and intensity of forest fires has increased. However, the forests of Western

[12] Please also see annexure 1

Himalaya are more vulnerable to fires as compared to its Eastern counterpart. This is because forests of Eastern Himalayas grow in high rain density.

Forest fires generally occur from November to June. High atmospheric temperatures, dryness and at times prolonged winter offer favourable circumstance for a fire to start. The severity of the fire varies greatly depending upon fire weather, fuel conditions, and physiography. Once the monsoon is established, usually by the middle of June, the fire problem gradually disappears.

Table 4.7 FOREST FIRE IN THE HIMALAYA

Region	Forest susceptible to fire (approx)	Tentative period of forest fire
Jammu and Kashmir	40%	-
Himachal Pradesh	50%	February to June
Uttaranchal	69%	February to June
Nepal	90% (of Terai forest)	February to June
Sikkim	40%	November to May
Bhutan	50%	November to May

Source: based on literature review

Forest fires cause immense damage to the Himalayan forest and associated biota every year. They pose a threat not only to the forest wealth but also to the entire regime to fauna and flora seriously disturbing the bio-diversity and the ecology and environment of a region. As fires damage the vegetation, the soil is often exposed to and eroded by wind and water. Occasionally, embers from forest fires also cause fires in nearby mountain villages. Many villages are burned every year with loss of lives, cattle and other property. Forest fires also pose serious health hazards by producing smoke and noxious gases. The burning of vegetation gives off not only carbon dioxide but also a host of other noxious gases such as carbon monoxide, methane, hydrocarbons, nitric oxide and nitrous oxide, that lead to global warming and ozone layer depletion. As a result, often, mountain people suffer from serious respiratory problems due to these toxic gases. Burning forests and grasslands further, allegedly, accelerate the already serious threat of global warming. Recent scientific studies suggest that biomass burning may be a significant global source of methyl bromide, which is an ozone depleting chemical.

Forest fires are usually seasonal phenomena, more often than not occurring during the dry season. They can be prevented by adequate precautions. As over half of the Himalayan forests are affected by annual forest fire, an effective policy on forest fire prevention and control becomes extremely important. While we do not have a comprehensive national policy in this regard successive Five Year Plans of India have provided funds for forests fighting. Surprisingly, in Nepal forest fire management is not in practice even at present times. The community forest user groups control forest fires in their own forests, although they do not have a plan for systematic prevention and control of fires (Bajracharya [undated]). With respect to Bhutan we do not have any reliable information towards this end.

It would be informative to note the recommendations of modern Forest Control Project that was taken up in five districts of Uttaranchal in early 1990s in view of the frequent and severe forest fires in the region. They include:

1. Development and demonstration of modern fire control techniques;
2. Preparation of division wise fire management plans;
3. Estimation of forest fires;
4. Development and application of a forest danger rating system;
5. Training of personnel;
6. Full fire protection of timber depots;
7. Manufacture of fire finders and hand tools within the country and standardisation of fire control equipment.

Plate 4.3: Forest Fire in Darjeeling Himalaya[13]
[Photo: Vimal Khawas, May 2008]

[13] This photograph was ranked among 60 best photographs in the Global Digital Photo Contest 2008 held to celebrate ICIMOD's silver jubilee and World Environment Day 2008

4.6 Unplanned Urbanisation[14]

Urbanisation across the Himalaya has a long history that started before the advent of the British. The earliest urban characters were mainly the capital towns built by different rulers. They were essentially rural in character made up mainly of the palaces, high walls, temples, pavilions etc. With the advent of the British and subsequent colonization of the Indian soil, centers for collection and other related activities started along with the development of administrative activities. Partition of India affected the towns by changing the population size and area of the towns. In the post independence era under the planned effort of development, decentralisation activities started and administrative units were reorganized. The second half of the 20th century saw tremendous pace in the level of urbanisation and urban growth in the uplands of South Asia.

Today the Himalaya accommodates over 500 towns, mainly the small and medium towns. If we dissect the hill towns it is found that small chunk of large towns accommodate considerable urban souls. For instance, out of the total urban settlements class one towns comprise only about 4 percent but shelter over 28 per cent of the total urban population of the region. Over 70 percent of the hill towns are small in character but accommodate less than 40 per cent of the urban population. Such scenario does indicate that the distribution of urban population in the Himalaya is also top heavy as in mainland. Information available in the preliminary census reports of India reveal that urban population in our hill towns are unevenly distributed among the different size classes of towns and cities as also over space.

The implication of such a situation may, however, be different as against mainland. The hills with different environmental set up and geomorphic characteristics may not support the excessive concentration of urban population in its towns and cities. Further, the hilly terrain may not have the scope for lateral expansion of urban settlements as in the plain lands. Hence hill towns in the long run may create hosts of environmental problems and thereby impact the livelihood of the people. Moreover, majority of the urban settlements across the hills are not planned, they grew historically as a trade or administrative centers. Unplanned urban

[14] Please also see annexure 2 and 3.

development across the Himalaya compounds the human security problem that concerns not only to 65 million people inhabiting the Himalaya but several times as many in the plains in the long run as a result of various environmental fallouts.

It is, therefore, necessary for policy makers and planners to revisit the urban situation across the settlements in the Himalaya. Class I towns in the region have very little scope for their spatial expansion in view of the physical limitations of the region. It is also that the geomorphic attributes of the region cannot sustain too many large towns. They need to be controlled and directed in a sustainable path. The medium and small towns particularly class III, IV and V towns are expanding with appreciable pace. They can be developed as major growth centres through appropriate planning and policy intervention in order to accommodate the rising urban population. Such intervention may also reduce the spatial disparity in the levels of urbanisation in the Himalaya.

4.7 Ambitious Development Projects

It is not new to us that development projects, particularly construction of roads and hydel dams, have always raised serious controversies in the context of the Himalaya, as they have tended to become a major source of environmental and other forms of conflict. The unnoticed character of development projects, as they are located in the remote villages, forests and such other locations, has been another critical feature, since they tend to destroy the environment and displace the indigenous people who have been the traditional agents of conservation. Undeniably, development is the most important aspect of human civilisation and Himalaya cannot be an exception in this regard. The point, however, is how sustainable has been a particular development venture. While we proceed ahead in the process of development we need to respect certain aspects concerning geographical locations, environment conditions, over all aspirations of the general public, cultural institutions to name only the important few. It is here we have failed and we have failed badly. With a rapid increase in the density of population and urbanisation in the Himalayan areas, the network of roads is increasing. Today the network of Himalayan roads is over 40,000 kms (Chadha 1989:6). It has been estimated that 2447.53 sq km forest area from 1951 to 1979 were utilised in various development works in Uttaranchal Himalaya, while maximum area came under river valley project (see Negi and Pal, 1989: 101).

Table 4.8 DIVERSION OF FORESTLAND FOR NON-FORESTRY PURPOSES IN INDIAN HIMALAYA (1980-MARCH 2004)

Region	No of Approved Cases	Area Diverted (Ha)
Arunachal Pradesh	100	43,403.8
Himachal Pradesh	586	8,553.7
Jammu and Kashmir	8	1,500.1
Sikkim	157	1,429.1
Uttaranchal	2361	72,094.1

Source: Forest and Wild Life Statistics, India 2004

Mention should be made that there have been tremendous oppositions across the Himalayan Region of India with respect to several ambitious/capitalistic ventures, especially the construction of dams, of the Government of India. Questions have been raised on many fronts by voluntary organizations in and around the region, academia and activists with respect to socio-economic and ecological viability of the projects. It is imperative that all development projects in the Himalaya should take care of the following crucial parameters, among many others.

1. Geographical and geo-environmental set up of the region
2. Socio-economic and environmental viability of the projects
3. Natural Vegetation and Biodiversity
4. Traditional eco-cultural milieu of indigenous and tribal communities
5. Livelihood of indigenous and tribal communities
6. Adequate Participation of the local people

When no attention is paid by development projects to topography, geological structures, drainage patterns and slope studies it often results into chronic landslips, mud slips, and landslides. Proper planning and methodical construction is necessary for ecological balance and sustainability of any development venture.

Plate 4.4: Taming River Teesta

Teesta Hydel Project Stage III under construction.
[Photo: Vimal Khawas, October 2006]

Plate 4.5: Dynamics of Development

NH31A that run-along a little above the construction site of Teesta Hydel Dam [Stage III] was washed down during the monsoon of 2006
[Photo: Vimal Khawas, October 2006]

4.8 Environmental Politics

Every year during the monsoon Himalayan region appears in the headlines with stories of large scale flooding in the plains of Ganges and Brahmaputra and resultant human-monetary-environment tragedy therein. As usual, there has been the yearly practice of accusing farmers of the Himalaya, particularly the Nepal Himalaya, for sending down the floods in ever-higher volumes. Floods occur on the Gangetic plain and Bangladesh every year largely due to their geo-environmental locations. We have, however, never been clear as to what extent of floods occur due to natural phenomenon and to what extent human activities like deforestation in the upstream or building of embankments downstream are responsible for increasing the inundation and deteriorating the flood situation in modern times. It is also not clear whether the floods are increasing in frequency and intensity over the decades, as is strongly claimed. In fact, recent work (Hofer and Messerli 2006) indicates that there have been little or no increases in frequency or intensity of flooding over the past century.

Environmental gossipmongers over the last 3 decades have been, nonetheless, accusing the Himalayan environmental degradation as a pertinent factor resulting in the monsoon tragedy on the Gangetic plain and Bangladesh. They say wanton deforestation in the Himalaya by poor farmers is responsible for flooding, which has been allegedly increasing with time. Such a thesis, based not on scientific fact but on assumption and emotion, that ignorant mountain minority farmers are devastating the forests and consequently causing serious down stream environmental and socio-economic damage is popularly known as the *Theory of Himalayan Environmental Degradation.*

The Himalayan degradation theory proposes that increased devastating flooding on the Ganges and Brahmaputra lowlands is a direct response to extensive deforestation in the Himalaya. The deforestation is presumed as a result of a rapid growth in the mountain subsistence farming populations dependent on the forests for fodder and fuel and for conversion to terraced agriculture. As steep mountain slopes are denuded of forest cover, it is assumed that the heavy monsoon rains cause accelerated soil erosion, numerous landslides, and increased runoff and sediment transfer onto the plains inducing a progressive increase in flooding of Gangetic India and Bangladesh and hence putting at risk the lives of several hundred million people (Ives and Messerli 1989, Ives 2004). Ives strongly criticizes this theory based on the 25 years of research that he and his team have carried out in the region. According to T. Hofer, 'such a supposedly scientific chain of events has served as an expedient tool for both the plains politician and his counterpart in the hills. For the former, it has been useful in times of flood-related crises to pin the blame on the peasantry of a remote region. His hill counterpart, meanwhile, was amenable to accepting the blame because bad science was presented to him as *fait accompli* and also because the aid agencies funded reforestation programmes in the bargain' (Hofer1997)[15].

Fig. 4.7 THEORY OF HIMALAYAN ENVIRONMENTAL DEGRADATION IN A FLOWCHART

Unscientific Population Growth in the Himalaya

Increasing demand for fuel wood, fodder, timber

Uncontrolled forest removal in more and more marginal areas

Intensified erosion and higher peak flows in the rivers

Severe flooding and siltation on the densely populated and cultivated plains of the Ganges and Brahmaputra

Source: developed by the author

[15] Hofer, T. (1997). "Meghalaya, Not Himalaya Himal South Asia". *Himal South Asia,* 10 (5) [Online: Web] Accessed March 12, 2006. URL: http://www.himalmag.com/sep97/index.html

The genesis of the theory can be traced to the GTZ-UNESCO conference of December 1974 in Munich, if not earlier. The summery report of the proceedings noted 'these mountain regions are seriously and increasingly affected by processes of deforestation, soil erosion, improper land use, and poor water management. Overuse of mountain environments has a widening impact on the plains with downstream floods, the siltation of dams and harbours and on the damage of crops and of homesteads'. Eckholm's paper published in *Science* (1975) and his book *Losing Ground* (1976) supporting the Himalayan Degradation Theory added fuel to the fire. His arguments dominated mountain environment and development thought for over 15 years and are influential even at present times in many areas of government and institutional decision-making. Subsequently, the World Bank in its report (1979) predicted a total loss of accessible forest cover in Nepal by 2000. Today intellectuals laugh at the predictions of the World Bank given the fact that Himalayan Kingdom of Nepal has a forest several times more than what was predicted. Several other reputed institutes, including the World Resources Institute (1985), Asian Development Bank (1982), and Centre for Science and Environment (1982, 1991) spoke with great authority in similar terms.

The *Bangladesh Observer* (June 2, 1990) under the headline 'Deforestation in the Himalaya Aggravating Floods' reported the comments of Dr. Tolba, then Executive Director, UNEP, stating '...the chronic deforestation in the Himalayan watersheds was already complicating and compounding seasonal floods in Bangladesh...700,000 people died in Bangladesh in 1970 because of flooding'. Many well-known academicians, foresters, environmentalists, journalists and technocrats were not behind in highlighting their points supporting the cause. As a result, the theory of Himalayan Environmental Degradation became all time strong in the 80s.

In the mean time, [donor] agencies, supported by the vested interests in government departments, NGOs, academics, media, and politics were busy repeating the same narrative over and over across the countries of the region. The lack of scientific confirmation did not deter them from engaging in passionate condemnation of upstream inhabitants for the inundation of South-Asian lowlands, particularly in years when the floods were high. Scholars argue today that it was nothing more than environmental geo-politics in order to enlarge the development budgets and expand and prolong the development projects by vested interests, both from within and outside the region.

The theory of Himalayan degradation and consequent flooding of Gangetic India and Bangladesh started receiving critical review from the academics undertaking research in the Himalayan region from around mid-1980s. Several research groups and individuals began detailed studies and also became aware of each other's work through research journals like *Mountain Research and Development.* Further, the Mohonk conference on the 'Himalaya-Ganges Problem' in May 1986 served as an initial platform to debunk the theory of Himalayan environmental degradation. The very objective of the conference was to discuss, debate and investigate the prevailing Himalayan environmental paradigm of the 1970s and 1980s. The conference paved the way for the publication of *The Himalayan Dilemma: Reconciling Development and Conservation (1989)* under the authorship of Jack D. Ives and Bruno Messerli, where they challenged the prevailing Himalayan environmental notion with several scientific evidences and asked for a more focused and rigorous empirical research in order to substantiate the many environmental issues that had been raised. Since 1989 a vast amount of related environmental research has been undertaken. Although scattered widely across the literature, majority of them support the findings of Ives and Messerli.

Among other scientific findings, data collected and analysed between 1992 and 1996 by a Bangla-Swiss team led by Bruno Messerli and Thomas Hofer provides scientific evidence to further disprove the Himalayan Degradation Theory and presents new suggestions as to the cause of Bangladesh floods. The study clarifies: 'floods in Bangladesh and India are largely independent of human activities in the upper catchment areas. Neither the frequency nor the volume of flooding has increased in Bangladesh over the last 120 years. Precipitation and runoff in the Himalaya do not seem to be important causes of floods in Bangladesh' (Hofer 1997)[16].

It is now largely accepted by the researchers that there was hardly any rigorous environmental research carried out in the Himalayan region prior to 1980 and the account of

[16] ibid

the alarmist Himalayan degradation discourse in both the academic and popular literature was based upon supposition and emotion that entered policy formulation. Such discourse subsequently entered into the environmental and development politics of the region. According to Professor Ives, 'examination of many of the reports prepared for aid agencies and local governments are particularly revealing- successive consultants simply reproduced the conclusions of their predecessors. There were exceptions although; the 'white noise' was almost overwhelming' (personal communication).

The objective of this critical assessment of 'Himalayan Degradation Theory' is not to claim that the Himalaya is as green and pure as it was. Environmental/ecological situations have been changing across spaces of the globe and the Himalaya cannot be an exception. In this connection, mention should be made that environmental problems in several parts of the Himalaya are serious and in some places severe needing immediate scientific attention. However, it is important also to understand that the environmental degradation theory, which openly blames poor subsistence mountain farmers for degrading the Himalayan environment and levels them as direct agents of Indo-Gangetic plain and Bangladesh floods is not true. Such a theory became prominent over the years due to vested interests, environmental politics, popular writings and massive media support without any scientific rigour. Today, it is accepted at least among researchers that the assumed environmental threat of the Himalayas on South Asian lowlands advocated by the Theory of Himalayan Environmental Degradation is far from truth. Rather, there are other pertinent forces including geomorphic, administrative/policy related, developmental, (geo)political, and ethnic/religious (including terrorism) that have played major role in directing the human security paradigm over the years and have acted as dominant factors of instability in the region. The tragedy of this situation is that poor mountain people, as in many other parts of the world, have become victims of convenience. This process has diverted attention away from the real problems – repression and/or neglect of minorities, social unrest and poverty, corruption, all of which contribute to the current violence that affects much of the region.

4.9 Unplanned Tourism

Tourism is a sector where Himalaya has a comparative advantage. It is a growing sector and is growing relatively faster. This sector is, however, yet to be properly regulated and efficiently diversified. Of late massive mass tourism pouring across the urban spaces of the Himalaya coupled with weak regulatory mechanism and inadequate institutions have been the cause of serious environmental concern. In order to accommodate the influx of mass tourists many new hotels, buildings, roads and such other infrastructure facilities are constructed in the hill towns like Gangtok, Darjeeling, Mussoorie, Nainital, Shimla, Malali etc. degrading the environmental situation therein.

> The cases of Dal Lake in Kashmir and Nainital Lake in Uttar Pradesh[17] are very alarming, because more and more sewer pipes have been emptying into these lakes. To promote tourism, ropeways are being introduced in many hills stations like Nainital and Mussoorie. This has made the hill slopes unstable and fragile. Some of the constructions are coming up on old landslides without adequate pretreatment and investments on hill side stability, compounding the problem. (Chadha 1989:7)

Diversification of the sector into eco-tourism, adventure tourism, cultural tourism, religious tourism, nature tourism etc is a welcome step provided such ventures are rationally planned and scientifically managed.

4.10 Inadequate Knowledge and Faulty Governance

For long the Himalaya was not seen by the governments as a separate and unique geographical unit needing different institutions and policies to govern them. Institutions and development policies of the mainstream 'prime locations' were extended to the 'marginal locations' like mountains and consequently several environmental and socio-cultural problems were invited. Although decision makers in recent times have perceived the

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[17] Now Uttarakhand

prevailing lacuna in their governance, Himalaya is still, largely, at the mercy of mainstream institutions. Development polices and programmes have consistently failed to identify and address the needs of the mountains and aspirations of the people therein. Even when attentions have been given, the mainstream approaches have at several cases proved inappropriate and thus have resulted many adverse impacts on the socio-economy and environmental set-up of the region. It is important for the development planners and policy makers to understand that mountains demand an individual approach. This becomes essentially imperative because the effects of slopes and elevation of the Himalaya add a unique dimension to the challenges in addition to such constraints present in the lowlands.

Unfortunately, understanding of the Himalaya and the intricate linkages between physical and socio-cultural dynamics are still limited to indigenous people of the mountains and few others outside the mountains. There is an appreciable gap in knowledge bases with respect to the socio-economic characteristics, traditional- institutional and ecological processes operating in mountain areas. Further, no serious and systematic attempts have been made to understand the various fallouts of modern development in mountain regions, like climate change, pollution, armed conflict, population growth, resource degradation, changes in agricultural patterns and practices, mining, unplanned tourism development, urbanisation and associated infrastructure development etc. and their impact on the overall environment and human security. A far greater effort, hence, needs to be invested in order to understand various challenges faced by mountains in the near future. There is a need for a more robust and science based research than a mere media reporting and popular write-ups that are often based on assumptions, emotions and suppositions in order to have sufficient and authentic database for effective policy formulation.

4.11 Conflict and Conflict Resolutions

One of the important challenges of human security in and around the Himalayan milieu is the disorder created by conflict and ethnic tension. Across the Himalayan region with the exception of Himachal Pradesh, Uttaranchal and Sikkim Himalaya all other locations, including Nepal and Bhutan, are presently infected with conflicts often violent in nature.

Table 4.9 CONFLICT SITUATION IN INDIAN HIMALAYA AND ITS SURROUNDING MILIEU

States	Number of terrorist, insurgent and extremist groups
Assam	36
Jammu and Kashmir	36
Arunachal Pradesh	01
Manipur	39
Meghalaya	04
Nagaland	03
Punjab	12
Tripura	30
Mizoram	02

Source: Frontline 2006, 23(24): 44

The current ethnic tension in the Darjeeling Himalaya and its adjacent Terai/Duar region is relevant to briefly discuss here. The Indian Nepal speakers, or the Gorkhas as they prefer to be called, residing in the region have been fighting for a separate state (province) of Gorkhaland since beginning of the 20th century. Darjeeling was granted Autonomous Hill Council in 1988. However, that could not satisfy the aspirations of the Indian Gorkhas and other ethnic communities residing in the area. In recent times, the agitation for the separate state has resumed once again with renewed vigour.

Several factors can be attributed for the development of a need to carve out a separate state for the Indian Gorkhas residing in Darjeeling Himalaya. First and the most important factor in this respect can be attributed to the lack of desirable development and declining/degrading resource bases in the region. Deficiency of basic infrastructure facilities like adequate educational institutions, health centres, proper communication (roads), safe drinking water etc. can be taken as important indicators in this respect. It is surprising that over 45 per cent of the villages in the region still do not have electricity facility while over 40 per cent of the villagers still have to walk to their nearest town. The spatial distribution of health centres and primary schools is extremely poor. Rampant unemployment of Gorkha youths is another critical phenomenon that has contributed to the movement.

Unless the ethnic conflicts are successfully addressed, the prospect for sustainable development over much of the Himalayan region is seemingly bleak.

4.12 Conclusion

The chapter briefly navigated and discussed some of the important environmental insecurities that are largely considered as human made and their bearing on the overall human security in the Himalaya. Environmental insecurities across the Himalaya have been responsible in guiding and directing civilisations in the area over the millennia. The relationship between human and environment in the Himalaya had been very close since antiquity. There had been a symbiotic and intimate relationship between man and environment over the ages. However, more recently, things are changing for bad in this fragile resource zone. Originally, we adjusted ourselves with the complex geo-environmental set up of the region and hence environmental determinism was very strong. In recent times, however, we have been seeking to adjust the Himalayan environment according to our needs thereby making way for environmental possibilism in this other wise susceptible region. It has resulted in imbalances in the environment and aggravated natural processes. This is a very serious issue having far reaching implications on the security of the Himalayan environment and human beings therein in the days to come.

Himalaya, often, regarded as the cradle of South Asian civilisation is at present suffering from various human onslaughts- in addition to numerous natural forces that have been acting and reacting in the region since geologic past- in the form of faulty development policies/ventures, population increase and degradation of its rich natural resource base. What is more, the situation is deteriorating with every passing day and the future of the Himalaya looks clearly grim given rate of onslaught the region is forced to tolerate. Further, the Himalaya has been a battleground between environmentalists/conservationists and commercial/vested interests since the last half century. Such a situation has only politicised pertinent environmental issues therein and hence have done little good to the region. In the process, the indigenous and tribal populations of the Himalaya have been sidelined and are often regarded as direct agents of 'Himalayan Environmental Degradation'

Environmental challenges faced by the region ranges from local to global as we noted in the chapter earlier and therefore it is next to impossible to outline a clear-cut mitigation plan (s) to reverse the ongoing trend. It is, further, important to note that Himalayan problems can neither be solved by adopting megabuck high tech approach nor by doomsayers' dream that there is no longer hope at all for the environment (Bahadur 2004) and human well-being in the region. What we need is a cooperative and coordinated approach where there is a mixture of deep concern and cautious optimism. While indigenous mountain communities should have their major stake, avarice and indifference, both from within and outside the region, should not be allowed in such an approach.

While doing so, the foremost task would be to revisit all the development policies that are functional in the region and ratify them in order to make them region and people specific. Often, the Himalaya has been kept at the mercy mainstream development policies that have little or no relevance in the region given its geo-environmental and socio-cultural dynamics.

Secondly, Himalaya should not be treated as a physical entity only as it has vibrant living aspects. It can neither be independent of people living therein nor the inhabitants without their habitats. There are areas, which are quite rich in natural resources but are inhabited by poor people. The inhabitants have been suffering under harsh environmental conditions, carrying out subsistence economic activities, based primarily on animal rearing and rudimentary farming (Bahadur 2004). Such situation needs up-gradation. Promotion of adequate education, health and food security of the mountain people include important challenges in this respect.

Thirdly, development planners and policy makers should not regard Himalaya as an appendage to economic and political interest of the indo-Gangetic plains. It is high time they recognised the geo-political and geo-environmental significance of the region at local, regional and global levels.

Lastly, Himalaya deserves objective research based on proper methodology and database rather than mere environmental gossip mongering based often on assumption and emotion.

We cannot expect / accept such scholars (Fuyusawa 2001, 2001a) who fly from Bangkok to Kathmandu, observe the Himalayan environment on their way, write on Himalayan forest degradation, or theorise Himalayan environment (see among others Eckholm 1975, 1976) from miles away, and tell us that we are degrading our environment. We also cannot accept the institutions that often blame mountain minorities as the forces behind Himalayan degradation. This is an issue where we all are collectively responsible and we should address it collectively. Our scientific community should observe carefully the natural processes and anthropogenic activities over time, utilizing rigorous techniques for precise measurement and scientific understanding. Such knowledge will help us improve future assessments and policies and thereby the development paradigm in the region.

CHAPTER 5
A Comparative Study of Sikkim and Eastern Nepal

5.1 Introduction

Both Sikkim and Nepal share the same geological history of the larger Himalayan Arc and hence form important units of Himalayan geology. Sikkim Himalaya, corresponding to the state of Sikkim[1], is located in the western end of eastern Himalaya. It lies between latitudes 27° 5' north to 28° 9' north and longitudes 87° 59' east to 88° 56' east. It is wedged between Nepal in the West and Bhutan in the East and China in the North and North-East. In the South it shares its Indian border with the state of West Bengal. It has a total area of 7,096 sq km. Nepal is a landlocked and isolated landscape located on the centre of the Himalaya. It is bordered on the west, south, and east by India and on the north by the Tibet Autonomous Region of China. It has a total of 147,181 sq km of land. The Eastern end of Nepal shares its boundary with Darjeeling and Sikkim Himalaya[2].

This chapter examines Sikkim and Eastern Nepal in the context of the arguments put forth in chapter two, three and four. The basic objective of this case study is to examine the relevance of the macro situation at a more local level and vice versa.

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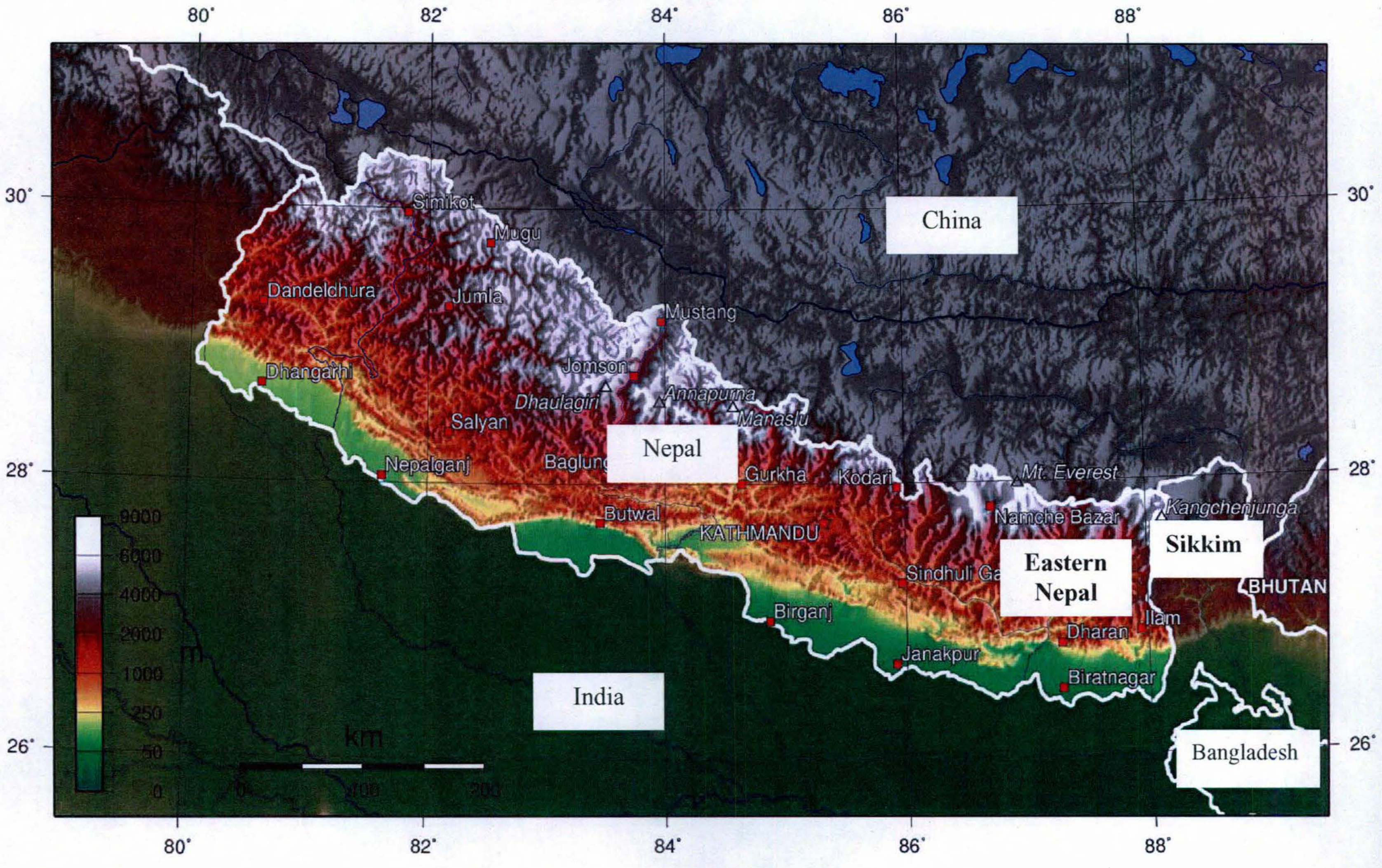
[1] Non-geographers especially Botanists, Naturalists and such other scientists have often regarded Darjeeling Himalaya as part of Sikkim Himalaya. However, geographers have demarcated Darjeeling as a separate geographical entity based on geographical, historical, demographic and other associated characteristics of the region.

[2] Hence, Sikkim and Eastern Nepal form a contiguous geomorphic region. For the convenience of research studies geographers have classified the whole of Nepal as part of Central Himalayan Region. Here again, botanists and naturalists have often put eastern Nepal into the larger geo-region of Eastern Himalaya for their own scientific convenience.

Map 5.1 GEOGRAPHICAL LOCATIONS OF SIKKIM AND EASTERN NEPAL



5.2 Sikkim Himalaya

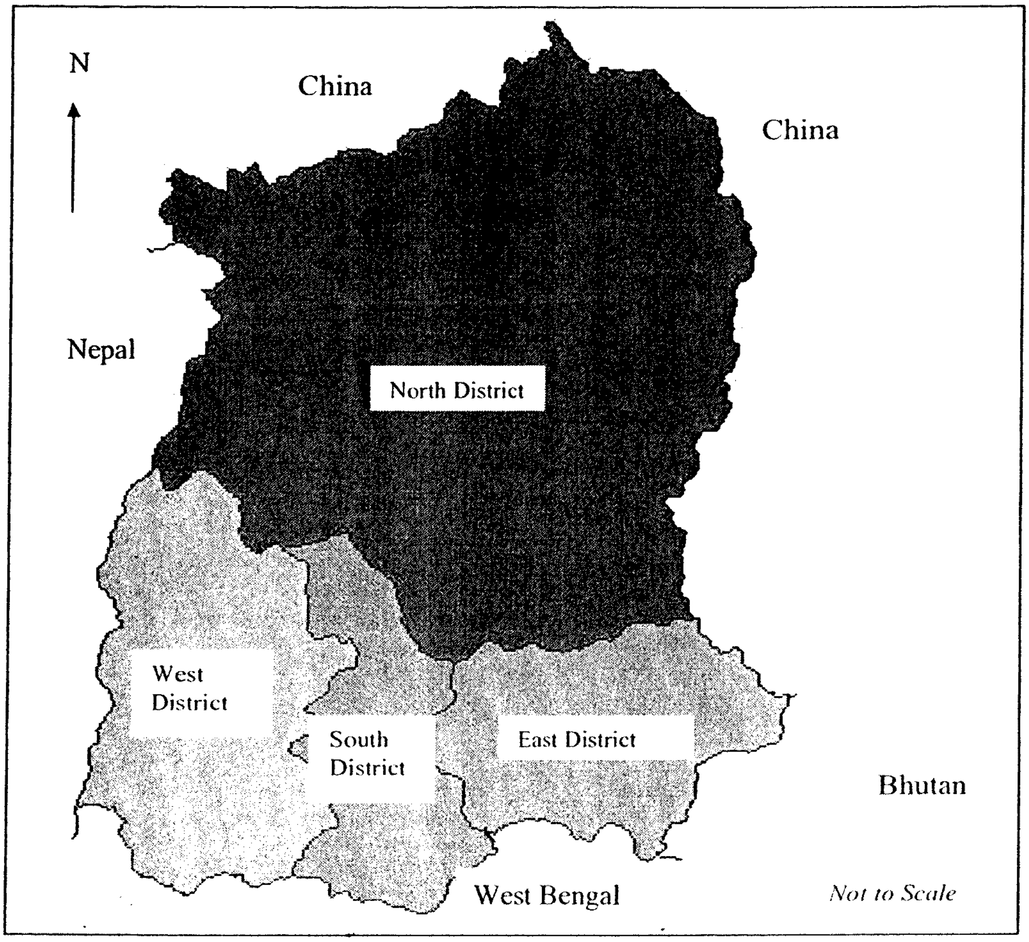
5.2.1 Geography and Environment

Sikkim forms a part of both Lesser and Great Himalayan ranges and geographically it shares an important portion of the Eastern Himalaya. Covering just 0.2 percent of the country the Sikkim Himalaya is characterized with formidable physical features. It presents a compound landscape because the complexity of geomorphic evolution has played an important role in the development of the existing topography. Starting at the foot with a meager elevation of less than 300 meters it stretches up to as high as 8550 meters above the mean sea level. The hills rise abruptly from the plains and the elevation increases northward and northwestward. The third highest mountain ridge Mt. Kanchenjunga (8598 m) and other high elevations are located in the northwestern part of the system.

It encloses within its borders a variety of geographic environments starting from lower snow free hills to the high peaks with permanent snow and glaciers (table 5.1). The highest portion of Sikkim lies in its North-West direction. A large number of mountains having altitudes of about seven thousand meters stand here with Mount Kanchendzonga (8598m). A number of glaciers descend from eastern slopes of Kanchendzonga into Sikkim. The biggest of them is Zemu, from whose snout, above Achen monastery, originates the river Teesta. Two principal mountain ranges of Sikkim are the Singilela[3] and Chola. They start in the north and continue more or less southerly direction. Between these ranges are the Principle Rivers, the Teesta and Rangit, forming the main channels of drainage. These rivers are fed by the monsoon as well as by melting glaciers.

3 This is the range that separates Sikkim with (Eastern) Nepal.

Map 5.2 ADMINISTRATIVE DIVISION OF SIKKIM



Soils in the region are medium in nutrition and indispensable for the natural vegetation. The soil developed from the gneissic group of rocks is brown clay, generally shallow and poor. They are typically coarse, often with ferric concentration, neutral to acidic with poor organic/mineral nutrients. They tend to carry most of the evergreen and deciduous forests. The eight sub-groups of soils reported in 1981 by high level team for land use plan of Sikkim survey is represented by table 5.2.

Table 5.1 GEOMORPHOLOGY OF SIKKIM HIMALAYA

Type of Land	Level of Elevation (meter)
Lower hills	270 – 1500
Middle Hills	1500 – 2000
Higher Hills	2000 – 3000
Alpine Zone	3000-3900 (with vegetation)
Snow Bound Land	Up to 8580 (very high mountains without vegetation and with perpetual snow cover)

Source: Sikkim-A Statistical Profile 2002; 2003: 62

Table 5.2 SOILS GROUPS IN SIKKIM

Soil Sub-groups	Soil Series
Typic Haplumbrepts	Markong Hilley
Lithic Haplumbrepts	Gompa
Typic	Lingtse, Lopep, Namthang
Lithic Dystrochrepts	Machong
Umbric Dystrochrepts	Thekabong, Cahatrikola, Padamchen
Lithic Undorthents	Putuli, Simkara, Nandugaon
Aquic Udifluents	Majitar
Ultic Hapludalfs	Taraku

Bhatt and Bhargava 2005: 26

Table 5.3 MAJOR RIVER SYSTEMS IN SIKKIM

River System	Major Tributary
Rangit	Rangbhang, Relli, Rathong and Lalej
Teesta	Dikchu, Rangyong, Bakchachu, Rongpochu, Zemu Chu, Lachung Chu

Source: Khawas and Tamang *et al.* 2005: 30

Sikkim is a land of rich and varied scenic beauty, magnificent mountains, eternal snow, dark forest, green fertile valleys, raging torrents and calm, placid lakes. Her magnificent variety of flora and fauna are the naturist's dream. The steep variations in elevation and rainfall give rise to a glorious multitude of species within a comparatively limited area of Sikkim Himalaya. As one moves northwards, valley floors and mountain peaks increase in altitude, the terrain becomes more rugged and the climate drier and more temperate, the vegetation changes from *Sal* forest to rhododendrons and conifers and finally to grass above timber line. The composition ranges from dry deciduous forest with *Sal* and its associates in the valleys of Teesta and Rangit to the alpine scrub an grasslands in high altitudes. Such a transition can sometimes be seen on a single mountain side in any of the ecological zones.

Sikkim's climate varies from the tropical heat in the valleys to alpine cold in the higher altitudes. The tropical climate prevails in the deep valleys with elevation up to 5000 ft. The temperate zone comprises areas having elevations between 5000 ft and 13000 ft. Above 13000 ft are the alpine climate zones reaching up to 16000 ft which marks the perpetually snow zone. The annual rainfall varies from 50-200 inches (mostly during May – October), and snow in the upper levels often accumulates to a thickness of 30 m. The summer maximum temperature comes to around 20. 7° C while the minimum is about 13.1 ° C. The average winter maximum temperature has been recorded at 14.9 ° C and the minimum at 7.7 ° C (Bhatt and Bhargava 2005: 9).

Sikkim Himalaya forms a part of the Brahmaputra river water ecosystem or Brahmaputra basin. The most important river of Sikkim - River Teesta along with its major tributary River Rangeet flows through the basin and join the great Brahmaputra. Teesta and Rangeet have their own basins with distinct watersheds and sub-watersheds. These great Himalayan Rivers have over the period of time created their own watersheds and sub watersheds. Numerous small streams, channels and rivulets flow along their basins and join them at lower reaches. Such network of the river systems in Sikkim Himalaya has played their own role in maintaining the over all ecology in the region and have crucially influenced the economy of the Sikkimese since historic past.

5.2.2 Socio-Economic Dimensions

Different social, religious, linguistic and ethnic groups co-exist in the Sikkim Himalaya practicing different types of agriculture and pastoral activities. The present population of Sikkim primarily consists of Lepcha, Bhutia, Nepali[4] and plainsmen. The records of the Gazetteer of *Sikhim* (1891) throws us the light that in the late 19th Century Nepalis with 56 per cent constituted a majority of the population followed by the Lepchas with 19 per cent and Bhutias constituting 16 per cent. There were also other groups like the Khambus and slaves. A little over century later, the share of Lepcha population has gone down to 14 per cent whereas that of the Nepalis climbed to almost 70 per cent with the Bhutias constituting more or less the same share (Sikkim Human Development Report 2001). These ethnic groups traditionally have their own language, culture and social practices although homogenisation of such practices has gradually been taking place in recent times.

All the ethnic groups are characterised by specific ecological adaptations as well as by the social organisation of the region where they live (Bhasin and Bhasin 1996: 270). Majority of the social groups are found throughout Sikkim Himalaya although some areas are dominated by Lepchas and Bhutias. The Dzongu and Lacheng/Lachung regions of North Sikkim are the strongholds of Lepchas and Bhutias respectively. Lepchas, traditionally nature worshipers, are now mainly Buddhist by religion. Bhutias are also Buddhist and follow a form of Lamaism while majority of Nepali speakers are Hindus. Geographically, the northern Sikkim is very scarcely populated while the eastern part is densely populated followed by southern and western region.

[4] Nepali language speakers residing in different parts of the world are termed as Nepali/Gorkhali. There are, however, several social groups within the larger Nepali community.

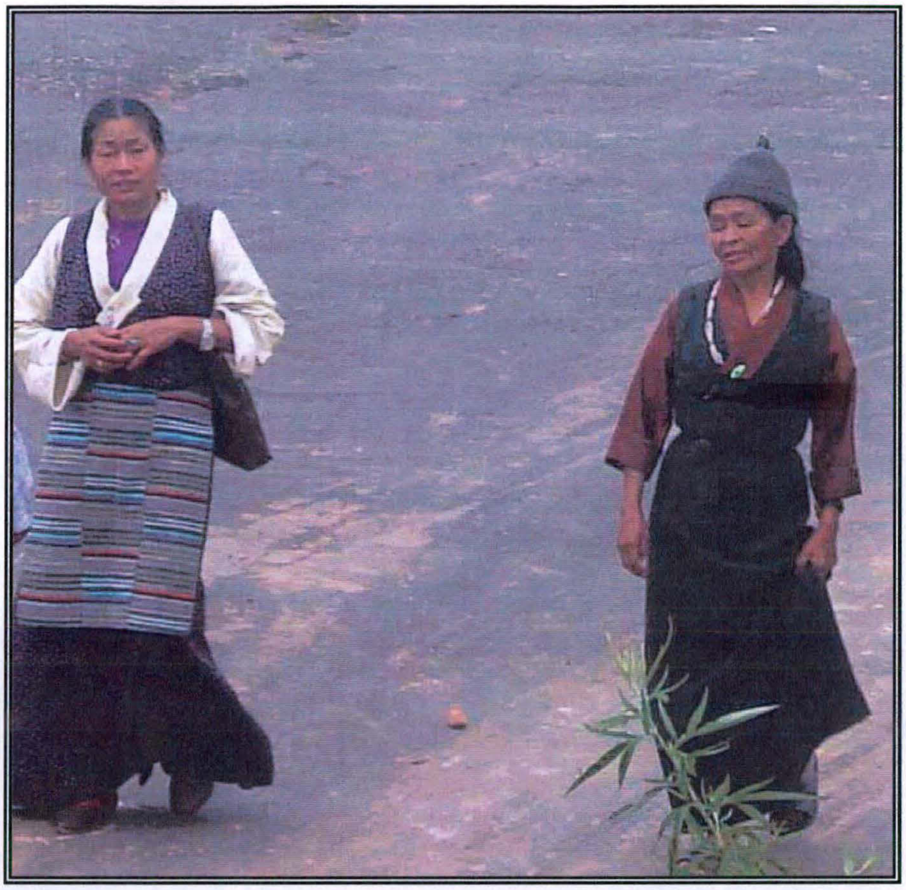


Plate 5.1 Sikkimese Bhutia Women

[Photo: Vimal Khawas, June 2007]

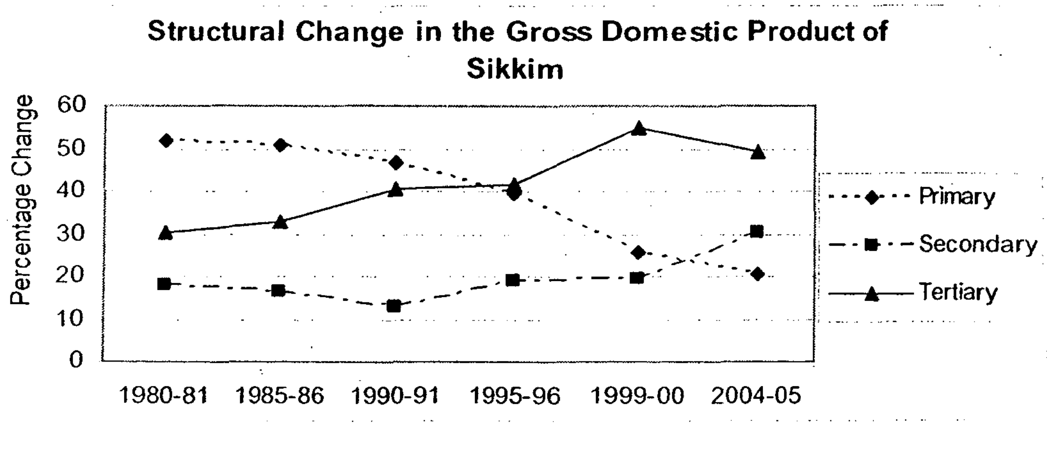
Sikkim is primarily a rural and agricultural economy where over 60 per cent of its population are directly engaged in agriculture and allied activities while 85 per cent of the population is in one way or the other linked with agriculture and allied activities including livestock. The state has limited industrial potential due to its geologic and geomorphic constraints. More recently small and medium scale industrial units like fruit processing, pickle making, jewels, distillery etc are, however, gradually penetrating in the region. Sikkim is also a well-known producer of alcoholic beverages (Bhasin and Bhasin 1996: 279). Notably, the contribution of agriculture and allied activities on the GDP of Sikkim has drastically reduced over the years while that of secondary and tertiary sector has increased. Conversely, however, the proportion of Sikkimese dependant on agriculture and allied activities has remained constant or decreased negligibly during the same period.

Table 5.4 STRUCTURAL CHANGE IN THE GDP OF SIKKIM (%)

Sectors	1980-81	1985-86	1990-91	1995-96	1999-00	2004-02*
Primary	51.59	50.96	46.49	39.41	25.52	20.54
Secondary	18.11	16.46	12.97	18.80	19.73	30.22
Tertiary	30.30	32.58	40.54	41.79	54.75	49.24

Source: Lama 2007:3 *Quick Estimate

Fig. 5.1 STRUCTURAL CHANGE IN THE GROSS DOMESTIC PRODUCT OF SIKKIM



Source: Based on table 5.4

Agriculture is dominated by the Nepalis who are industrious and practice intensive agriculture (Bhasin and Bhasin 1996: 276). The Bhutias, in north Sikkim, with their large animal herds practice pastoral economy on high altitudes, while Lepchas practice subsistence agriculture. The original inhabitants of Sikkim were not agriculturists. They led a very primitive life. Gathering of wild roots, fruits, hunting and fishing were their means of livelihood. When Bhutia people migrated to Sikkim they started semi-pastoral economy and sedentary farming. They ploughed only the flat pieces of land available here and there. Settled agriculture stepped into Sikkim only with the arrival of Nepali immigrants. These sturdy, hardy, energetic and innovative people cleared large tracts of forestlands and made the land fit for agriculture (Bhatt and Bhargava 2005).

Principal food crops cultured in the region include maize, paddy, barley, millet, wheat, buck wheat, beans etc. Important cash crops are cardamom, ginger, potato, soyabean, fruit crops and vegetables etc. Horticulture crops like cardamom, ginger, orange and are raised on commercial basis and are exported within and outside the country. Sikkim has the largest area and the highest production of large cardamom in India (Bhatt and Bhargava 2005: 126). It is a foreign exchange earner crop of Sikkim. Therefore special steps are being taken to augment the production of cardamom. A special kind of tea much valued by the connoisseur for its taste and quality is also produced in Sikkim. A government tea estate is being developed in Kewzing in the western part Sikkim. There is one more tea estate at Temi. Both these estates extend over an area of 400 acres. Further, livestock and animal husbandry engage a measurable proportion of rural folks in the area. In short, agriculture, horticulture and animal husbandry constitute a mainstay of the largest segment of Sikkim's population.

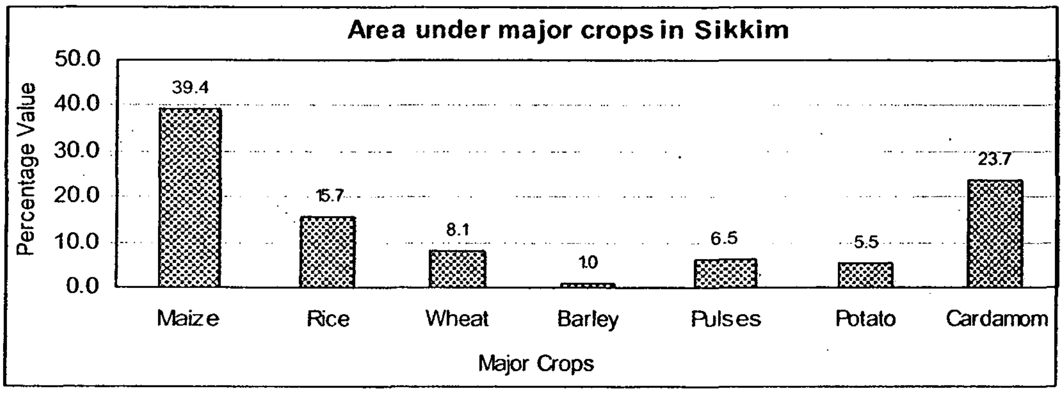
Sikkimese agriculture has to be seen in the context of larger Himalayan geography and environmental specificities therein. Physiography of the region has made agricultural conditions extremely diverse. Agriculture is greatly impacted by altitude and slope aspect. Agricultural fields are invariably terraced all over Sikkim Himalaya. The nature of the terrain and varied micro climatic conditions influence agriculture in Sikkim to a great extent.

Table 5.5 DISTRICTWISE AREA UNDER MAJOR CROPS: SIKKIM (% share)

Crops/Districts	North	East	South	West
Maize	7.8	24.3	33.8	34.1
Rice	9.1	42.0	33.9	15.0
Wheat	12.6	33.5	23.4	30.5
Barley	12.3	28.3	18.9	40.6
Pulses	0.0	25.5	35.5	38.9
Potato	8.0	23.2	13.4	55.4
Cardamom	31.6	29.8	19.6	19.0

Source: Computed from Bhatt and Bhargava 2005: 128

Fig 5.2 AREAS UNDER MAJOR CROPS IN SIKKIM



Source: Based on table 5.5

Usually, agriculture is practiced on irrigated terraces called *Khet* or rain fed terraces called *Bari*. *Khets* are mostly seen on the lower altitudes and is meant mainly for paddy cultivation although winter or dry season crops are also grown in addition to paddy at many instances. *Bari* on the other hand are prevalent both at lower and higher altitudes. With the increase in altitudes, the proportion of *Bari* to *Khet* increases as a result of cooler dry season conditions, increasing slop gradient and inaccessibility of water. Livestock supply draught power and serve as the primary and perhaps the most important source of fertilizer. The villagers use the pairs of oxen to cultivate the terraced fields. Animal manure is indispensable for field fertilization as chemical fertilizers are hardly used.

The humid tropical zone of southern Sikkim constitutes the maize cultivation belt. Needing high temperature and good amount of rainfall, maize is sown in early summer and harvested in September-October. Maize is an exacting crop and requires a good amount of human labour for thinning and weeding process.

Paddy is a crop mainly of river valleys. Along river beds the crop is raised with the help of irrigation. Small channels taken out of the rivers irrigate the surrounding land. On higher areas where temperature and rainfall conditions permit the cultivation of paddy the crop is grown on terraced fields. Paddy is a summer crop and it is grown every where in the state except in very high areas. Because of copious water requirement during its growth period paddy is raised on irrigated fields.

Wheat and barley are winter crops. They are mainly raised in southern and central Sikkim where temperature and growing period during winter permit the cultivation of this crop. In areas with short growing period and insufficient moisture during winter barley and buck wheat are raised. On the soils with are not fit for paddy or wheat cultivation or where short growing period does not permit the cultivation of superior cereals, millets are raised. Luscious oranges are grown in the southern warmer area of the state whereas crops like Cardamom and apple are grown in elevated areas of central and northern Sikkim. Ginger, another important cash crop of Sikkim Himalaya, is a feature of lower elevations in the region.

Sikkim has only 13 per cent of its reported area under net sown area while the gross cropped area comes to around 18 per cent. Further, the intensity of agriculture on the land resource of Sikkim is alarming given its geo-environmental location. The figures available with us highlight that the intensity of agriculture on land comes to over 133, which is higher than the national average in this respect. Such high intensity of agriculture on land resource can be explained by the fact that Sikkim has relatively higher percentage of its land under forest and other uses. Hence, the small amount of land available for agriculture is intensively utilized, often beyond the carrying capacity of the resource base.

Table 5.6 INTENSITY OF AGRICULTURE ON LAND RESOURCE

State	Net sown Area (%)	Gross Cropped Area (%)	Intensity of agriculture on land resource
Sikkim	13.4	17.9	133.7
Arunachal Pr	2.7	4.7	172.0
Assam	34.5	48.6	141.1
Manipur	6.3	9.0	142.1
Meghalaya	9.4	11.1	118.1
Mizoram	3.1	5.1	164.6
Nagaland	12.3	14.1	114.8
Tripura	26.4	43.9	166.1
Northeast	16.5	23.4	141.8
India	46.6	61.1	131.2

Source: computed from Khullar, 2000

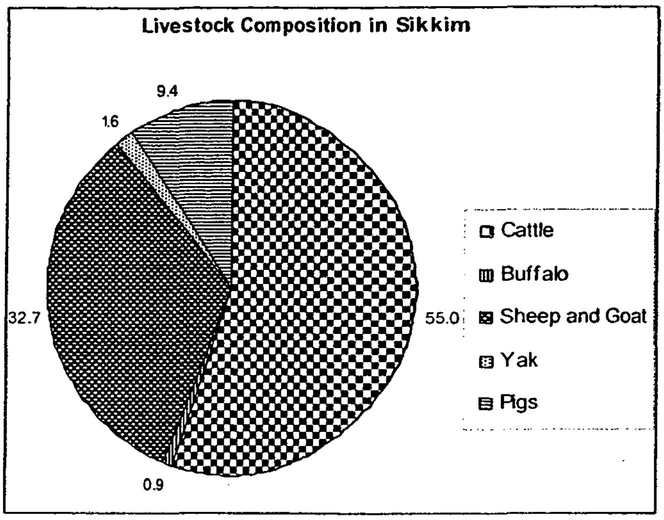
Cattle, buffaloes, yak, sheep, goat, pigs, mules and ponies are the important domestic animals of Sikkim. Poultry birds are also domesticated in different parts of the state. Buffaloes and cattle are mainly limited to the tropical humid belt and temperate zone. In higher cold areas yak is the important animal. Livestock rearing is an important aspect of every household's economy to supplement and compliment other components of farming. The fodder includes paddy straw, crop residues, green grasses etc.

Table 5.7 LIVESTOCK AND POULTRY IN SIKKIM Number

Particulars	North	East	South	West	Sikkim (total)
Cattle	14587	59250	57330	53318	183385
Buffalo	10	543	807	1728	3088
Sheep and Goat	15498	36313	28650	28682	109143
Yak	4865	40	8	441	5354
Horses	1169	121	44	34	1368
Pigs	3958	11204	6317	9728	31207
Donkeys and Mules	39	-	2	-	41
Poultry	309447	92547	63379	69967	256840

Source: Bhatt and Bhargava 2005: 134

Fig 5.3 LIVESTOCK COMPOSITION IN SIKKIM



Source: based on table 5.7

Tourism in Sikkim: A rising sector

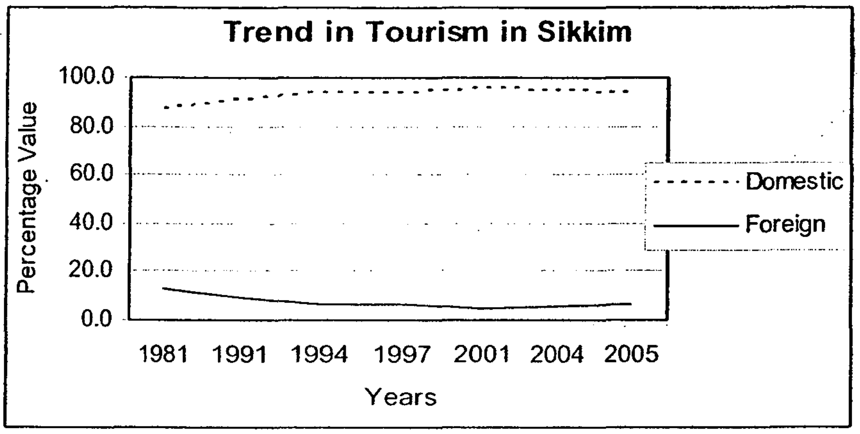
Sikkim's comparative advantage lies in tourism sector (Lama 2007:113). The geographical location followed by unique geo-environment, unparallel natural beauty and hospitable people of the state are its competitive advantage. However, tourism industry in the state could not pick up even after several decades in post 1950. This was precisely due to poor planning, unscientific tourist management, and lack of tourism promotion activities. It was only after 1990 that tourism sector notably started picking up in the state. The major reason behind was a conscious tourism development plan of the State Government and also the politically disturbing situations in other hills stations like Darjeeling and Jammu & Kashmir (Lama 2007). The total number of tourist arrivals in the state has increased from a meager 21854 in 1981 and 67547 in 1991 to 2.68 lakhs in 2005. The Tourism Master Plan (1998) for Sikkim has made a projection of 371743 tourists by 2011 (ibid). More recently, the tourism policy of the Government of Sikkim is driven by the mantra of making Sikkim the number one Ecotourism Destination in India. The State Government has been making special efforts to develop tourist villages, trekking routes, adventure activities, bio-diversity parks, hotels and cultural centres.

Table 5.8 TOURIST ARRIVAL IN SIKKIM

Year	Domestic	Foreign	Total
1981	19115	2739	21854
1991	61360	6187	67547
1994	92435	6888	99323
1997	116500	8068	124568
2001	146923	7757	154680
2004	233285	12912	246197
2005	251744	16523	268267

Source: Lama 2007: 115

Fig 5.4 TRENDS IN TOURISM IN SIKKIM



Source: based on table 5.8

A case from one of the villages of Western Sikkim would be relevant to depict the general socio-economy of the region[5]: Suldung-Kamling is a Gram Panchayat unit in West Sikkim district under Chakung constituency. Due to rain shadow of the Darjeeling hills the area receives scant rainfall with a long lean season of 3-4 months. The terrain is very steep with the average slope being about 45 degrees, with some areas being still steeper. The soil in the area is of two types: lateritic with better soil depth and sandy shallow soil. The villagers have made a sustainable use of the limited resources they have. The steepest part of the fields are planted with useful trees, moderately steep areas are planted with pulses and less steep and

[5] Based on field visit.

terraced fields are used for cultivating maize and ginger. The main challenges provided by nature are geographic wherein steep lands combined with scant rainfall reduce productivity.

Culturally, Rais, Lepchas, Chettri and Mangers dominate[6] the landscape. The economy is largely agrarian with ginger and pulses providing the main source of income. The total absence of irrigation facility is the main bottleneck for sustainable farming. Incomes from ginger have gone down drastically over the years due to reduced productivity. The productivity has fallen from 4 -5 times to 2-3 times now. The main source of cash incomes is from sale of ginger, pulses and from wage labour amounting to about Rs 1500 per month. About 50 per cent of the income is used for buying rice while the remaining is used for purchasing grocery, clothes etc. Amongst livestock poultry, goatery and cattle are reared in limited numbers. Cattle are reared for manure, milk and for ploughing while chicken and goat function as rural household banks, to be liquidated during times of need.

5.2.3 Natural Environmental Challenges

The entire Sikkim Himalaya is a part of the youngest and loftiest mountain system of the world 'the Himalaya' and hence is characterized with highly folded and faulted rock strata at many places. Being a part of the larger Himalayan Region, Sikkim is seismically sensitive and threatened by a number of geo-environmental challenges. The rock type in the region mainly consists of phyllites and schists and therefore the slopes are highly susceptible to weathering, erosion, landslides and other forms of mass wasting. The high intensity of rain falling during monsoon in the state often causes extensive soil erosion and heavy losses of nutrients from the land by leaching. Important physical challenges that often threaten human security in Sikkim Himalaya may be listed and briefly discussed below.

Earthquake

While Sikkim has not witnessed any major earthquake events within its geographical boundary in the recent history the possibility of such disaster cannot be ignored given the history of earthquake happenings in the Himalayan Region.

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[6] All of which belong to the larger Nepali speaking community.

Heavy and Spontaneous Monsoon Rainfall

Monsoon rainfall is greater in the Eastern Indian Himalaya than in its western counter part. Within Eastern Himalaya again the rainfall is intense in Sikkim - Darjeeling Himalaya. The reason being: with the Rajmahal hills situated to the west and the Shillong plateau to the east there is no mountain range to protect the Teesta Valley from the sweeping monsoon winds rising from the Bay of Bengal. As a result the summer monsoon directly hits the foothills and the lesser Himalayan ranges of Darjeeling and Sikkim and gives the Teesta Valley exceedingly high burst of rainfall ranging between 3000 mm to 6000 mm every year (CSE 1991). In this connection, it is informative to highlight that India Meteorological Department classifies rainfall (24 hours) in the following categories:

> 65mm:	heavy,
> 85mm:	very heavy
> 250mm:	exceptionally heavy precipitation

Soil Erosion, Landslides and Floods

Sikkim Himalaya is seismically active and featured by frequent mass wasting including landslides and land subsidence. The steep hill slopes in the area are very sensitive to any geo-environmental changes. The fragile geological structure of the terrain due to faulty rock formation is certainly one of the main causes of landslides in Sikkim. The strata consist of sandstone, shale, mica, schist and quartzite, which are in disintegrated condition in many places and folded and thrusted with a number of fault planes. Incidence of landslides are lower where the rocks are in anticline faults where the direction of layers embedded in the slopes is away form the direction of the slope (Lama 2001). Further, the topography is such that it leads to enormous erosion, landslides and toe cutting. The steep slopes when saturated with rainwater and added by gravitational force sometimes naturally give ways to various forms of mass wasting. For instance, even sudden and spontaneous rainfalls destabilize the soil-rock balance and encourage various forms of mass destruction like landslides and floods and inflict large-scale environmental and human insecurities every year. The excess run off causes the formation of gullies and scouring of the banks of the streams and *jhoras* thereby resulting in floods and landslides. Contrary to the popular belief that forests conservation has a positive correlation with the non-occurrence of landslides, there are instances in Sikkim to show that even very dense forests have faced one of the worst landslides in the past (Lama 2007:110).

Table 5.9 PLACES THREATENED BY RIVER EROSION IN SIKKIM

Districts	Places prone to River Erosion
North District	Mangan, Lachung, Chungthang, Dikchu
East District	Ranipool, Singtam, Sirwani, Rangpo, Rorathang, Rongli, Saramsa
West District	Legship, Dentam, Reshi, Rimbi
South District	Melli, Jorthang, Majhitar

Source: Khawas and Tamang *et al* 2005: 30

Table 5.10 MAJOR LANDSLIDE BELTS IN SIKKIM

Districts	Landslide Belts
North District	Rang-Rang, Meyong, Lanthey Khola, Ritchum
East District	Bhusuk, Barapathing, Changey Senti, Namcheybong, Parakha, Barapathing, 9th Mile, Bordang, Lueing, Kumrek, 6th Mile, Tadong, Phadamchen, Sirwani
West District	Mangnam-Kurchey, Sakyong, Chewrey Botey (Bermiok), Singshore (Uttarey), Reshi, Daramdin (Rambang), Rumbuk (Ringyang), Reyong-Tikpur
South District	Lingi-Payong, Kateng, Turung, Turuk, Kewzing, Heigdam (Legship), Shyampari, Sada

Sikkim Human Development Report 2001: 61

Landslides, triggered by heavy and spontaneous monsoon rain of 2007 killed and injured several people and damaged houses and property across the state. NH31A, the main road linking Sikkim to the rest of the country, was also cut off in many places for many days. According to an inter-ministerial central team that assessed the damage caused by rains in Sikkim Himalaya in 2007, the total damage in the state because of rain in 2007 was Rs 94.41 crore.[7] The assessment did not, however, include the damage to NH31A, which was being

[7] Reported by Shangderpa, Pema Leyda (2007), "Central team in Sikkim", The Telegraph, November 6, 2007

assessed independently by the National Highways Authority of India and the Border Roads Organisation.

Several places along the National Highway 31A that runs across the Indo-Chinese boarder (Nathula La) and Siliguri are chocked and become insecure to humans due to heavy rains and subsequent landslides/ mudslides between mid-June and September. This is a regular phenomenon during monsoon period every year.

The 1968 flood[8] remains the biggest incident in recent years of Darjeeling-Sikkim Himalaya. In October 1968, rainfall between 600 mm and 1200 mm fell a three day period at the end of the monsoon when the ground was already saturated. It is estimated that some 2000 landslides took place in the region. The impact of the rains was such that the Darjeeling-Sikkim road was breached at 92 places and the road transport was totally disrupted. It is estimated that some 20000 people were killed, injured or displaced. The landslides played a major role in exacerbating the floods of 1968. Numerous bridges were washed away and rail traffic was closed for 32 days. Rangpo's lower market, which was well above the river before 1968, came under two meter of sand after the flood and is now almost at the same level as the river's flood plain. Parts of it have been since abandoned. Further downstream, enormous silt came down the *Tar Khola* and the road leading up to the bridge across it was badly damaged.

In the month of June 2008[9], landslides at 9 Mile, 32 Mile, Bardang, 20 Mile, Rangpo, Fatak Lane severely affected normal flow of traffic along the NH31A in Sikkim side. In the West Bengal side, massive landslides occurred in stretches of Kirney, Chitrey, 27th Mile, 29th Mile and Kali Jhora. During such period of monsoons, passengers that ply from Gangtok (Sikkim) to Siliguri take no less than seven hours to reach Siliguri as compared to four hours taken during other months.

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[8] For detail see: Centre for Science and Environment (1991), Floods, Flood Plains and Environmental Myths, CSE, New Delhi, Pp.37-39

9 based on field observation

Plate 5.2 Landslide in North Sikkim

[Photo: Vimal Khawas, June 2004]

Plate 5.3: Mudslide destroys Footpath in South Sikkim

[Photo: Vimal Khawas, July 2008]

Table 5.11 DAMAGES CAUSED BY MONSOON RAINS IN SIKKIM: 2007

Type of Damage	Degree of Loss
Total Damage	Rs 95 crore
Dead	12
Injured	8
Houses and property completely damaged	126
Houses and property partially damaged	854
Loss of Livestock	911

Source: *The Telegraph* (Siliguri edition) November 6, 2007

Table 5.12 MAJOR NATURAL ENVIRONMENTAL CHALLENGES IN SIKKIM

Environmental Challenges	Geographical Extent	Instances
Snowfall [occasional]	Northern parts of the State	In June 1982 masses of snow and rocks hurtled down from above 4615 meters which buried the army camp killing 29 army personnel and injuring 7 others seriously, damages: 4-5 km. stretch of a road washed away.
Drought [occasional]	South and West Districts	In June 1983 crops in 34 villages lost, loss estimated at Rs. 1.1 crore
Heavy monsoon rain followed by soil erosion, landslides and floods	Entire State	Every year during monsoon. Damages to human life and property: Incalculable. In October 1968, rainfall between 600 mm to 1200 mm lashed the Darjeeling-Sikkim Himalaya for three days when the ground was already saturated after a long monsoon. It is estimated that some 2000 landslides took place. The damage done to human life and economy were extensive.

Source: compiled by the author

5.2.4 Human Interference on Environment and resultant Human Security Challenges

The natural environmental challenges are often exacerbated by human induced forces further aggravating the situation. Anthropogenic activities like the development intervention have had adverse impact on Sikkim Himalaya. The disturbing natural processes when coupled with unplanned development interventions overload the carrying capacity of the soil and bring about mayhem in the region. Some of the anthropogenic forces that have aggravated the fragile physical situation of Sikkim may be briefly discussed below.

Population

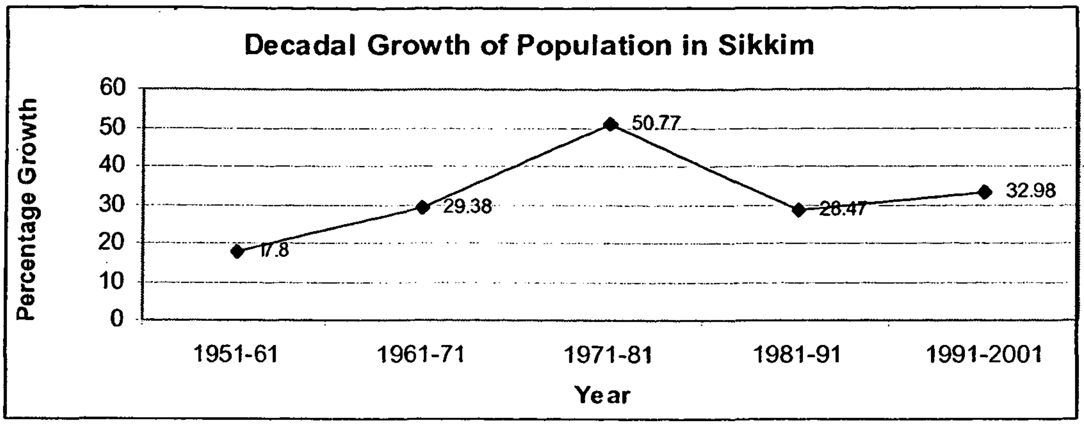
The population of Sikkim according to the Census of 2001 is 5.4 lakh. The increase in population in the region is about 18 times against the population figure of 1901. The density of population has also witness similar kind of increase in the last one century. It rose from 4 persons per square kilometer in 1901 to 76 in 2001 registering about 19 fold climb in its population density during the period. Such unprecedented rise in the population of Sikkim and resultant population density is not only because of natural addition. The other important factor in this regard is the continuous migration process from the surrounding geographical milieu. The geometrical increase in the population of Sikkim Himalaya in the last 100 years has put forth tremendous pressure on its natural resource bases and its fragile geo-environment often inflicting human insecurities at many instances.

Table 5.13 POPULATION PROFILE AND DENSITY IN SIKKIM

1901	1951	1981	2001
Population (Number)			
30,458	137,725	315,682	540,493
Population Density (Person per Sq Km)			
4.29	19.41	44.49	76.17

Source: based on Census of India, various years

Fig 5.5 DECADAL GROWTH OF POPULATION IN SIKKIM

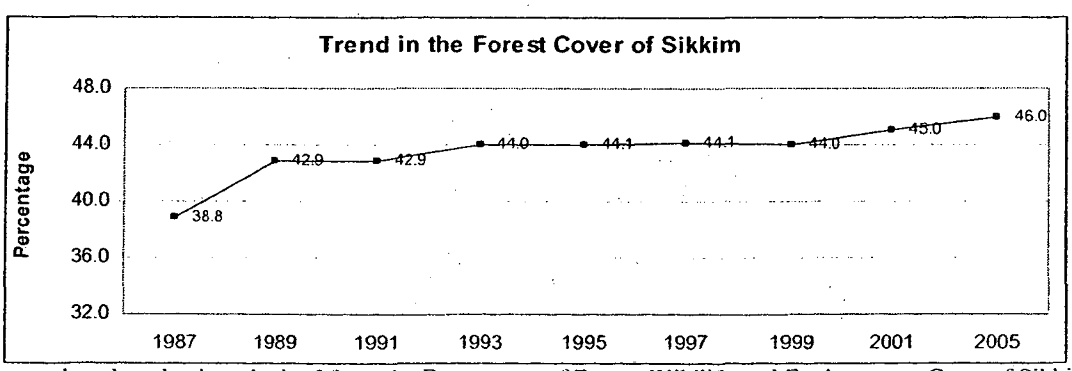


Source: based on table 5.13

Deforestation

The state of Sikkim has 81.24 percent of the total geographical area (7096 sq kms) under the forestlands and in the custody of the forest department. Out of the total land of 5765 sq kms under the forest lands over 93 percent is classified as reserved forest, and 7 percent as protected forests (about 5 percent as Khasmal and 2 percent Gorucharan). However, the actual forest cover of the state was only 45 percent of the total geographical area as in 2001. This was the status of the forest in Sikkim in spite of the notable improvement made by the state in the last one and the half-decade, as highlighted by the graph below.

Fig 5.6 TRENDS IN THE FOREST COVER OF SIKKIM



Source: based on the data obtained from the Department of Forest, Wildlife and Environment, Govt. of Sikkim

Across the districts of Sikkim the highest percentage of forest is noted in the East district (70.23) followed by South (68), West (61) and North (30.79). Although the north district has the largest geographical area in the state and that it has also largest area under the forest it has only over 30 per land under the actual forest cover. This is because of the fact that a large part of the north district is perpetually snow covered and above the normal tree line. All the large mountain ranges of the state lie in the north district and there are very few human habitations in the area. The south and west also have relatively less forest covers as compared to the east district as these two districts have relatively large portions of land under agricultural utilization and human habitation. Although the east district is the district with the large number of population in the state the population in the district is mainly concentrated in the Gangtok Town and thus east district has the largest percentage of forest cover in the state.

Table 5.14 DISTRICT WISE FOREST COVER (SQ KMS): 2001

District	Geo. Area	Forest Cover	Percentage to Geo Area
East	954	670	70.23
West	1160	712	61.06
North	4226	1301	30.79
South	750	510	68.00
Total	7090	3193	45.04

Source: Department of Forest, Wildlife and Environment, Govt. of Sikkim

Sikkim Himalaya as a major subsystem of Eastern Himalaya has not been free from the deforestation hazard. One of the most pertinent challenges of Sikkim today is rendered by the destruction of natural vegetation in the high altitude areas. This, however, does not mean that the less elevated areas including lower and middle hills are free from deforestation hazards. The point here, however, is that in higher elevations, i.e. alpine zone, particular ecological equilibrium is maintained with reference to organisms, grasses, snow, temperature etc. (i.e. to say among biotic and a biotic factors). Any of the slightest interference in this equilibrium may bring about enormous environmental hazards. Thus, snow melts from the perennial glaciers at a natural rate if the natural ecological features in and around them are maintained. Consequently, hydrological and geo-hydrological balance in a particular geomorphic region is maintained. However, if such delicate ecological linkages are disturbed through human interference or sometimes even naturally, host of environmental hazards may crop in bringing about immense sufferings to the mankind in the long run. Abnormal rate of snow melting and glacial retreat, snow avalanches, disbalance in hydrological cycle, mass wasting (landslides, subsidence etc), drying up of the perennial streams, extinction of the rare species, climate change, desertification and floods are some of the consequences that human may witness as a result. As a result of the habitat destruction a number of species are already in the endangered lists, some of the natural aspects of Sikkim are disappearing. Lama (2001) reports a variety of modes with respect to the encroachments in the forest areas in Sikkim:

1. Fragmentation of households is taking place as a natural and customary process. The move towards nuclear families has further accelerated the financial incentives advocated by the government for which a household is considered to be a basic unit rather than the number of families. Families often clear forest areas for cultivation, since fragmented family landholdings are insufficient for their livelihood.

2. Encroachment in and around the forest area for building and construction activities has been a major menace. Many of the private lands in the state are attached to the forest. It is very difficult to monitor the extent of encroachment because of lack of resources, manpower and technology.

3. In rural areas, the encroachers are cultivators[10] who are ignorant of the laws relating to the protection of forestlands or people whose holdings are attached to the boundaries of forestland. In urban areas, encroachment generally does not take place in forestland because people are conversant with the law. If any encroachment takes place, it is immediately detected, as no large stretch of forestland exists in urban areas.

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[10] In the past livestock grazing was one of the major contributors of deforestation and degradation of land and forest in Sikkim. However, the Government of Sikkim has in recent times has banned grazing by all domestic and semi-domestic animals in reserve forest areas in the State to protect the environment. Consequently, at present over 70 per cent (http://sikkim.nic.in/sws/sikk_live.html) of the farmers in Sikkim rear their livestock under stall fed condition and has hence drastically reduced pressure on forest and land due to overgrazing.

The steady deforestation and other environmental insecurities in Sikkim can also be attributed in one way or other to the following aspects and such other anthropogenic activities-

a) Energy Needs

Forest has been the major source of energy in the hills and mountains even in the recent times. Across the Indian mountain system people are still largely dependant on the forest and the related biomass for their energy need. This is particularly pertinent across the rural himalaya and is also true in case of many urban settlements. Firewood, animal dung, and crop residues has been the traditional sources of energy in Sikkim. They are still the only major energy sources for the majority of the people, particularly in the rural areas. Biomass has also been a vital part of the state energy scenario.

The degradation of the environment because of the continuous over dependence on the forest and the associated biomass has now reached alarming levels. Since most of the biomass fuel is used for domestic cooking, particularly in the confined spaces, its adverse health effects are becoming evident strongly among the women. Further, the highly inefficient traditional cooking methods make the energy wastage from biomass combustion very high and also pollute the environment.

Table 5.15 FIREWOOD IN DOMESTIC FUEL CONSUMPTION IN SIKKIM

District	Firewood (%)	
	Rural	Urban
East	82.03	8.44
West	92.96	61.81
South	87.37	44.23
North	92.95	62.42
Total	87.40	29.35

R=Rural, U=Urban

Source: Gyatso and Bagdass, 1998: 33

Plate 5.4: Rural Fuelwood storage

[Vimal Khawas, October 2003]

Firewood still continues to be the main source of energy in rural Sikkim sharing more than 85 per cent of the total energy consumption. Forest wood continues to be the predominant source of fuel for cooking across the rural villages of all the districts. Even in the urban areas the West and North districts are still majorly dependant on fuel-wood for cooking. Besides fuel wood urban areas are also using kerosene and LPG of late although their use is relatively low compared to other mainstream urban settlements. Even across the districts of Sikkim the more rural North and West districts use lower amount of LPG indicating the high degree of dependence on forest wood.

Unlike the popular belief that electricity is increasingly replacing conventional sources of energy, it is found that not even 1 per cent of both urban and rural population use it for cooking. There has been burgeoning domestic demand for power in Sikkim. The power driven industrialization of the neo-liberalized economic regime is likely to compound this demand. The issues of energy security and energy conservation are therefore critical and need to be addressed at the policy level.

b) Commercial Felling of Trees

It is often argued that the dense and often inaccessible forests of the India Himalaya became the victim of commercial deforestation majorly under the British rule. Commercial deforestations that took place in British India were dictated by strategic imperial needs. Besides the increasing demand for timber from shipbuilding industry and rapid development of railway network in the later part of nineteenth century highlighted the fact that the hitherto dense forests of Indian Himalaya were not inexhaustible. Although Sikkim as an independent kingdom was not directly impacted by the above onslaughts of British India, the neighbouring Darjeeling Himalaya, which was once a part of the kingdom of Sikkim, could not escape.

In Sikkim commercial deforestation was initiated under the scheme of Floatation of Timber in 1951. Water body in the form of rivers used to be the major mode of transportation in this respect where the timber was floated both in log and sown forms. Over the years such system did not prove to be sustainable. There were massive losses of forest resources mainly because of floods in the riverine and riparian belts and wrong timing of the launching of timber.

c) Forest Fire

Among other important sources of environmental challenges in Sikkim Himalaya, forest fire acquires a prominent position and poses a direct challenge to the planners and administrators.

The forest department has resorted to all possible measures to prevent forest fires in the state. It has identified the forestlands that are prone to fire across the districts and have cautioned the general mass, tourists, travellers with signboards, special signals and other measures. Besides, the department has also been rehabilitating the fire damaged forest areas in the south and west districts where the problem is severe. In this regard 240 hectares have already been rehabilitated between 1997-02. One possible way to prevent forest fire would be to create fire lines before the fire season, construction of fire watchtowers, improvement in wireless communications and deployment of special fire fighting squads with tools during the fire season. However, all these measures are expensive strategies, which cannot be easily undertaken with present resources, which are scarce (Lama 2001).

Table 5.16 AFFORESTATION AND REHABILITATION (HEC)

Afforestation Scheme	District	1997-98	1998-99	1999-2000	2000-01	2001-02
Conservation of Ecologically Fragile Areas	North	100	50	35	50	-
	East	180	50	40	50	-
Rehabilitation of Fire Damaged Forest Areas	South	100	50	40	50	-
	West	100	50	35	50	-

Source: Annual Administrative Report 2001-02, 2002, Dept. of Forest, Wildlife and Environment, Govt. of Sikkim

It is, nonetheless, hearting that the Government of Sikkim through the Department of Forest and with the assistance of voluntary organizations, research institutions and massive people's participation has been working tirelessly towards this end and positively the forest cover has improved notably in the last one and a half decade. Various conservation programmes that are directly and indirectly related to forest resource have been doing exceptionally well in the state. Joint Forest Management, Eco-development and Social Forestry deserve special mention in this regard.

Climate Change

Sikkim is dotted with glaciers. Some of the prominent glaciers and the associated features of the Eastern Indian Himalayan System flank the region that makes it one of the unique regions across the Himalaya. Some eight important glaciers features the region as highlighted in the table below-

Table 5.17 IMPORTANT GLACIERS OF SIKKIM HIMALAYA

Sl No	Name of Glacier	District
1	Zemu Glacier	North
2	Rathong Glacier	West
3	Lonak Glacier	North
4	Hidden Glacier	North
5	Talung Glacier	North
6	North Lonak Glacier	North
7	South Lonak Glacier	North
8	Tista Khangse Glacier	North

Source: Sikkim: A Statistical Profile 2002, 2003, Govt. of Sikkim

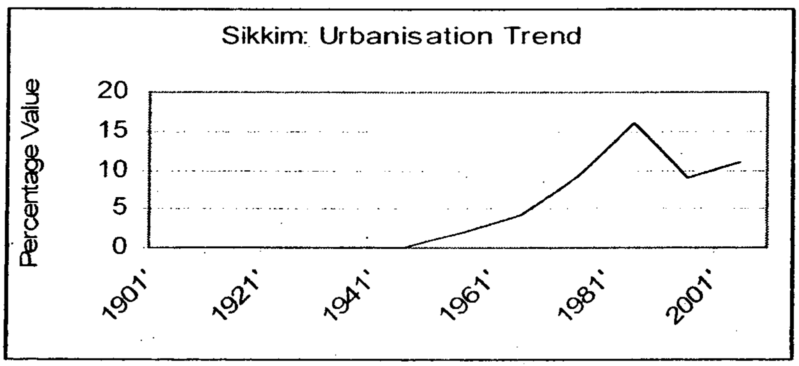
Geographically they are located in Northern and Northwestern part of the Sikkim Himalaya. These glaciers are the sources of hydrological flows in the State. It has been found that Glaciers in Sikkim Himalaya are not behaving normally in recent years. For instance, the Jemu Glacier retreated around 20 meters per year during 1975-1990 (Bahadur 2004: 53). Small streams that feed the large rivers are drying up more recently in and around the major watersheds of the region. This has not only affected the volume of the major rivers but also impacted the delicate relationship of flora & fauna and human habitation mainly the livelihood of the poor rural hill folks.

Keeping in mind the world wide debate on global warming and its likely impact on glaciology, the Government of Sikkim has recently appointed a high level national expert Group/ Commission headed by glaciologist Prof Syed Iqbal Hasnain. The Commission is expected to examine all the significant issues related to glaciers in and around Sikkim Himalaya.

Urbanisation

Although Sikkim is still primarily an agrarian state, its urban areas have begun to experience the pressures of urbanisation. This is partly because of the growing migration in the region. Unplanned urbanisation followed by poor service delivery further exasperates the situation leading to unsustainable pressure on the environment and human security. In Gangtok vehicular congestion, unauthorized construction and disregard for urban aesthetics are fast making their growth. More importantly the explosion of vehicular traffic in a hill town like Gangtok calls for an immediate reduction in taxi licenses and government vehicles.

Fig 5.7 SIKKIM: URBANISATION TREND



Source: based on the Census of India, various years

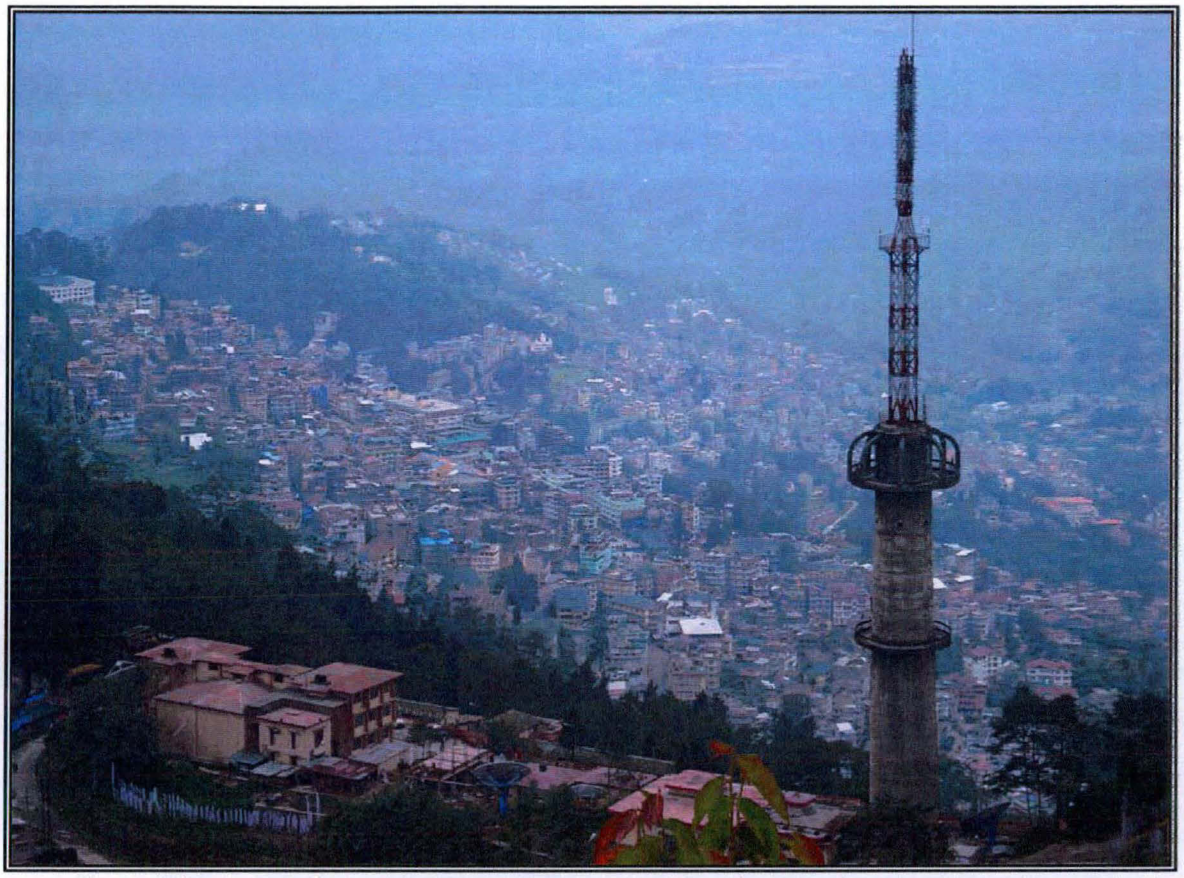


Plate 5.5: General view of Gangtok City
[Photo: Vimal Khawas, May 2008]

Infrastructure Development

Sikkim at present is at the summit of infrastructure development ventures. Up to March 2003 an estimated 834 hectares of forestland was diverted for development related activities. The share of hydroelectric projects, construction of roads, buildings, complexes and playgrounds, transmission line etc has been prominent in this regard.

Table 5.18 DIVERSIONS OF FORESTLAND AND COMPENSATORY AFFORESTATION TILL MARCH 2003

Item/District	North	East	South	West	Total
Number of cases approved for diversion	28	36	35	14	113
Total forestland diverted (hectare)	348.37	196.95	244.98	44.94	835.24
Compensatory Afforestation (completed)					
a. In forest land	749.06	562.00	422.50	263.00	1996.56
b. In non forestland	2.26	0.89	2.50	5.01	10.66
c. Total	715.33	562.89	425.00	268.01	2007.23

Source: Annual Administrative Report 2002-03, 2003, Dept. of Forest, Wildlife and Environment, Govt. of Sikkim

Mention should be made here that the Sikkim government's plans to construct around 42, allegedly, large hydroelectric projects in the Teesta river basin is meeting with stiff resistance in recent times. Protestors have joined together in an organisation called the Affected Citizens of Teesta (ACT) and have been on *satyagraha* against these plans since June 20 2007. The ongoing protests are focused on projects proposed in North Sikkim, particularly in Dzongu, the holy land and exclusive reserve of the Lepcha tribe. The protesters want the seven proposed projects in Dzongu scrapped and others in Sikkim reviewed. The ACT protest has received commendable support from the activists and environmentalists from across the Country and outside.

The arguments put forward to justify hydel projects in Sikkim are: exploitation of the state's perennial water system to produce power for the nation; economic benefits to the state through power export; employment generation and low displacement of local communities.

However, critics lament several unique features of the state including its ecological and geological fragility, its indigenous communities, their cultural and spiritual association with the river system and the landscape pose a challenge to these ambitious plans (Vagholikar, 2007).

Table 5.19 CURRENT PRIORITY AREAS OF SIKKIM IN THE CONTEXT OF ENVIRONMENTAL SECURITY

1	Protection and conservation of natural resources on a sustainable basis
2	Implementation of the State Policy on Forest, Environment and Land- use (see appendix for detail)
3	People's participation in forest protection, regeneration, Afforestation and benefit sharing through Joint Forest Management, Watershed Development and other programmes
4	In Situ and Ex Situ Biodiverstiy conservation through a network of Biosphere Reserves, National Parks, Sanctuaries, Zoological Parks, nature reserves and heritage sites
5	Amelioration of urban environment, urban Afforestation, urban sanitation, awareness and cleanliness drives, vehicular pollution measures and others
6	Ban on use and sale of polythene bags and control and management of non biodegradable material through various Acts, Rules and Regulations
7	Creation and establishment of Smriti Vans, Recreational Parks and Gardens in rural and urban areas through active people's participation
8	Introduction of environmental education in government as well as in private schools in the state
9	Health, hygiene, sanitation and drinking water status in rural areas
10	Development of 'model villages' and 'eco villages' across the state based on the principal of sustainable development, healthy environment and eco friendly technology
11	Environmental Impact Assessment, Environment Management Plans for all development projects including hydroelectric projects, industries, satellite towns etc
12	Prevention and control of pollution of water bodies – rivers, streams, lakes etc to eliminate water born diseases and safe drinking water.

Source: compiled by the author

While Sikkim has seen dam-related protests before, there have never been any on this scale. The 1990s saw the construction of the 60MW Rangit project, clearances for the 510MW Teesta V project (currently under construction) and the scrapping of the Rathong Chu project following protests about its impact on a sacred landscape. Further, in May 2008 the Chief Minister of Sikkim decided to cancel the Teesta IV Hydropower project, the Lingza Hydropower project, the Ringpi Hydropower project, the Rangyong Hydropower project and the Rukel Hydropower project, all expected to affect the Lepchas of the Dzongu region in North Sikkim in view of the persistent protests.

The six-member Independent Committee on Big Hydro Projects that visited the Dzongu region in May 2008 stressed that the development of small and micro hydro power projects would economically benefit the people of Dzongu and in addition help Sikkim generate additional electricity. The Committee headed by Himanshu Thakkar suggested the State Government to develop small and micro hydropower projects in the Dzongu region. Consequently, the Government of Sikkim has recently cancelled 11 hydro-electric projects in and around Dzongu region.

Nonetheless, in the last three years, the state government has signed Memorandum of Understandings for no less than 42 large hydroelectric projects in the state. It is alleged, Sikkim government has committed itself to develop about 42 big hydropower projects, without much consultation with the Sikkimese people or without considering the implications of the projects for the local people, environment, culture, future generations and even return on investment for the state or the people.

5.2.5 Implications on Human Security

Sikkim Himalaya is a small geo-ecological entity located in the eastern part of the Himalaya. The region represents vertically all the geological sections of the Himalaya thereby exhibiting rich and diverse natural resource bases. Due to its unique ecological location over 81 percent of the region's geographical area is under the administrative control of the State Forest Department. However, only a little over 45 per cent of the total geographical area of the Sikkim Himalaya is actually under the forest covers while about 34 per cent is set aside as Protected Area Network in the form of National Park and Wildlife Sanctuary (Lama 2007: 99).

The fragile geo-ecology of the Sikkim Himalaya can be assessed from the fact that only about 11 per cent of its total geographical area is arable representing a very high human pressure on the natural resources in the region. Agriculture, horticulture and animal husbandry constitute a mainstay of the largest segment of Sikkim's population engaging large chunk of them in this sector. Agriculture is the primary driver of the economy. Over 85 per cent of the population is directly or indirectly dependent on agriculture and allied activities for its livelihood. Food production in the Sikkim Himalaya has, however, not kept up with the population growth.

As an integral part of the Himalayan orogeny Sikkim is not free from the various geomorphic processes and consequent human security challenges. The most prominent natural challenges that threaten the human security of Sikkim Himalaya periodically include heavy monsoon rain, flash floods, landslides, soil erosion and other associated natural catastrophes. The natural environmental challenges are often exacerbated by human induced forces further aggravating the situation. The development intervention has at many instances had adverse impact on Sikkim Himalaya. The disturbing natural processes when coupled with unplanned development interventions overload the carrying capacity of the soil and bring about mayhem in the region.

One of the biggest environmental problems of Sikkim is the inadequate and fast dwindling forest cover. The state of Sikkim although has been regaining the forest cover more recently, it still has less amount of forest cover with reference to the desirable 60[11] per cent of forest cover to its geographical area. Even this small percentage of forest cover is seriously threatened by the increasing demand for major and minor forest products. These products are badly needed for fuel, building and to feed a large number of forest based industries. Further, vast forests have been cleared for agriculture and other development purposes. Overgrazing

[11] As prescribed by the Government of India for the Hills and Mountain regions of the country

had been a big problem in the past serious damaging the forests and land. Moreover, large tracts of forest cover are destroyed every year by forest fires. Forest fires in Sikkim are more destructive in dry season. Insufficiency of properly trained personnel is a big handicap in this respect.

Table 5.20 MAJOR HUMAN SECURITY CHALLENGES FOR SIKKIM

Natural Environmental Challenges[12]	Human Induced Environmental Challenges
Heavy Monsoon Rainfall, Flash Floods, Landslides, Soil Erosion, Snowfall (only in the northern part), Drought (occasional),	Population growth, Deforestation, Forest Fire, Intensive Agriculture, Climate Change, Massive Infrastructure Development Venture, Unplanned Urbanisation

Source: based on available literature and field visit

Moreover, as a sensitive border state, Sikkim has been the most significant geographical entity in providing comprehensive security to the Indian nation state in terms of military security, environmental security and human security (Lama 2007:99). The geo-strategic location of Sikkim means huge concentration of security and military forces in and around its vicinity. It further means huge physical burden of such forces on the natural settings and resources of the region. Further, the physiography and geomorphology of Sikkim Himalaya often forbids the state to go for many necessary development interventions making the development process extremely limited. At times the state is compelled to implement development projects in view of the changing interest and demand of the time inviting hosts of environmental challenges to the human security of the region.

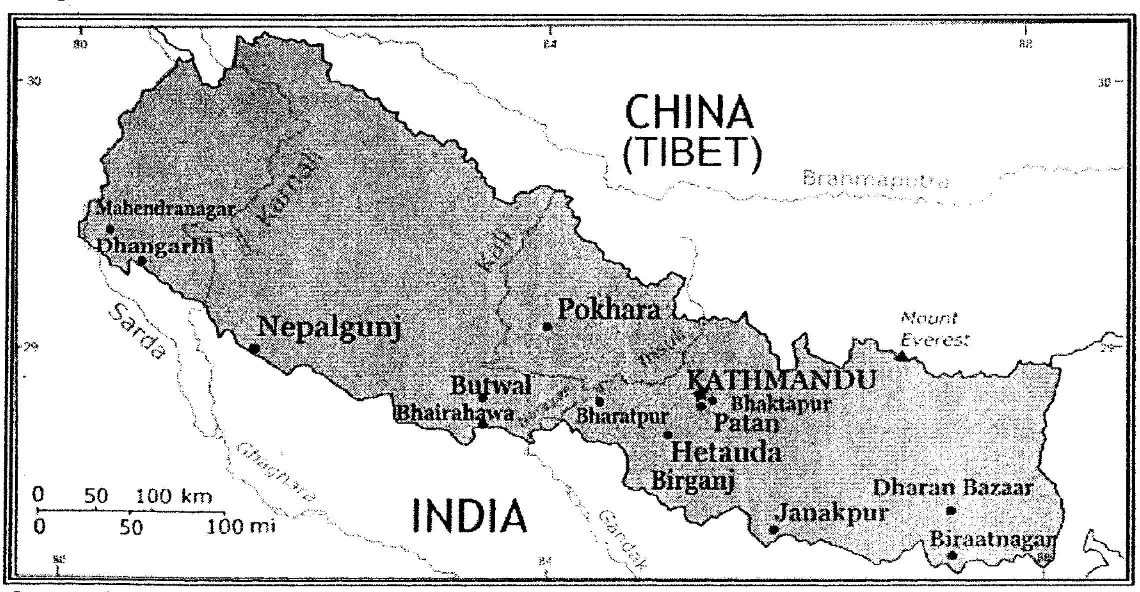
[12] Please see annexure 12 for The Sikkim Disaster Management Act, 2006

5.3 Eastern Nepal

5.3.1 Geography and Environment

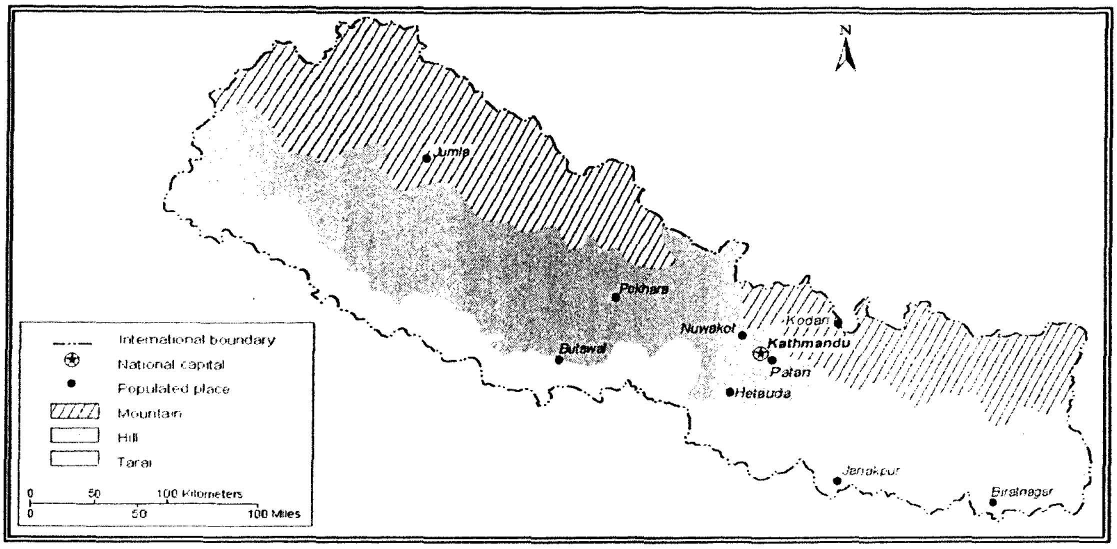
Nepal is a landlocked country, surrounded by India on three sides and by China's Xizang Autonomous Region (Tibet) to the north. It is separated from Bangladesh by an approximately fifteen kilometer-wide strip of India's state of West Bengal, and from Bhutan by the eighty-eight-kilometer-wide Sikkim Himalaya, also an Indian state. Nepal is almost totally dependent on India for transit facilities and access to the sea, that is, the Bay of Bengal, even for most of the goods coming from China (Savada 1991). Noted for some of the highest mountain peaks of the Himalayas, Nepal is geographically very mountainous and hilly in nature. Its shape is roughly rectangular, about 650 kilometers long and about 200 kilometers wide, and comprises a total of 147,181 square kilometers of land.

Map 5.3 GEOGRAPHICAL LOCATION OF NEPAL



Source: adopted from http://en.wikipedia.org/wiki/Image:Nepal_map.png (Accessed 24/12/07)

Map 5.4 PHYSIOGRAPHIC REGIONS OF NEPAL



Source: adopted from http://lcweb2.loc.gov/frd/cs/nepal/np02_01a.pdf (Accessed April 23, 2007)

Nepal has great diversity of physical geography as a result of which scholars have broadly divided the region into three major physiographic areas: the Mountain Region, the Hill Region, and the Terai Region (Savada 1991). It stretches from the Terai Plain that includes the northern rim of the Gangetic Plain, situated at about 300 meters above sea level, in the south to almost 8,848 meter high Mount Everest, locally known as *Sagarmatha*, in the northeastern part. From the lowland Terai belt, landforms rise in successive hill and mountain ranges, including the stupendous rampart of the towering Himalaya, ultimately reaching the Tibetan Plateau beyond the Himalaya. This rise in elevation is punctuated by valleys situated between mountain ranges. Within this maze of mountains, hills, ridges, and low valleys, altitudinal changes has resulted in ecological variations. All three geo-ecological regions run parallel to each other, from east to west, as continuous ecological belts, occasionally bisected by the country's river systems.

Table 5.21 PHYSIOGRAPHIC REGIONS OF NEPAL

Physiographic Regions	Elevation (Meters) above the Mean Sea Level
Mountains	4000 or more
Hills	1000 to 4000
Tarai	300 to 1000

Source: adopted from Savada 1991

The climate varies from sub-tropical to arctic in a span of less than 200 km. There is a broad range of natural resources, the most prominent among them being water and the Himalayas. In theory, the hydropower potential in Nepal is estimated at 83,000 MW but the practical potential might only be 50 percent of the theoretical (WWF, 2005). The total installed capacity of hydropower is only 494.9 MW on the ground—about 0.6 percent of the theoretical potential (Ibid). Evidently, there is a lot to achieve in this field alone if hydropower is to be a positive anchor of Nepal's future development. Irrigation facilities and water supply also have to be enhanced.

The Mountain Region

The Mountain Region, also called *Parbat* in Nepali, is situated to the north of the Hill Region Its starts at 4,000 meters and goes beyond. The region constitutes the central portion of the Great Himalayan range. Its prominent natural landscape[8] includes Mount Everest and the other seven of the world's ten highest peaks, which are the legendary habitat of the mythical creature, the yeti, or abominable snowman (Savada 1991). In general, the snow line occurs between 5,000 and 5,500 meters. The region is characterized by inclement climatic and rugged topographic conditions, and human habitation and economic activities are extremely limited and arduous. Indeed, the region is sparsely populated, and whatever farming activity exists is mostly confined to the low-lying valleys and the river basins.

The Hill Region

The Hill Region locally called *Pahar* is situated south of the Mountain Region and mostly spreads between 1000 and 4000 meters in altitude. The region includes the Kathmandu Valley, the country's most fertile and urbanized area. Two major ranges of hills, known as the *Mahabharat Lekh* and Churia Range, occupy the region. In addition, there are several intermontane valleys. Because of immigration from Tibet and India, the hill ranges historically have been the most heavily populated area. Despite heavy out-migration, the Hill Region comprised the largest share of the total population in 1991 (Savada 1991).

[8] Majority of which are located in North Eastern part of Nepal.

Although the higher elevations above 2500 meters in the region are relatively sparsely populated because of physiographic and climatic difficulties, the lower hills and valleys are densely settled. The hill landscape is both a natural and cultural mosaic, shaped by geological forces and human activity. The hills, sculpted by human hands into a massive complex of terraces, are extensively cultivated.

The Terai Region

The Terai Region, in absolute topographic contrast to the Mountain and Hill regions, is a lowland tropical and subtropical belt of flat, alluvial land stretching along the Nepal-India border, and paralleling the Hill Region. It is in fact the northern extension of the Gangetic Plain in India, commencing at about 300 meters above sea level and rising to about 1,000 meters at the foot of the Siwalik Range. It hence is not, technically, a part of the Himalayan geology. The Terai has with it several valleys or what we also call them *dun*. The region is geomorphologally formed and is fed by three major rivers: the Kosi, the Narayani (India's Gandak River), and the Karnali. It, in the past, contained malaria-infested, thick forests, commonly known as *char kose jhari* (dense forests approximately twelve kilometers wide), and was used as a defensive frontier by Nepalese rulers during the period of the British Raj (1858-1947) in India. In 1951 the Terai served as the country's granary and land resettlement frontier and became the most coveted internal destination for land-hungry hill peasants (Savada 1991).

The aforementioned ecological regions of Nepal were divided by the government into five major development regions[9] and 14 zones within the framework of regional development planning of the area after the Fourth Plan (1970-75) period (table 5.22). Eastern Nepal is one of the important development regions of Nepal and is located on the easternmost portion of the country. It shares 19 percent of the total geographical area of the country and accommodates 23 percent of the total population. Out of the total of 75 districts, 16 of them

[9] Of major concern in this section would be the Eastern Nepal. However, geo-environment and socio-economic dynamics of Nepal are mainly informed by different ecological regions and the environmental processes operating therein. Hence, it becomes imperative for us to understand the geography of Nepal as a whole while we discuss relevant issues pertaining to Eastern Nepal.

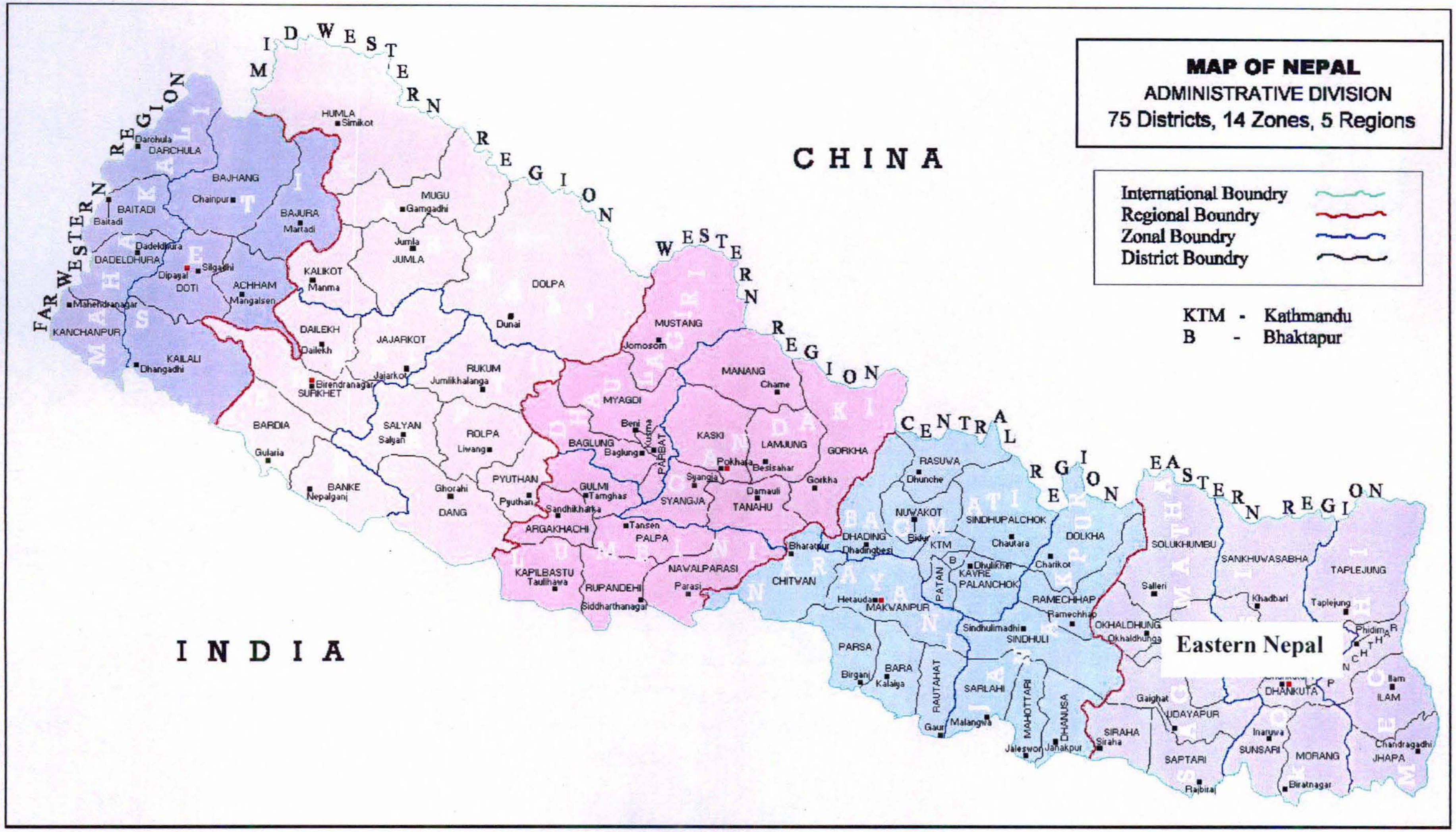
are located in the Eastern Nepal. The proportion of Mountains, Hills and Terai in the Eastern Nepal are 36.7 percent, 37.8 and 25.5 percent respectively.

Table 5.22 REGIONAL DEVELOPMENT DIVISIONS OF NEPAL

Administrative/ Development Region	Area (sq km)	Zones	Districts
Far-Western	19,539	Mahakali, Seti	Baitadi, Dadeldhura, Darchula, Kanchanpur, Achham, Bajhang, Bajura, Doti, Kailali
Mid-Western	42,378	Bheri, Karnali, Rapti	Banke, Bardia, Dailekh, Jajarkot, Surkhet, Dolpa, Humla, Jumla, Kalikot, Mugu, Dang, Pyuthan, Rolpa, Rukum, Salyan
Western	29,398	Dhaulagiri, Gandagi, Lumbini	Baglung, Parbat, Mustang, Myagdi, Gorkha, Kaski, Lamjung, Manang, Syangja, Tanahu, Arghakhanchi, Gulmi, Kapilbastu, Nawalparasi, Palpa, Rupandehi
Central	27,410	Bagmati, Janakpur, Narayani	Bhaktapur, Dhading, Kathmandu, Kabhrepalanchok, Lalitpur (patan), Nuwakot, Rasuwa, Sindhupalchok, Dhanusa, Dolakha, Mahottari, Ramechhap, Sarlahi, Sindhuli, Chitawan, Bara, Makwanpur, Parsa, Rautahat
Eastern	28,456	Mechi, Sagarmatha, Koshi	Ilam, Jhapa, Panchthar, Taplejung, Khotang, Okhaldunga, saptari, Siraha, Solukhumbhu, Udayapur, Bhojpur, Dhankuta, Morang, Sankhuwasabha, Sunsari, Terhathum
Nepal (5 Regions)	147,181	14 Zones	75 Districts

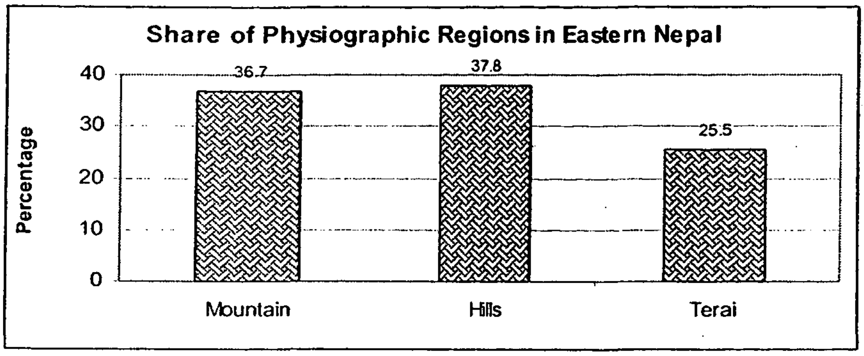
Source: compiled by the author

Map 5.5 ADMINISTRATIVE DIVISIONS OF NEPAL



Source: adopted from www. ncthakur.itgo.com/map04.htm (accessed June 2, 2007)

Fig 5.8 SHARES OF PHYSIOGRAPHIC REGIONS IN EASTERN NEPAL



Source: based on table 5.22

As a consequence of immense physiographic, geographic and geomorphic diversity, Nepal has a great deal of variation in its climatic pattern. The Tarai Region is featured by a tropical and subtropical climatic regime. Beyond the Terai, however, the climate is completely different. Such extraordinary differences in climatic conditions are primarily related to the enormous range of altitude within a relatively short north-south distance. The presence of the Himalayan massifs and the monsoonal alteration of wet and dry seasons also greatly contribute to local variations in climate. Scholar Sharad Singh Negi (Savada 1991) identifies five climatic zones in Nepal based on altitude: the tropical and subtropical zone of below 1,200 meters in altitude; the cool temperate zone of 1,200 to 2,400 meters in altitude; the cold zone of 2,400 to 3,600 meters in altitude; the subarctic climatic zone of 3,600 to 4,400 meters in altitude; and the arctic zone above 4,400 meters in altitude.

In terms of natural vegetational regimes and its distribution patterns, altitude again plays a significant role. Below 1,200 meters, the dominant form of vegetation consists of tropical and subtropical rain forests. Altitude also affects annual rainfall or precipitation patterns. Up to about 3,000 meters, annual rainfall totals increase as the altitude increases; thereafter, annual totals diminish with increasing altitude and latitude. In addition to this latitudinal differentiation in rainfall, two other patterns can be discerned. First, given the northwestward movement of the moisture-laden summer monsoon (June to September), the amount of annual rainfall generally decreases from east to west. Second, the horizontal extension of hill and mountain ranges creates a moist condition on south and east facing slopes whereas it produces a major rain shadow on the northern sides of the slopes. The aridity increases with altitude and latitude, especially on the northern slopes, and reaches its climax in the inner Himalayan region and on the Tibetan Plateau. The Eastern Nepal receives approximately 2,500 millimeters of rain annually, the Kathmandu area about 1,420 millimeters, and western Nepal about 1,000 millimeters (Savada 1991). The towering Himalaya play a critical role, blocking the northwesterly advances of moist, tropical air from the Bay of Bengal, and ultimately leading to its conversion to rain in the summer. In the winter, this range prevents the outbursts of cold air from Inner Asia from reaching southern Nepal and northern India, thus ensuring warmer winters in these regions than otherwise would be the case.

For the vast majority of South Asians, including Nepalese, the term *monsoon* is synonymous with the summer rainy season, which makes or breaks the lives of hundreds of millions of farmers on the subcontinent. Even though the arrival of the summer monsoon can vary by as much as a month, in Nepal it generally arrives in early June, is preceded by violent lightning and thunderstorms, and lasts through September, when it begins to recede. The plains and lower Himalayas receive more than 70 percent of their annual precipitation during the summer monsoon. The amount of summer monsoon rain generally declines from southeast to northwest as the maritime wedge of air gradually becomes thinner and dryer. Although the success of farming is almost totally dependent on the timely arrival of the summer monsoon, it periodically causes such problems as flash floods, landslides, soil erosion and subsequent losses of human lives, farmlands, and other properties, not to mention great difficulty in the movement of goods and people, and heavy flooding in the plains. Conversely, when prolonged breaks in the summer monsoon occur, severe drought and famine often result.

Nepal can be divided into three major river systems from east to west: the Kosi River, the Narayani River (India's Gandak River), and the Karnali River. The eastern part[10] of the country is drained by the Kosi River, which has seven tributaries. It is locally known as the Sapt Kosi, which means seven Kosi rivers (Tamur, Likhu Khola, Dudh, Sun, Indrawati, Tama, and Arun). The principal tributary is the Arun, which rises about 150 kilometers inside the Tibetan Plateau. The Narayani River drains the central part of Nepal and also has seven

[10] Roughly corresponding to Eastern Nepal

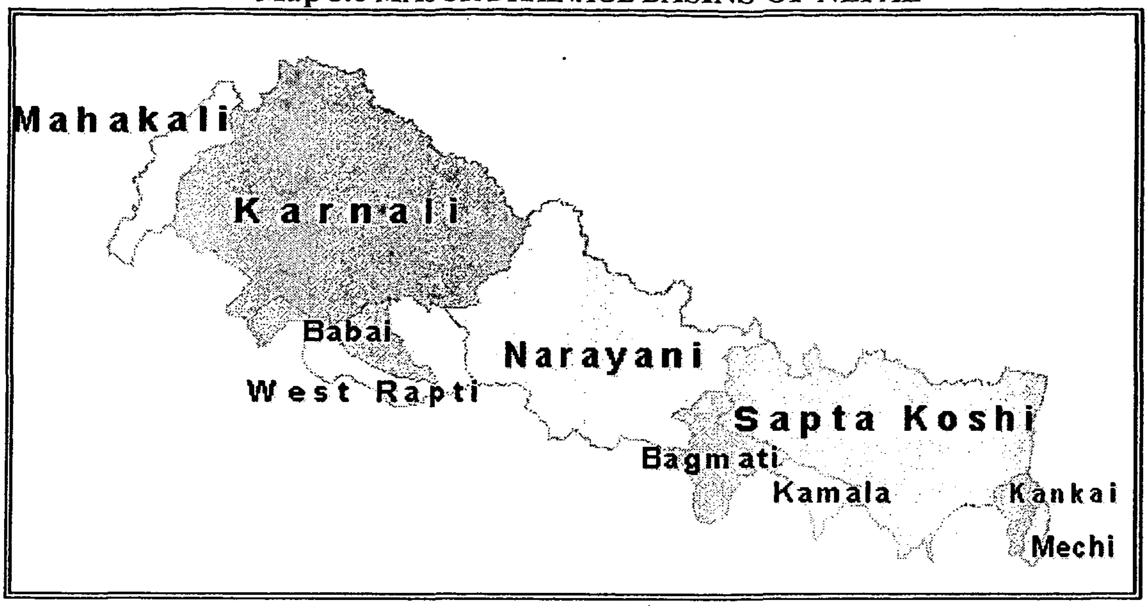
major tributaries (Daraudi, Seti, Madi, Kali, Marsyandi, Budhi, and Trisuli). The Kali, which flows between the *Dhaulagiri Himal* and the *Annapurna Himal* (Himal is the Nepali variation of the Sanskrit word *Himalaya*), is the main river of this drainage system. The river system draining the western part of Nepal is the Karnali. Its three immediate tributaries are the Bheri, Seti, and Karnali rivers, the latter being the major one. The Maha Kali, which also is known as the Kali and which flows along the Nepal-India border on the western side, and the Rapti River also are considered tributaries of the Karnali. All the rivers ultimately become major tributaries of the Ganges River in northern India. After plunging through deep gorges, these rivers deposit their heavy sediments and debris on the plains, thereby nurturing them and renewing their alluvial soil fertility. Once they reach the Terai Region, they often overflow their banks onto wide floodplains during the summer monsoon season, periodically shifting their courses and frequently flooding the lowland areas.

Table 5.23 MAJOR RIVER SYSTEMS IN NEPAL

Major River	Principal Tributary Rivers	Catchment Area
Koshi	Tamur, Likhu Khola, Dudh, Sun, Indrawati, Tama, and Arun	Eastern Nepal
Narayani	Daraudi, Seti, Madi, Kali, Marsyandi, Budhi, and Trisuli	Central Nepal
Karnali	Bheri, Seti, Karnali, Kali, Rapti	Western Nepal

Source: Compiled by the author

Map 5.6 MAJOR DRAINAGE BASINS OF NEPAL



Source: adopted from WWF 2005:9

5.3.2 Socio-Economic Dimensions

The population of Nepal in present times is the outcome of a long intermingling of Mongolians, who migrated from the north (especially Tibet), and Indo-Aryan people who came from the Gangetic plain in the south (India). On the basis of recorded mother tongue, Nepali-speaking caste Hindus are the largest and most dominant ethnic group in the hills and mountains of Nepal and account for at least two thirds of the population there. The rhythm of life in Nepal, as in most other parts of monsoonal Asia, is intricately yet intrinsically intertwined with its physical environment. Hence, the livelihood patterns of Nepal are inseparable from the environment.

Levine (1987) broadly divides Nepal into three zones of habitation, each occupied by a distinctive set of ethnic groups. These include a northern, high-altitude zone peopled by groups of Tibetan language and culture; a middle-altitude zone inhabited by the distinctively Nepalese peoples who combine Tibetan, Indian and probably certain aboriginal elements common to neither and deriving from cultures that may have been preceded by both and Parbatiya in the valleys and a lowland zone occupied by Hindu, Muslim, and certain longresident populations, such as Tharu. Similarly, political scientists Joshi and Rose (Savada 1991) broadly classify the Nepalese population into three major ethnic groups in terms of their origin: Indo-Nepalese, Tibeto-Nepalese, and indigenous Nepalese. In the case of the first two groups, the direction of their migration and Nepal's landscapes appeared to have led to their vertical distribution; most ethnic groups were found at particular altitudes. The first group, comprising those of Indo- Nepalese origin, inhabited the more fertile lower hills, river valleys, and Terai plains. The second major group consisted of communities of Tibeto-Mongol origin occupying the higher hills from the west to the east. The third and much smaller group comprised a number of tribal communities, such as the Tharus and the Dhimals of the Terai; they may be remnants of indigenous communities whose habitation predates the advent of Indo-Nepalese and Tibeto-Mongol elements. Savada (1991) describes the geographical distribution of Nepalese populations:

> An extraordinarily complex terrain also affected the geographic distribution and interaction among various ethnic groups. Within the general latitudinal sorting of Indo-Nepalese (lower hills) and Tibeto-Nepalese (higher hills and mountains) groups, there was a lateral (longitudinal) pattern, in which various ethnic populations were concentrated in specific geographic pockets. The deeply cut valleys and high ridges tended to divide ethnic groups into many small, relatively isolated, and more or less self- contained communities. This pattern was especially prominent among the Tibeto-Nepalese population. For example, the Bhote group was found in the far north, trans-Himalayan section of the Mountain Region, close to the Tibetan border. The Sherpas, a subgroup within the *Bhote*, were concentrated in the northeast, around the Mount Everest area. To the south of their areas were other Tibeto-Nepalese ethnic groups-the Gurung in the west-central hills and the Tamang and Rai in the east-central hills particularly close to and east of the Kathmandu Valley. The Magar group, found largely in the central hills, was much more widely distributed than the Gurung, Tamang, and Rai. In the areas occupied by the Limbu and Rai peoples, the Limbu domain was located farther east in the hills, just beyond the Rai zone. The Tharu group was found in the Terai, and the Paharis were scattered throughout Nepal. Newars largely were concentrated in the Kathmandu Valley. However, because of their past migration as traders and merchants,

> they also were found in virtually all the market centers, especially in the hills, and as far away as Lhasa in Tibet.[11]

In most of Nepal there is a strong tendency toward clustered housing in settlements, perhaps reflecting previous defense needs. The earliest settlement locations were usually along ridge crests possibly to avoid malarial areas. Although Nepal continued to be something of a frontier well into the 19th century, most areas in the hills and mountains have had settled populations of agriculturalists for hundreds of years. Nepali, the country's official language, is an Indo-European language and has similarities to Hindi.

Nepal is among the poorest and least developed countries in the world with almost one-third of its population living below the poverty line (Savada 1991). Various factors contribute to its economic underdevelopment including geo-environmental and geomorphic constraints, lack of adequate resource endowment, landlocked position, lack of institutions for modernization, weak infrastructure, and a lack of policies conducive to development. Agriculture is the mainstay of the economy, providing a livelihood for three-fourths of the population and accounting for 38 percent of GDP[12]. Industrial activity mainly involves the processing of agricultural produce including jute, sugarcane, tobacco, and grain. Security concerns relating to the Maoist conflict have led to a decrease in tourism, a key source of foreign exchange. Nepal has considerable scope for exploiting its potential in hydropower and tourism areas of recent foreign investment interest. Prospects for foreign trade or investment in other sectors still remains poor, however, because of the small size of the economy, its technological backwardness, its remoteness, its landlocked geographic location, its civil strife, and its susceptibility to natural disaster. Savada (1991) succinctly narrates the economy of Nepal:

> Nepal in the early 1990s was predominantly a rural-agricultural society, where more than 90 percent of the people lived in rural areas and depended on farming as a source of livelihood. Even in settlements designated as urban areas, the rural-urban distinction easily was blurred;

[11] Available at http://countrystudies.us/ (accessed 26/07/07)

[12] The CIA World Factbook, U.S. Department of State, Area Handbook of the US Library of Congress

approximately 50 percent of urbanites outside the three cities in the Kathmandu Valley were engaged in farming for their livelihood. Even in the Kathmandu Valley cities, 30 to 40 percent of city dwellers were agriculturalists. In this sense, most urban areas were economic extensions of rural areas, but with an urban manifestation and a commercial component. Farming was the dominant order of society and the mainstay of the economy, a situation that was unlikely to change, given the extremely sluggish pace of economic transformation[13].

Around one-fifth of the total land area in Nepal is cultivated and about 7 percent is under cultivable category (but not cultivated). Forest land and shrubs together occupy 42 percent of the total area of the country. Nearly 12 percent of the area is accounted by pastures and another 19 percent is covered by snow, rocks, boulders, sand, landslide areas, barren land, lakes and urban areas (CBS 1998).

Cereals are the most important crops in Nepal occupying over 80 percent of the total cropped area. Pulses are the other common crops. Horticultural crops including fruits, vegetables and flowers are also grown. In recent years, vegetable farming in commercial scale has been increasing (CBS 1998). Across the physiographic regions, the Terai is favourable for most of the crops. The Eastern Nepal occupies a very important position in terms of agriculture. It accommodates about 30 percent of total cultivated area in the country. The following table highlights the share of Eastern Nepal with respect to major agricultural crops in Nepal.

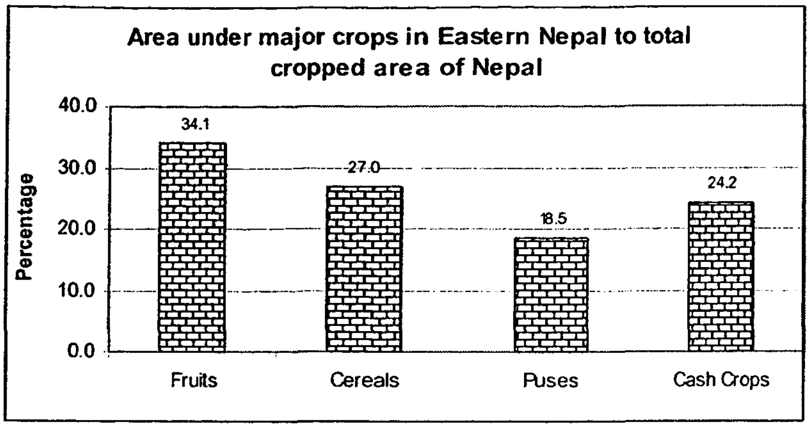
Table 5.24 AREAS UNDER MAJOR CROPS ACROSS DEVELOPMENT REGIONS OF NEPAL (%)

Development Region	Fruits	Vegetables	Cereals	Pulses	Fodder
Eastern	34.1	34.4	27.0	18.5	37.6
Central	36.2	32.6	28.7	39.0	6.7
Western	20.8	13.6	21.6	13.1	41.3
Mid-Western	6.0	11.0	13.7	16.9	14.1
Far-Western	2.9	8.8	9.0	12.5	0.3

Source: CBS, 1998: 31-32

[13] Available at http://countrystudies.us/ (accessed 26/07/07)

Fig 5.9 AREAS UNDER MAJOR CROPS IN EASTERN NEPAL TO TOTAL CROPPED AREA OF NEPAL



Source: based on table 5.24

Table 5.25 DOMESTICATED ANIMAL RESOURCES IN NEPAL

Domesticated Animals	Endangered
Cattle, Buffaloes, Goats, Sheep, Pigs, Poultry, Ducks	*Lulu* cattle, *Achhami* cattle, *Khaila* cattle, *Lime* buffalo, *Gadde* buffaloe, Yak/*Nak*, *Pate* Pig, *Bampudke* pig, *Kage* sheep, Nepali *Saanen*

Source: CBS 1998: 34

Livestock is a backbone of the Nepalese economy. As a result livestock density in Nepal is appreciably high. In 1996/97 there were 7.02 million cattle, 3.36 million buffaloes, 5.92 million goats, 0.87 million sheep, 0.72 million pigs and 15.58 million chickens (CBS 1998 1998: 54). Cattle are very popular in Nepal with over 80 percent of the livestock holding shared by cattle. The eastern region of Nepal has the highest share of cattle and pig population among the development regions of the country. It occupies third position in terms of Buffaloe and second position with respect to goat population.

Table 5.26 LIVESTOCK POPULATION BY DEVELOPMENT REGIONS IN NEPAL (%)

Development Region	Cattle	Buffaloe	Goat	Sheep	Pig
Eastern	24.0	20.7	25.1	13.3	46.8
Central	22.7	24.4	30.3	11.8	13.2
Western	19.9	28.2	19.1	18.6	15.8
Mid-Western	20.0	14.5	17.7	46.3	18.0
Far-Western	13.4	12.2	7.8	10.0	6.2

Source: CBS 1998: 55

Besides, agriculture and allied activities tourism also contributes to the economy of the Nepal. It is a key foreign exchange earner of Nepal. Half a million of tourists visited Nepal in 1999 but the sector deteriorated due to the political instability, with an all-time low of 275,000 tourists in 2002 (-45%)[14] . The situation has improved somewhat, especially since the Maoist unilateral cease-fire declared on 1 September 2005 but if the security situation does not improve it will not reach its full potential.

[14] European Commission: http://ec.europa.eu/external_relations/nepal/intro/index.htm (Accessed 22/12/2007).

Plate 5.6: General View of Rural Ilam- Eastern Nepal
[Photo: Vimal Khawas, April 2008]

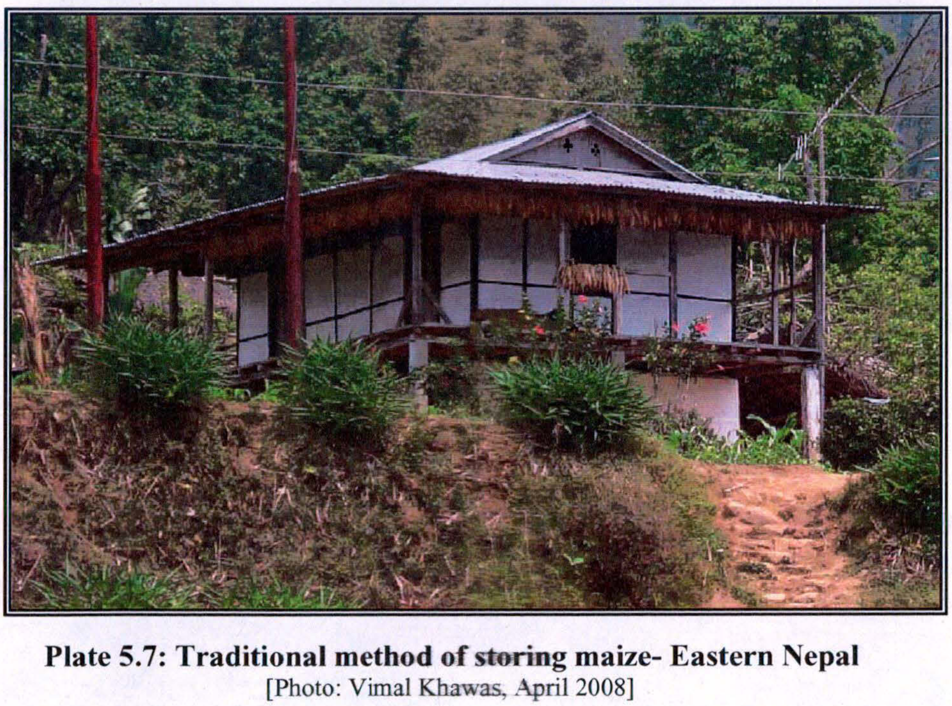


Plate 5.7: Traditional method of storing maize- Eastern Nepal
[Photo: Vimal Khawas, April 2008]

Plate 5.8: Broom Plantation- Eastern Nepal
[Photo: Vimal Khawas, April 2008]

Plate 5.9: Cowshed in Eastern Nepal
[Photo: Vimal Khawas, April 2008]

5.3.3 Natural Environmental Challenges

Nepal's small size betrays its geological, topographical and climatic diversities. The geology and geomorphology of Nepal is favorable to several natural challenges. The challenges range from earthquake to various types of geomorphic processes such as mass wasting and floods. Hence, Natural disaster is common in Nepal. As a central part of the Himalayan geo-system the country is geologically young and still evolving. Given its mountainous topography and the fact that the country comes under the spell of the monsoon every summer, various types of natural challenges are quite common and frequent. The increase in population and the change in its distribution also meant that the country is now faced with a new set of natural disaster risks. The UNDP lists earthquake[15], floods and flash floods[16], landslides[17], and drought[18] as the major natural challenges for the Nepal as a whole.

Earthquake

Geologically, Nepal is considered to lie on a seismic zone which experiences frequent earthquakes. As a result, earthquakes of various magnitudes occur almost every year and have caused heavy losses of lives and property on several occasions. Based on the data available from the Department of Mines and Geology, CBS (1998) concludes that earthquakes of more than or equal to 5.0 on the Richter scale have occurred at least once every year in Nepal. Nepal has been identified as the eleventh most earthquake prone zones in the world (Sitoula 2007). Ten gigantic earthquakes have already hit Nepal in the last 680 years (ibid). According to National Society for Earthquake Technology-Nepal (NSET), 92 fault lines have been identified in Nepal. Indian tectonic plates continue to be overlapped by the Tibetan tectonic plate. This has led the upper crust of the plates to develop fault lines. Earthquake occurs in the process of the movement of the earth's crust. As Nepal is situated between the two, it physically experiences jerks from time to time.

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[15] Potentially lethal, liquefaction becoming a serious cause.

[16] Annual phenomenon but the impact is increasing.

[17] Induced by earthquakes, torrential rains, and natural geological change (frequent and deadlier).

[18] Occasional in nature.

Scientists presume that an earthquake of massive scale follows a ninety-year cycle. According to NSET if an earthquake of the same scale as the one that hit Nepal in 1934 recurred some 40,000 people would die and the number of injured would climb to more than 95,000. Sixty per cent of the buildings are likely to be destroyed and 700,000 people would be rendered homeless. The damages of bridge, road, water supply, telephone lines have been forecast at 50 per cent, 10 per cent, 95 per cent and 60 per cent respectively. The snapping of power lines has been put at 40 per cent. As earthquakes are unpredictable and unavoidable, earthquake preparedness training and educating the general public should be the first priority in a poor country like Nepal. Strict building codes to minimise the impact of earthquake should also be followed.

Heavy Monsoon and Associated Natural Hazards

Heavy monsoon followed by flash floods and landslides in Nepal characterise a major constraint on development, causing high levels of economic loss and substantial numbers of fatalities each year. There is a general consensus that the impacts of landslides in countries such as Nepal are increasing with time. Petley *et al* (2007), in their analysis of landslide fatalities in Nepal for the period 1978–2005 found a high level of variability in the occurrence of landslides from year to year and that the overall trend was upward. Their analyses of the trends in the data suggested that there was a cyclicity in the occurrence of landslide fatalities that strongly mirrored the cyclicity observed in the SW (summer) monsoon in South Asia, that was explained through an inverse relationship between monsoon strength and the amount of precipitation in the Hill District areas of Nepal. It was also clear that in recent years the number of fatalities had increased dramatically over and above the effects of the monsoon cycle. Three explanations were explored for this: land-use change, the effects of the ongoing civil war in Nepal, and road building. The study concluded that a major component of the generally upward trend in landslide impact probably resulted from the rural road-building programme, and its attendant changes to physical and natural systems.

The Eastern Nepal represents one of the most vulnerable regions to various types of natural disasters in the country. In 1996 Eastern Nepal accounted for over 23 percent of the total human losses, 33 percent of animal loses, 63 percent of affected family, 95 percent of the financial loss and about 58 percent of the affected land in the country to natural hazards. Of the various natural disasters windstorm, Floods and Landslides seem to be the major forces that inflict severe human insecurity in the region. Heavy monsoon rains triggered flash floods and massive landslides in the villages of Sungdel and Dipsung of Khotang District in eastern Nepal, on 14 July, 2002 (OCHA 2002). Some 46 people were feared killed and 150 missed. The landslides reportedly also swept away 29 houses and a health post, and more than 90 houses in the area were severely damaged. To make the situation worse communication between Diktel, the district capital, and Kathmandu had been hampered since the telecom tower in Udaypur was destroyed in the armed conflict affecting Nepal, a few months ago.

Table 5.27 ESTIMATED SOIL EROSION RATES AT SELECTED SITES IN NEPAL

Location and Characteristics		Land-Use	Erosion Rate (tons/ha/year)
Siwalik Range	**Eastern Nepal: south aspect, sandstone, foot hills**	**Forest to grazing**	**7.8-36.8**
	Far West Nepal: south aspect, sandstone, foothills of Surket	Degraded forest	20.0
		Gully land	40.0
		Degraded heavily grazed gully land	200.0
Middle Mountain	Central Nepal: Mahabharat Lek, steep slope, metamorphic and sedimentary rocks	Degraded forest and agricultural land	31.5-40.0
		Gully land	63.0-420.0
	Kathmandu Valley: northern foothills	Degraded forest and shrub land	27.0-45.0
		Overgrazed shrub land	43.0
	Kathmandu Valley: south	Severe gully land	125.0-570.0
		Dense forest (75%)	8.0
		Protected Pasture	9.2
	Pokhara Valley: Phewa Tal watershed	Overgrazed grassland	22.0-347.0
		Gully, overgrazed grass land	29.0

Ha=hectare; Source: CBS 2004: Table No 4.36

Table 5.28 IMPACTS OF HEAVY RAIN AND LANDSLIDES ON HUMAN SECURITY

Region	District	Date	Type of disaster	Impact on Human Security
Eastern Nepal	Khotang	14 July, 2002	Heavy monsoon rain followed by floods and massive landslides	46 People Died
				150 People Missed
				29 Houses Swept away
				More than 90 Houses severely damaged
				Communication hampered

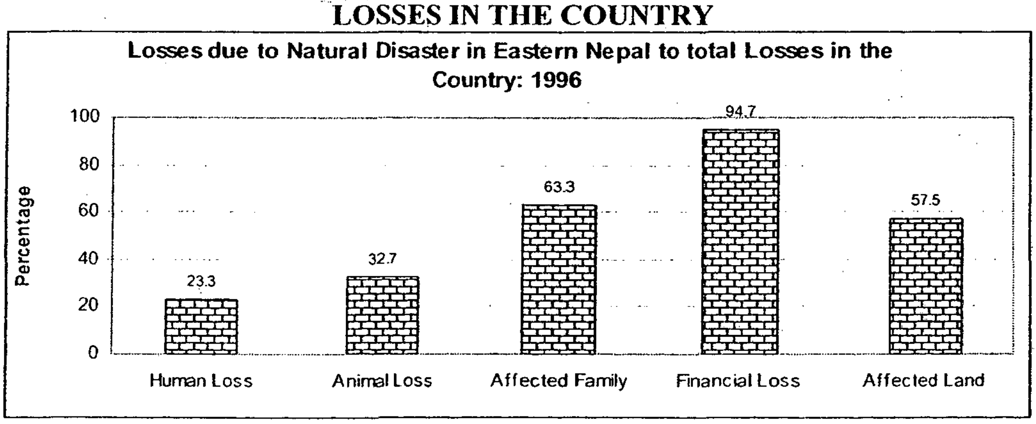
Source: tabulated by the author from OCHA 2002

Table 5.29 DISTRIBUTIONS OF LOSSES DUE TO NATURAL DISASTER IN NEPAL: 1996

Development Region	Human Loss	Animal Loss	Affected Family	Financial Loss (in Million Rupees)	Affected Land (in Ha)
Eastern	219	934	35919	11594	3916
Central	212	682	7418	95	2144
Western	70	729	6400	392	310
Mid-Western	282	231	4806	133	151
Far-Western	157	280	2243	33	289
Nepal (Total)	940	2856	56786	12248	6810

Source: CBS 1998: 143

Fig 5.10 LOSSES DUE TO NATURAL DISASTER IN EASTERN NEPAL TO TOTAL LOSSES IN THE COUNTRY



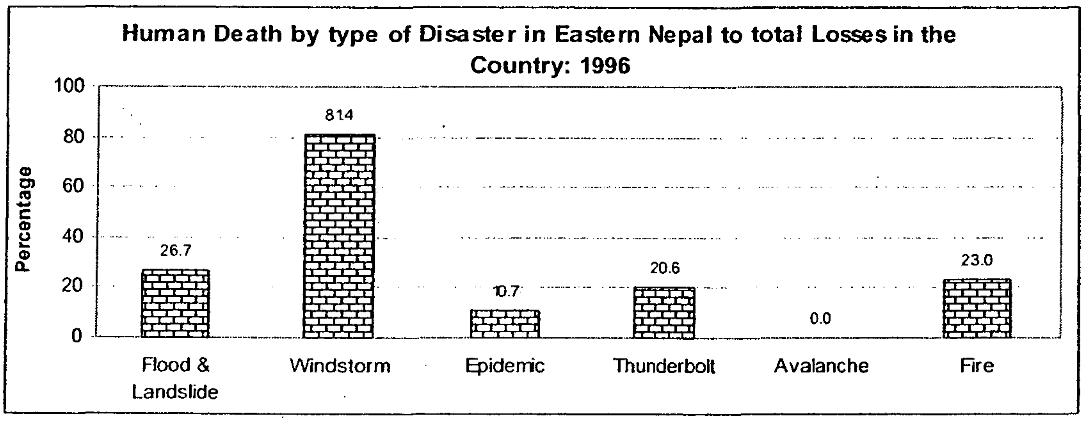
Source: based on table 5.29

Table 5.30 NUMBER OF HUMAN DEATH BY TYPE OF DISASTER IN NEPAL: 1996

Development Region	Flood & Landslide	Windstorm	Epidemic	Thunderbolt	Avalanche	Fire
Eastern	69	79	50	7	-	14
Central	118	15	64	3	-	12
Western	30	3	20	6	-	11
Mid-Western	32	0	205	17	4	24
Far-Western	9	0	147	1	-	-
Nepal (Total)	258	97	468	34	4	61

Source: CBS 1998: 144

Fig 5.11 HUMAN DEATH BY TYPE OF DISASTER IN EASTERN NEPAL TO TOTAL LOSSES IN THE COUNTRY



Source: based on table 5.30

Windstorms, hailstorms and thunderbolts (lightening strikes) also occur frequently in Nepal and affect many areas of the country on a regular basis. Although not as serious as floods, landslides, and earthquakes these events, nevertheless, cause loss of human lives and damages to properties. Analyzing the available data CBS (1998) concludes that in 1995, forty-five districts of Nepal were affected by hailstorms, windstorms and thunderbolts. These events, particularly the hailstorms, cause considerable damages to the standing crops in the fields and bring about human insecurities in the region. Further, the topography and geology of Nepal is favorable to soil erosion. Erosion rates vary largely and range between 800 to 57,000 T per km2 (Bhusal 1998, WWF 2005). As a result, sediment loads in the rivers of

Nepal are among the highest in the world. The monsoon is mainly responsible for surface erosion and sediment load closely follows the river discharge, peaking in August (WWF 2005).

5.3.4 Human Interference on Environment and resultant Human Security Challenges

Nepal is minuscule in size by Asian standards but it forms the nucleus of the Himalaya and affects the well-being of hundreds of millions in its vicinity and downstream. As back as in 1976, Eckholm noted in the context of Nepal, 'In probably no other mountain country are the forces of ecological degradation building so rapidly and visibly' (Eckholm 1976:76). He further reminded, '... in this land of unexcelled natural beauty live some of the world's most desperately poor' (Pp. 77).

Population

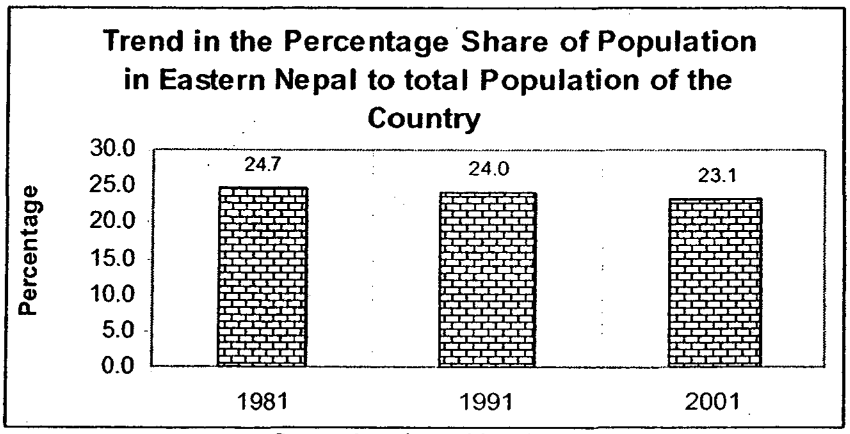
Schroeder (1985) reasonably highlights the trend of population and its growth in the historical perspective:

> Nepal experienced a slow rate of population growth that was probably under one percent per year for the period from unification in the late 1700s to the beginning of the twentieth century. Total population may actually have declined slightly during and after World War I as a local effect of world-wide epidemics. The 1930s mark the beginning of a modern and continuing period of rapid population growth. Total population grew from about 5 million in 1930 to 11.6 million in 1971, and to an estimated 15 million in 1983. (Pp. 32)

He attributes control of cholera, smallpox, and other virulent epidemic diseases in most of rural Nepal, and improved government and international response to localized famines to the ongoing population increase and not the economic prosperity of the country which according to him has remained stable or worsened (Schroeder 1985).

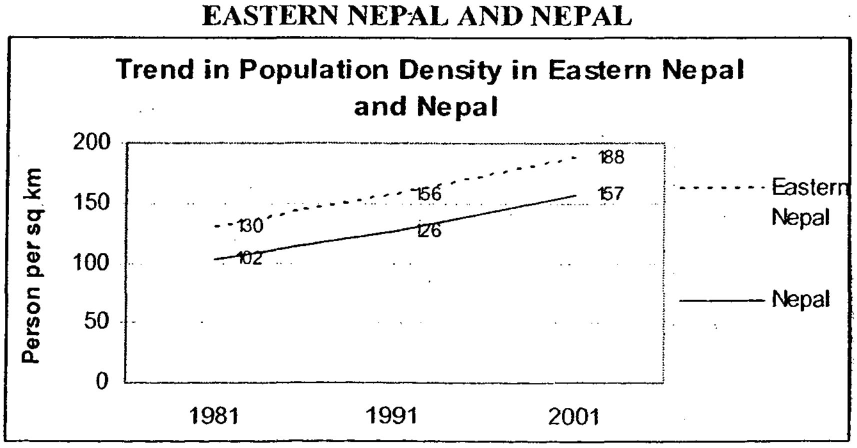
The Eastern Nepal as one of the prominent development regions of the country had about 3.7 million populations in 1971 representing around 25 percent of the total in the country. Although it increased to over 5.4 million in 2001, the corresponding percentage share declined to about 23 percent. This means the populations in other development regions are either rising faster or people of the eastern region are out-migrating. Conversely, however, population density has been much higher in Eastern Nepal as compared to the average of Nepal even at present times. This again highlights that population pressure in the Eastern Region is still much higher than the national average.

Fig 5.12 TREND IN THE PERCENTAGE SHARE OF POPULATION IN EASTERN NEPAL TO TOTAL POPULATION OF THE COUNTRY



Source: based on table 5.31

Fig 5.13 TRENDS IN POPULATION DENSITY IN EASTERN NEPAL AND NEPAL



Source: based on table 5.31

Table 5.31 DISTRICTWISE POPULATION PROFILE IN EASTERN NEPAL

Sl No	District	2001	1991	1981	Area (Km2)	Physiographic Region
1	Bhojpur	203018	198784	192689	1507	H
2	Dhankuta	166479	146386	129781	891	H
3	Ilam	282806	229214	178356	1703	H
4	Jhapa	688109	593737	479743	1606	T
5	Khotang	231385	215965	212571	1591	H
6	Morang	843220	674823	534692	1855	T
7	Okhaldhunga	156702	139457	137640	1074	H
8	Panchthar	202056	175206	153746	1241	H
9	Sankhuwasabha	159203	141903	129414	3480	M
10	Saptari	570282	465668	379055	1363	T
11	Siraha	572399	460746	375358	1188	T
12	Solukhumbu	107686	97200	88245	3312	M
13	Sunsari	625633	463481	344594	1257	T
14	Taplejung	134698	120053	120780	3646	M
15	Terhathum	113111	102870	92454	679	H
16	Udayapur	287689	221256	159805	2063	H
	Eastern Nepal	5344476	4446749	3708923	28456	-
	Nepal	23151423	18491097	15022839	147181	-

T: Terai; H: Hill; M: Mountain
Source: Census of Nepal [various years]

Across the ecological region within Eastern Nepal, the Terai bears the maximum population pressure and the burden has been increasing with time. About 62 percent of the total population of eastern region lived in Terai in 2001. The Hills and Mountain regions, on the other hand, have witnessed a decreasing share of population in the last three decades. The hills accommodated about 31 percent of the population while the mountains supported about 8 percent of the total population of the Eastern Nepal.

Table 5.32 SHARE OF POPULATION IN DIFFERENT PHYSIOGRAPHIC REGIONS OF EASTERN NEPAL

Physiographic Region	1981	1991	2001	Growth [1981-2001]
Mountain	9.1	8.1	7.5	-1.6
Hills	33.9	32.1	30.7	-3.1
Terai	57.0	59.8	61.7	4.8

Source: based on Census of Nepal [various years]

Table 5.33 DENSITY OF POPULATION IN DIFFERENT PHYSIOGRAPHIC REGIONS OF EASTERN NEPAL

Physiographic Region	1981	1991	2001	Growth [1981-2001]
Mountain	32.4	34.4	38.5	6.0
Hills	116.9	133.0	152.9	35.9
Tarai	290.7	365.7	453.9	163.2

Source: based on Census of Nepal [various years]

Deforestation

From 1950 to 1980, Nepal lost half of its forest cover (Savada 1991). The forest resources survey (1964), which estimated about 6.5 million hectares of forest area, indicated that as of 1987 the forest area in the hills had remained more or less the same but that elsewhere forests had been degraded. By 1988 forests covered only approximately 30 percent of the land area and by 2003 it had gone down to 25 percent. Deforestation was typical of much of the country and was linked to increased demands for grazing land, farmland, and fodder as the animal and human populations grew. Further, most of the population's energy needs were met by firewood. All these factors exacerbated deforestation. Fuelwood needs of the population mainly resulted from the lack of alternative sources of energy. Bajracharya (1983) in his paper postulated a thesis that the primary cause of deforestation in Nepal is the clearing of forests to increase land for agriculture and fodder, and not, as generally assumed, the need for fuel wood. According to him, to successfully counteract deforestation and the resulting ecological damage, it is necessary to consider the full range of needs of the rural people: food, fodder, building materials, and fuel. Deforestation caused soil erosion and complicated cultivation, affecting the future productivity of agricultural lands. Although several laws to counter degradation have been enacted, the results are modest, and government plans for afforestation have not met their targets.

Interestingly, however, Virgo and Subba (1994), in their study of Land-Use Change between 1978 and 1990 in middle mountain zone of Dhankuta District, Eastern Nepal, found out stability in land use, despite an estimated 19 percent increase in population. No statistically significant changes in overall land use were detected but considerable internal trading had occurred between categories within sample areas, especially between "forest" and "shrub," demonstrating a fluidity of land use. Total forest cover increased from 36.5 percent of the sample area in 1978 to 38.8 percent in 1990. Forest land increased by 34 percent, indicating a significant improvement in on-farm fodder, fuel wood, and fruit tree resources. Landslide areas increased from one percent of the total sample in 1978 to 1.9 percent in 1990. Their study was based on interpretation of air photographs taken in 1978 and 1990 and field checks on a sample of 13 sites of 300 ha each, representing a 20 percent sample. Population changes were estimated by house counts on the air photographs.

Table 5.34 FOREST COVER BY DEVELOPMENT REGIONS IN NEPAL (%)

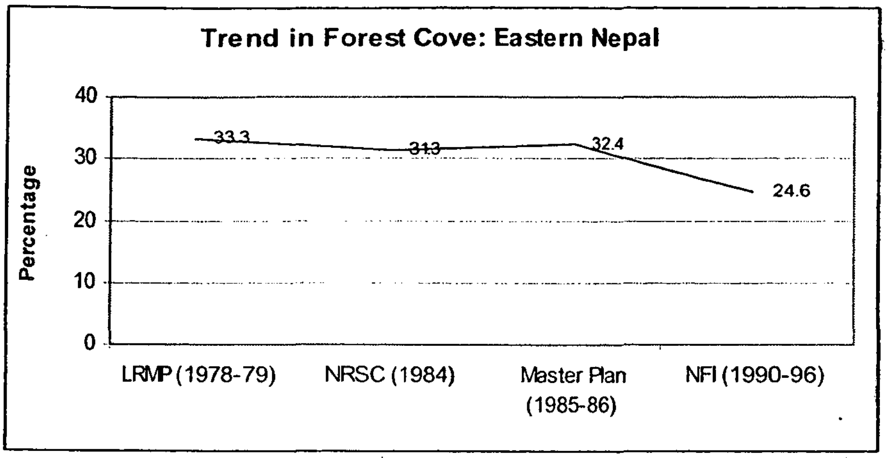
Development Region	LRMP (1978-79)	NRSC (1984)	Master Plan (1985-86)	NFI (1990-96)
Eastern	33.3	31.3	32.4	24.6
Central	40.3	38.4	39.0	33.5
Western	31.5	39.4	30.7	22.7

Source: CBS 1998: 114

It is clear from the table that forest resource all the development regions of Nepal including Eastern Nepal is clearly at declining trend. Due to increasing population pressure, lack of awareness and ignorance of people, the areas of forest has been gradually decreasing forcing the environment to change (CBS, 1998).

Plate 5.10: Rural Fuelwood Storage: Eastern Nepal
[Photo: Vimal Khawas, April 2008]

Fig 5.14 TREND IN FOREST COVER: EASTERN NEPAL



Source: based on table 5.34

Insurgency and Repression of the common people

Nepal's political landscape changed dramatically on 1 February 2005, when King Gyanendra dismissed Prime Minister's Sher Bahadur Deuba's multi-party government and assumed executive powers. The King's move came against a backdrop of more than a decade of political turmoil and conflict in the country: the law and order situation rapidly deteriorated since the proclamation of the "Peoples' war" in 1996 by Maoist insurgent groups. Multiparty democracy was introduced in 1991 after popular protests, but it was characterised by factionalism, with frequent changes of government. The conflict in Nepal has left more than 12,000 people dead since it started in 1996[19]

When King Gyanendra's direct rule ended in April 2006 after a mass movement the rebels entered talks on how to end the civil war. The movement in April 2006 brought about a change in the nation. The autocratic King was forced to give up power. A landmark peace deal was agreed in November and in early 2007 the Maoists joined an interim government. The dissolved House of Representatives was restored. The House of Representatives formed a government which had successful peace talks with the Maoist Rebels. An interim

[19] European Commission: http://ec.europa.eu/external_relations/nepal/intro/index.htm (Accessed 22/12/2007)

constitution was promulgated and an interim House of Representatives was formed with Maoist members. The numbers of seats were also increased to 330. The peace process, however, seemed to be in jeopardy after Maoists decided to leave coalition government on September 18, 2007, demanding the declaration of a republic before the scheduled constituent assembly.

The livelihoods of the majority of the rural population in Nepal are often vulnerable and insecure, and there has been concern that this situation has been worsened by the long-running Maoist uprising in the country. Seddon and Adhikari (2003) assesses the impact of conflict on the food security of Nepal -

1. Food insecurity exists in several regions of Nepal, but it is unclear to what extent this is a result of the conflict;
2. The conflict has disrupted local economies and this may be significantly affecting rural livelihoods;
3. The food security situation is likely to be very precarious in remote mountain regions such as Mugu district and other parts of Upper Karnali;
4. There is a growing recognition that the conflict-affected areas are those most in need of development assistance, but there is evidence to suggest that there has been high levels of conflict in those areas where poverty and deprivation are prevalent, rather than that the conflict has created these disadvantages;
5. The conflict has affected different regions, and different sectors of the population in different ways;
6. Political insecurity has been added to the environmental and economic insecurity generally experience by poor rural populations, thus increasing vulnerability;
7. The conflict has affected traditional livelihood opportunities through decreasing mobility, market activity and employment opportunities;
8. The restrictions on the movement of goods and people have increased the self-reliance of rural areas, particularly of the remoter rural areas, and de-linked them from the wider market economy. This will have the effect of increasing food insecurity in areas where both local food production and purchasing power are weak;
9. In some areas, food production has declined;

10. Food distribution has been disrupted, particularly affecting already vulnerable regions;
11. The conflict has accelerated the rural exodus. Whilst internal displacement is causing food insecurity in some areas, in other regions, such as Upper Karnali, food insecurity is causing migration.

The report concludes that the fear of war has made life more uncertain for many rural populations, but at the same time, the structural problems of Nepal's economy as a whole, causing poverty and food insecurity, persist.

Forest Fire

Every year forest fires occur in many places of Nepal and Eastern Nepal is no exception. Forest fire cause heavy loss of property as well as loss of many species of wildlife. Ironically, Nepal has no statistics on the occurrence of forest fires, and no assessment of impact on the economy or on the environment of the country is available (CBS 1998). The Central Statistical Bureau of Nepal (1998) describes the forest fire situation of Nepal-

> Though there are no records, forest fire is mainly caused by ignorance and illiteracy of local people, or personal interest such as interest of illegal wood cutters, poachers, charcoal traders, or persons encroaching on forest land. There is no record of forest fires caused by natural events like thunderbolts. About 45 percent of forest fires with known causes are due to burning for new grass to graze cattle and to smokers. About 64 percent of forest fires are set intentionally by local people. The share of accidental cause of forest fire is only 32 percent. The Department of Forest is the main responsible government organization to control forest fire. But progress on this field is yet to be achieved due because of lack of resources, lack of specific fire control rules and regulations, etc (Pp141-142).

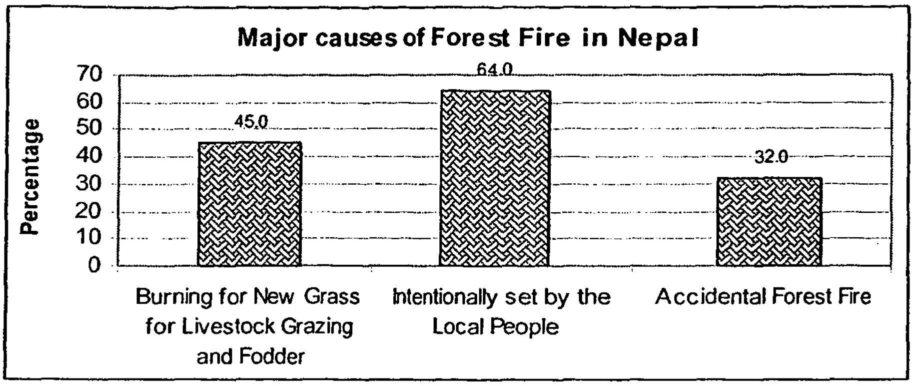
The recent national roundtable meeting[20] for the development of national strategy for wild land fire management concluded that forest in Nepal were being destroyed because rural people used fire for clearing forests making room for agriculture and pasture land. The meeting further made the following points in the context of forest fire in Nepal-

[20] The meeting was held on the Sunday, December 16, 2007

1. 40,000 hectares of forest area are set fire annually;
2. Over 90 per cent of forest lose their regenerating capacity because of fire;
3. Due to the lack of resources and equipment, the Department was not able to control wild land fire;
4. Nationwide fire management committee was needed for controlling wildfire and collecting information about loss of forest and human lives due to forest fire;
5. The communities have a central role to reduce wild land fire and the ministry, NGOs and INGOs should work collaboratively;
6. Most of the forests in South Asia and Nepal are set to fire either intentionally or for getting little profit;
7. Public awareness, training and sufficient equipment should be provided to local people to avert setting fire to the forests;
8. Nepal had not made any national level strategy for controlling wild land fire.

The meeting highlighted the need to strongly raise the agenda of wild land fire and evolved a roadmap for wild land fire management of Nepal. It pointed out the necessity for a separate governmental body with the participation of community forest users group, to establish inter country network and asked to make special policy on the national and international level for the preservation of forest, wild animal and human sufferings.

Fig 5.15 MAJOR CAUSES OF FOREST FIRE IN NEPAL



Source: based on the information available in CBS 1998: 138-154

Tourism

Tourism development has brought prosperity to many people in Nepal over the years. In case of the Eastern Nepal Tourism development has brought prosperity to many Sherpas[21]. It has also, however, had adverse impacts on regional forests and alpine vegetation because of the use of firewood by camping groups and inns and the felling of trees to construct inns and other tourist facilities. Concern that tourism was causing widespread deforestation helped catalyse the 1976 establishment of an inhabited protected area, Sagarmatha (Mt Everest) National Park, in the Khumbu region and spurred the implementation of a series of forest conservation and alternative energy development measures both within the national park and in a recently declared buffer zone in the adjacent Pharak region (Stevens 2003).

Stevens (2003) examined the changing pressures that tourism has placed on regional forests and alpine vegetation over the past half century and their role in regional vegetation change in and around Mount Everest region of Eastern Nepal. His analysis was based primarily on detailed accounts of past and present forest use and change obtained during fieldwork conducted in all Khumbu and Pharak villages, along with corroborating evidence from early foreign visitors' accounts and photographs. Contrary to some early reports he found that there has actually been little deforestation since 1950. The continuing use of firewood by inns,

[21] Over the past 50 years the Sherpa-inhabited Mt Everest region of Nepal has become a premier international mountaineering and trekking destination.

however, has contributed to the thinning of forests in some parts of the national park and to the depletion of shrub juniper in the most heavily visited alpine regions. He further found that there has been a greater impact on forests just outside the national park, which have been heavily thinned over an extensive area in order to provide timber to build inns within the national park.

Climate Change and its Consequences

Since glaciers are excellent indicators of climate change (Oerlemans 1994, WWF 2005), Nepali glaciers provide an excellent opportunity to study the impact of global climate change in this region[22]. Regular glacier studies in Nepal began in the early 1970s (WWF 2005). Since then, several glaciers have been studied across the geographies of the country.

In the context of the Eastern Nepal it would be relevant to look into the situation in and around Kanchenjunga Region[23] that boarder (Eastern) Nepal - Sikkim. Asahi and Watanabe (2000) studied glacier fluctuations in the Ghunsa Khola basin, Kanchenjunga area. Based on aerial photo interpretation and field observations, clear morphological changes were indicated. These suggest glacier variation in the region during various stages in the past [Historical stage (around the early part of the 20th century), the Little Ice Age, the Holocene, and the late and early sub-stages of the Last Glaciation]. Further, a comparison of the 1992 glaciers with those of 1958 in the area revealed that out of 57 glaciers, 50 percent had retreated in the period from 1958 to 1992. In addition, 38 percent of the glaciers were under stationary conditions and 12 percent were advancing.

Table 5.35 SOME RECENT EXAMPLES OF GLOF IN EASTERN NEPAL

Date	River Basin	Name of the Lake
4th August, 1985	Dudh Koshi	Dig Tsho, Nepal
12th July, 1991	Tamo Koshi	Chubung, Nepal
3rd September, 1998	Dudh Koshi	Sabai Tsho, Nepal.

Source: WWF 2005: 24

[22] The Nepal Himalaya accommodates 3252 glaciers and 2,323 lakes above 3500 m above sea level. They cover an area of 5323 km2 with an estimated ice reserve of 481 km3. [WWF 2005: 16]

[23] As summarised by WWF 2005: 21

Among many types of human and environmental insecurities inflicted by climate change and the consequent glacier retreat in Nepal, the impact of Glacier Lake Outburst Floods (GLOFs) has been very critical. GLOFs in Nepal has caused extensive damage to major infrastructure like roads, bridges, trekking trails, and villages as well as incurring loss o human life. There are 2,315 glacier lakes of varies sizes, the total area of which is 75 km2. (ICIMOD/UNEP2001, WWF 2005). The record of past few disastrous GLOF events in Eastern Nepal is shown in Table 5.35. Although GLOF events are not new in Nepal, GLOFs attracted scientific and government attention only when Dig Tsho Glacier Lake flooded on 4 August 1985 in the Langmoche valley, Khumbu (Ives 1986, Yamada 1998, WWF 2005). The lake, crescent in shape, was dammed by a 50 m high terminal moraine. The lake had a length of 0.605 km and width of up to 0.230 km in 1974 (ICIMOD/UNEP 2001). The GLOF was caused by detachment of a large ice mass from the upper portion of the Langmoche glacier after clear weather in July. The ice mass overran the glacier and splashed into the lake, which was full. The impact caused significant rise in the water level, overtopped the moraine dame cutting a Vshaped trench. The GLOF emptied the lake water within four to six hours. The flood water surged 10 to 15 m high in the valley and the effect was felt for more than 90 km downstream. It caused serious damage to the nearly completed Namche Hydropower Project, washed away cultivated land, bridges, houses, livestock and people. The flood waves that lasted for about four hours released about 6 to 10 million cubic meter of water (Ives 1986). Since then, His Majesty's Government of Nepal (HMG/N) has considered GLOFs as a threat to the development of water resources of the country and has focused on glacier flood studies (WWF 2005).

Other important human security consequences of the climate warming and glacial retreat in Nepal may be with respect to fresh water regime, agriculture, biodiversity & wildlife and health.

> Dawa Steven, an Everest summiteer, has his roots and close cultural ties in the Khumbu region. In recent years he has become acutely aware of the threat of climate change on this vulnerable habitat that is both a major world water resource and climate regulator. Says Dawa Steven: 'I fulfilled my dream and stood on the summit of Mount Everest in May 2007. The world was at my feet. But I also noticed strange things happening. The solid ice of the

Khumbu icefall had melted into slush and, on the way down, was crackling and crumbling beneath my feet. Fellow Sherpas on the mountain were running for their lives and asking me to get down as quickly as possible. I did, and on that same day the entire ice field simply collapsed. I was shocked, and wanted to understand why this had happened. After returning to Kathmandu I began my quest for answers. Most of my findings pointed towards the effects of global warming.'[24]

Urbanisation

In developing countries like Nepal, urbanisation is supposed to have come out because rural migrants have been 'pushed' rather than pulled into the urban areas, as a result of great and mounting population pressure in the rural areas. Although Nepal in 2001 had only 16 percent of its total population living in urban locations the rate at which urbanisation has been taking place in recent decades is a cause of serious concern both from environmental and human security point of view. Urban population as percent of total population has been growing steadily in the last five decades. Between 1952/54 and 1971 urban population increased rather sluggishly from 3 percent to 4 percent. Since the eighties the growth has accelerated from 6 percent to 14 percent of the total population (Sharma [undated]).

In terms of development regions conceived after the Fourth Plan (1970-75) the Central Development Region (CDR) has consistently the largest share of urban population, as well as the largest number of urban places in the last five decades. In 2001 the CDR had almost half of Nepal's urban population, and 20 urban places. In spite of the fact that the share of urban population in the CDR has been declining it still has the largest size of urban population in Nepal. The Eastern development region has consistently ranked second in both the share of urban population, and the number of urban places. The Mid western and the Far western development regions have acquired urban population only in the last two decades.

[24] Posted by Bobby Chettri and Nira Gurung via email dated 11 February, 2008 , Subject: mf-asiapacific News: Eco Everest Expedition 2008 [mf-asiapacific@mtnforum.org]

Table 5.36 DISTRIBUTION OF URBAN POPULATION BY DEVELOPMENT REGIONS, 1952/54–2001 (%)

Development regions	1952/54	1961	1971	1981	1991	2001
Eastern	3.4 (1)	16.2 (3)	19.1(5)	24.5 (7)	20.3 (9)	19.4 (14)
Central	92.0 (8)	75.9 (10)	63.4 (6)	49.1 (7)	54.4 (13)	49.7 (20)
Western	-	3.2 (2)	12.4 (4)	11.9 (4)	12.4 (5)	16.1 (12)
Mid Western	4.6 (1)	4.7 (1)	5.1 (1)	7.1 (3)	5.9 (3)	7.2 (6)
Far Western	-	-	-	7.4 (2)	7.0 (3)	7.6 (6)

Note: Figures in parenthesis are number of urban places
Source: Sharma [undated]

Solid waste is the most conspicuous environmental problem across Nepal's urban areas. Random and insanitary collection and disposal of urban solid waste in Nepal is the result of lack of long-term perspective; deficiency in the planning, provision and operation of infrastructure; insufficient public lands that can be accessed for waste disposal purposes; and absence of a holistic and integrated system for solid waste management. Deficiency in wastewater and solid waste facilities and their mismanagement have often resulted in pollution of surface and groundwater. The number of motor vehicles in the larger urban centers has increased rapidly in recent years. This has not been matched by provision of roads and infrastructure, leading to persistent traffic congestion. Urban development is taking place without adequate planning or provision of transport infrastructure, and with inadequate consideration of the nature and composition of the traffic. Urban roads are commonly narrow and crooked, and the road network function is poor. There is no or insufficient parking space. The mixture of vehicle types, poor driving, bad parking, and roadside trading add to traffic congestion. The consequences of this are longer travel times, greater levels of air and noise pollution, and less efficient fuel consumption (ADB 2006).

Pressure on Agriculture

Population growth in the context of a traditional agrarian economy is forcing farmers onto ever steeper slopes that are unfit for sustained farming. Continuing rapid population growth and present population density are among the most important factors affecting Nepali agriculture. Agriculture in virtually all areas of Nepal is hard pressed to meet the food needs of the dependent population (Schroeder 1985). In 1971 the hill and mountain areas of Nepal had a population density per unit of arable land that was much greater than that of Bangladesh where double and triple cropping are more agronomically feasible and land is more productive than in most of Nepal (Schroeder 1985, Tuladhar *et al.*1977). Current agriculture production levels are barely sufficient for the minimum caloric food needs of subsistence farmers. The consequent local response has been to further intensify stressed agricultural systems and to work delicate environments even harder. Population pressure and the severely stressed agro-environment across the geography of the country have led to dramatic out-migration of Nepali villagers. Both temporary and permanent out-migration to the Terai Region of Nepal, to squatter land in Assam, to wage employment in India and to mercenary service in the British and Indian armies have been responses to this exponential growth of population (Schroeder 1985: 32).

Table 5.37 RECENT EVENTS LEADING TO ENVIRONMENT PROTECTION AND HUMAN SECURITY IN NEPAL

Years	Events
1985	In the Five Year Plan (1985-1990), environment was considered as a distinct component.
1988	The National Conservation Strategy was prepared with the intention to ensure sustainable use, preservation of cultural aspects and biological diversity.
1990 - 91	The Constitution of the Kingdom of Nepal gave priority and emphasised the protection of the environment with provisions and laws enacted thereafter. The Natural Resources and Environment Committee was set up in the parliament to serve as an evaluation body of policies, programmes, resources and administration of issues related to environment in collaboration with relevant ministries.
1992	The Environment Protection Council (EPC) was established to formulate and implement environmental activities. After which several international conventions have been signed including the CBD, Climate change conventions. Local level standards etc have also been enacted.
1995	The EIA was made mandatory any major development projects.
1996-97	The Environment Protection Act and Environment Protection Rules

	institutionalised the EIA, pollution control, management of conservation areas, funds etc.
1998	At local levels the Self-Governance Act gave over environmental functions to District and Village Development Councils to handle local level planning, conservation, land use and pollution control activities.
Other Important Legislations in relation to environment protection	Plant Protection Act, (1972); Royal Chitwan National Park Regulation, (1974); Soil and Watershed Conservation Act, (1982) King Mahendra Trust for Nature Conservation Act, (1982) Pesticide Act (1992) Forest Regulations, (1994) Buffer Zone management rules (1996) Hygiene; Consumer Protection Act, (1997) Livestock health and services rules (1999) Government managed conservation area rules (2000)

Source: South Asia Cooperative Environment Programme, URL: http://www.sacep.org/html/mem_nepal.htm (accessed on 21/12/2007)

5.3.5 Human Security Implications

As a central unit of the Himalayan orogeny, Nepal possesses the world's highest mountain and its physical feature, among the most varied of any country in the world, range from the glaciers of Mt. Everest in the (North) Eastern Nepal to warm tropical forests on its southern fringe. Within the 147,181 km^2 area of the country, physiographic regions range from tropical forests in the south to the snow and ice covered Himalayas in the north. Nepal has a very diverse environment resulting from its impressive topography. A cross-section of the country reveals that the topography generally progresses from altitudes of less than 100 m in the southern Terai plain, up to more than 8,000 m peaks in the north. Several rivers that originate in the Himalayas cut across these ecological zones, creating many river valleys and some of the most rugged terrains on earth, and feed into the Ganges. The Terai, till late 1950's, was a forbidden place to live because of the malaria and thick tropical forest infested with wildlife.

The economy of the whole of Nepal is characterised by a large rural sector based on subsistence agriculture and a small industrial sector centred on manufacturing activities and tourism. In this land of unexcelled natural beauty live some of the world's most desperately poor (Ekholm 1976:77). Agriculture is the mainstay of the economy, providing livelihoods for over 80 percent of the population. In the fiscal year 2001-02, the share of agriculture in GDP was 37.9 percent. The total land used for agricultural operation is 20.2 percent of the total area of Nepal (WWF 2005: 5). Industrial activity mainly involves the processing of agricultural products including sugarcane, tobacco, jute and grain. Nepal has a comparative advantage with respect to tourism but this sector has seen a declining trend in the last couple of year due to political intricacies in the country. Water and hydroelectric potential are the most important natural resources of Nepal.

The Human security in Nepal including Eastern Nepal as selectively discussed in the preceding paragraphs is centered around its fragile physical setup. The geology and geomorphology of Nepal is favorable for several natural challenges. The challenges range from earthquake to various types of mass wasting and floods. Each year floods, landslides, soil erosion, forest fires, epidemics, and various other natural and man made disasters cause heavy casualties and destruction of physical property in Nepal thereby wreaking severe human insecurity across the geography of the country. According to Ekholm (1976), Nepal faces one of the world's most acute national soil erosion problems.

Given its mountainous topography and the fact that the country comes under the spell of the monsoon[25] every summer, various types of natural challenges often disastrous in nature are quite common and frequent. As a central part of the Himalayan geo-system the country is geologically young and seismically very active. The UNDP lists earthquake, floods and flash floods, landslides and drought as the major natural challenges for overall human security of Nepal. Eastern Nepal is an integral part of these challenges.

Often the fragile geo-environmental setup of Nepal has been exacerbated, both in terms of intensity and frequency, by increasing unscientific anthropogenic activities. The increase in

[25] The monsoon menace is more severe in the Eastern Nepal.

population and the change in its distribution also mean that the country is now faced with a new set of natural disaster risks. Ekholm (1976) remarks:

"There is no better place to begin an examination of deteriorating mountain environments than Nepal.... The façade of romance and beauty remains intact, but behind it are the makings of great human tragedy. Population growth in the context of a traditional agrarian technology is forcing farmers onto steeper slopes; slopes unfit for sustained farming even with the astonishingly elaborate terracing practiced there. The villagers must roam farther and farther from their homes to gather fodder and firewood, thus surrounding most villages with a widening circle of denuded hillsides. Ground holding trees are disappearing fast among the geologically young, jagged foothills of the Himalaya, which are among the most easily erode-able anywhere. Landslides that destroy lives, homes, and crops occur more and more frequently throughout the Nepalese hills... If Nepal's borders ended at the base of the Himalayan foothills, the country would by now be in the throes of a total economic and ecological collapse. Luckily, the borders extended farther south to include a strip of relatively unexploited plains know as Terai, an extension of the vast indo-Gangetic plain of Northern India, one of the world's most productive agricultural areas. ". (Pp 76- 79)

In the context of the Eastern Nepal, Ekholm (1976) writes:

> In the country's most densely populated region, the eastern hills, as much as 38 percent of the total land area consists of abandoned fields. Once these slopes are left to face the violent monsoon downpours without protective vegetation, their more fertile soils may be lost forever and their potential usefulness to people permanently reduced. There is absolutely no scope whatsoever for bringing new land under agriculture across the hills. (Pp 78)

Although Ekholm's perspective on the environment and development of Nepal was severely criticised by the scholars like Ives (1986, 2004) it is difficult to overlook many of his points in the context human security of Nepal. Nepal has one of the highest population densities in the world with respect to cultivable land (Ekholm 1976, Tuladhar *et al.*1977, Schroeder 1985). Within the country the density of population has historically been much more in the Eastern Nepal. As a result clearance of precious hills forest was obvious. Forest was cleared for various purposes like extension of agriculture land, fodder for livestock, rural energy, road building and other infrastructure ventures including unplanned urbanisation. Tourism has also contributed to some extent in the degradation of forest resources. Today Nepal including Eastern Nepal has only 25 per cent of its total geographical area under forest cover. Such a state of affairs has over the period of time aggravated geo-environmental fragility of Nepal and the situation is worsening with time. Consequently, natural events like landslides, floods/flash floods, top soil erosion, seasonal epidemics and such other processes have amplified in their intensity and frequency. Nepal experienced a major earthquake in 1988, which killed over 700 people. Floods and landslides, however, are the most destructive types of disasters in Nepal. In 1993, Nepal experienced a devastating flood in which 1,336 people perished and nearly 500,000 people were affected (OCHA 2002).

Lastly, the political instability has caused tremendous environmental and human insecurity in Nepal. The conflict popularly called 'Peoples' War' led by the Maoists has left more than 12,000 people dead since it started in 1996. It has made the livelihoods of majority of the population in Nepal vulnerable and insecure. Maoists with their very strong bases in Western and mid-Western region and partially in Eastern region (South Asia Terrorism Portal Institute for Conflict Management [undated][26] have been the major source of human insecurity in the country.

5.4 Conclusion

Both Eastern Nepal and Sikkim are integral parts of the Himalayan mountain system and feature the geologic and geomorphic characteristics of the Himalaya. Together, they represent vertically all the geological sections of the Himalaya thereby exhibiting rich and diverse natural resource bases. The regions are physically fragile in nature. The fragility of both the regions can be assessed by the extent of geologic and geomorphic forces operating therein. The arable land in both Sikkim and Eastern Nepal also exhibit their degree of fragility to physical forces.

It has long been accepted that environment and human beings are inseparable entities in Himalayan mountain areas. As an important part of the larger Himalayan orogeny, the geographic and climatic characteristics of both Sikkim and Nepal Himalaya, including

[26] http://www.satp.org/satporgtp/countries/nepal/terroristoutfits/index.html (Accessed 26/12/07)

Eastern Nepal, have deeply influenced their social and economic setup. Settlement pattern consists of relatively dispersed hamlets on the lower slopes. As one moves upward from the lower altitude the dispersal of the hamlets become more pronounced. In other words, the lower altitude areas are more thickly populated as compared to the higher areas.

Human settlements and economic activities have been built largely around local ecology and topography. In other words, the society-economy-environment relationship is fundamental in both Sikkim and Nepal. The high hills and mountains were until recently inhabited by a self-sufficient transhumant population (Bhasin and Bhasin 1996:279) while the lower hills and foothills/terai have more diverse economic activities.

Agriculture, horticulture and animal husbandry constitute a mainstay of the largest segment of both Sikkimese and Nepalese population engaging large chunk of them in this sector. Agriculture is the primary driver of the economy. Over 80 per cent of the population is directly or indirectly dependent on agriculture and allied activities for their livelihood. Food production in both Sikkim and Eastern Nepal Himalaya has, however, not kept up with the population growth. Water and hydroelectric potential are the most important natural resources of both Sikkim and Eastern Nepal.

As an integral part of the Himalayan orogeny, Sikkim and Eastern Nepal are not free from numerous geo-environmental forces and consequent human security challenges. The most prominent natural challenges that threaten the human security of Sikkim and Eastern Nepal periodically include earthquake, glacial lake outburst floods, epidemic, heavy monsoon rain, flash floods, landslides, soil erosion and other associated natural catastrophes (Table 5.38).

Table 5.38 MAJOR HUMAN SECURITY CHALLENGES IN EASTERN NEPAL AND SIKKIM

Region	Major Factors of Human Insecurity	
	Natural Factors	Anthropogenic Factors
Eastern Nepal	Earthquake, Heavy Monsoon, Landslide, Flash Floods, Soil Erosion, Glacial Lake Outburst Floods, Epidemic	Population Growth, Deforestation, Pressure On Agriculture, Conflict And War, Physical Development, Climate Change
Sikkim	Heavy Monsoon, Landslide, Flash Flood, Soil Erosion, Earthquake	Population Growth, Deforestation, Physical Development, Climate Change

Source: developed by the author

The natural environmental challenges are more often exacerbated by human induced forces like unplanned population growth, deforestation, intensive agriculture, climate change and associated challenges, conflicts, and poorly planned development ventures. The development intervention has at many instances had adverse impact on both Sikkim and Nepal Himalaya. The troubling natural processes when united with unplanned development interventions overload the carrying capacity of the soil and bring about turmoil. In short, a wide range of physiological, geological, ecological, meteorological, anthropogenic and strategic factors significantly contribute to the human insecurity of both Sikkim and Eastern Nepal.

As a major resource-zone of South Asia, it provides numerous goods and services to the people of both uplands and lowlands besides acting as a strong defence barrier against aggression by enemies, thereby, performing the role of primary source of regional environmental and human security. This mountain region is rich in biological and environmental resources and serves as a water tower for the region, and the world. Nine Himalayan river systems flow along these ranges and provide direct basis for livelihoods for over 150 million people. In total, they sustain the lives of over 1.3 billion people – a fifth of the world's population. In fact, the importance of Himalaya in the context of regional environmental security and the resultant human-wellbeing is beyond ordinary human perception.

The Himalaya is, however, not as strong as it appears to be. Dynamics of change in the entire Himalayan ranges are inextricably intertwined with factors such as climate, geology, fauna, flora, water resources etc. The region experiences various types of geo-environmental/geomorphic processes and thereby is prone to a number of natural hazards. Often these hazards assume the form of disaster due to the region's inherent nature, climatic conditions and lack of adequate disaster preparedness mechanisms, consequently inflicting widespread catastrophe and human insecurities in the region. However, more recently, many of the natural processes have been accelerated by unscientific and unsustainable anthropogenic activities.

Earthquakes ranging in severity, floods/flash floods, and glacial lake outbursts are common among other major natural hazards. Monsoon is the time when water-induced disasters take place in some form or other in various places across the Himalaya. Cloudbursts are generally reported every monsoon period wreaking tremendous environmental and human devastation within the region and downstream.

Most of the rivers in the Himalayan terrain flow through narrow gorges abutting moderate to steep slopes with sharp bands and meet tributaries on steeper slopes. As the rivers flow downstream, the valley becomes comparatively wider and less steep. The occurrence of flash floods, particularly in narrow river valleys, is one of the most feared consequences of major cloudbursts, landslides or glacial lake outburst. Rolling of debris by cloudburst or landslide along the constricted course of the rivers lead to a short-term damming of the river flow, resulting in the creation of temporary lakes, which can last anywhere from a few days to a few decades. When the backwater pressure of the lake exceeds the retention capacity of the barrier, the accumulated water gushes down stream with powerful force inundating otherwise safe settlements. Such flooding has an immense impact on the economy of the region and safety of the local population.

Majority of the settlements across the Himalaya are located on the middle slopes where fluvial terraces exist. People prefer to exploit such areas lying adjacent to the rivers. These areas are considered to be the most fertile locations by the Himalayan standards. However, such areas are also the most vulnerable to floods caused by the breaching of landslide-induced dams. Evidence of past damming in different river basins of the Himalayan region indicates that the river was blocked many times, particularly at the confluence with tributaries.

A combination of factors appears to contribute to the susceptibility of the Himalayan region to various geo-environmental processes. The fragile geology and torrential rains play a significant role in destabilising the Himalayan terrain. The entire Himalayan belt is, both tectonically and seismically, a very sensitive domain with strong tectonised rocks and fragile mountain slopes vulnerable to the onslaughts of rains. The cumulative effects of past earthquakes in such a zone aggravate these phenomena. Even a cursory assessment of the severity of different natural disasters occurring in the Himalayan region indicates that the dwellers of this region are living with the great risk. Yet a comprehensive security mechanism in order to cope with these risks in the field has yet to be designed and developed.

Environmental insecurities across the Himalaya have been responsible in guiding and directing civilisations in the area over the millennia. The relationship between human and environment in the Himalaya had/has been very close since antiquity. In other words, environment and socio-economy are inseparable in the Himalaya. There had been a symbiotic and intimate relationship between humans and environment over the ages. However, more recently, things are changing for bad in this fragile resource zone. Originally, humans adjusted themselves with the complex geo-environmental set up of the region and hence environmental determinism was very strong. In recent times, however, we have been seeking to adjust the Himalayan environment according to our needs thereby making way for environmental possibilism in this other wise susceptible region. It has resulted in the imbalances in the environment and aggravated the natural processes. This is a very serious issue having far reaching implications on the security of the Himalayan environment and human beings living therein in the days to come.

Himalaya, often, regarded as the cradle of South Asian civilisation is at present suffering from various human onslaughts - in addition to numerous natural forces that have been acting and reacting in the region since geologic past - in the form of faulty development policies/ventures, unprecedented population growth and degradation/depletion of its rich natural resource bases. What is more, the situation is deteriorating with every passing day and the future of the Himalaya looks clearly grim, given the rate of onslaught the region is forced to tolerate. Further, the Himalaya has been a battleground between environmentalists/conservationalists and commercial/vested interests since the last half century. Such a situation has only politicised pertinent environmental issues therein and hence have done little good to the region. In the process, indigenous and tribal populations of the Himalaya have been sidelined and are often regarded as direct agents of 'Himalayan Environmental Degradation'

6.2 Cases from Sikkim and Eastern Nepal

Both Eastern Nepal and Sikkim (India) are integral parts of the Himalayan mountain system and feature the geologic and geomorphic characteristics of the Himalaya. They represent vertically all the geologic sections of the Himalaya thereby exhibiting rich and diverse natural resource bases. The regions are physically fragile in nature. The fragility of both the regions can be assessed by the extent of geologic and geomorphic forces operating therein.

The arable land in both Sikkim and Eastern Nepal also exhibit their degree of fragility to physical forces.

It has long been accepted that environment and human beings are inseparable entities in Himalayan mountain areas. As a part of the larger Himalayan orogeny, the geographic and climatic characteristics of both Sikkim and Nepal Himalaya, including Eastern Nepal, have deeply influenced their social and economic setup. Settlement pattern consists of relatively dispersed hamlets on the lower slopes. As one moves upward from the lower altitude the dispersal of the hamlets become more pronounced. In other words, the lower altitude areas are more thickly populated as compared to the higher areas.

Human settlements and economic activities have been built largely around local ecology and topography. The society-economy-environment relationship is fundamental in both Sikkim and Nepal. Agriculture, horticulture and animal husbandry constitute a mainstay of the largest segment of both Sikkimese and Nepalese population engaging large chunk of them in this sector. Agriculture is the primary driver of the economy. Over 80 per cent of the populations are directly or indirectly dependent on agriculture and allied activities for their livelihood. Food production in both Sikkim and Eastern Nepal Himalaya has, however, not kept up with the population growth. Water and hydroelectric potential are the most important natural resources of both Sikkim and Eastern Nepal.

As an integral part of the Himalayan orogeny, Sikkim and Eastern Nepal are not free from numerous geo-environmental forces and consequent human security challenges. The most prominent natural challenges that threaten the human security of Sikkim and Eastern Nepal periodically include earthquake, glacial lake outburst floods, heavy monsoon rain, flash floods, landslides, soil erosion and other associated natural catastrophes

The natural environmental challenges are more often exacerbated by human induced forces like unplanned population growth, deforestation, intensive agriculture, climate change and associated challenges, ethnic tensions, and poorly planned development ventures. The development intervention has at many instances had adverse impact on both Sikkim and

Nepal Himalaya. The troubling natural processes when united with unplanned development interventions overload the carrying capacity of the soil and bring about turmoil. A wide range of geo-physical, ecological and demographic factors thus contribute to the disaster vulnerability and human insecurity of both Sikkim and Eastern Nepal.

Moreover, a sensitive border state like Sikkim has been the most significant geographical entity in providing comprehensive security to the Indian nation state in terms of military security, environmental security and human security. The geo-strategic location of Sikkim means huge concentration of security and military forces in and around its vicinity. It further means huge physical burden of such forces on the natural settings and resources of the region which in one way or the other impact the overall human security of the region.

6.3 Towards an Alternative Security Paradigm in the Himalaya

The Himalaya should not only be looked at as a military frontier. It should not be treated merely as a physical entity because it also has vibrant living aspects. The Himalaya cannot be independent of people living therein nor the inhabitants without their habitats. From the point of view of the larger human interests of the region and its neighbouring highlands and lowlands both within and outside South Asia, it is high time the planners, policymakers and researchers employ the human security approach to the region. Environmental security as we have noted in the preceding chapters is the most important human security parameter of the Himalaya that exerts deep bearing on the society, economy and polity of the region. Scholars have already established that environment and socio-economy in the Himalaya are the two sides of the same coin and that they are inseparable from each other.

Environmental security challenges faced by the Himalaya are primarily physical in nature and ranges from local to global. However, majority of the physical threats to human security in the region are often aggravated by unscientific anthropologic activities. Therefore, it is next to impossible to outline a clear-cut mitigation plan to reverse the ongoing trend. It is, however, important to note that Himalayan problems can neither be solved by adopting megabuck high tech approach nor by doomsayers' dream that there is no longer hope at all for the environment and human well-being in the region. What we need is a cooperative and coordinated approach where there is a mixture of deep concern and cautious optimism. In this regard, while indigenous mountain communities need to have their major stake, avarice and indifference, both from within and outside the region, should not be allowed in such an approach.

At the macro level, the first errand should be to revisit all the development policies that are functional in the region and ratify them in order to make them region and people specific. Often, the Himalaya has been kept at mercy of the mainstream development policies that have little or no relevance in the region given its geo-environmental and socio-cultural dynamics. There are areas that are quite rich in natural resources but are inhabited by poor people. The inhabitants have been suffering under harsh environmental conditions, carrying out subsistence economic activities, based primarily on animal rearing and rudimentary farming. Such situation needs up-gradation. Promotion of adequate education, health and food security of the mountain people include important human security challenges in this respect.

The policy makers, development planners and project implementers should not regard Himalaya as an appendage to economic and political interest of indo-Gangetic plains. It is high time they recognised the geo-political and geo-environmental significance of the region at local, regional and global levels. It is also vital that geomorphologists, geologists, geographers, environmental scientists, climatologists, and such other scientists are included in the interdisciplinary experts' team at the highest level of planning process both at the national and sub-national levels for larger human security of the Himalaya and sustainable development of the region. Ignorance and neglect of geo-environment is the cause of many developmental and security problems of the region impacting human security of the Himalaya and adjoining lowland resource zones.

Further, development planning across the Himalaya must not only aim at improving quality of life but also should have a target of 'Zero Disaster Impact'. Disasters erode away not only the resource base but also cause loss of human life and bring about unprecedented human insecurities. It further requires extraordinary post disaster non-productive expenses. Efforts need to be focused to use efficient flow sheets absorbing newer technologies and ideas and incorporate Disaster Management Plan for terrain induced as well as human induced disasters in the development planning process of the Himalaya. Terrain induced natural disasters cannot be stopped or diverted away but damages can be prevented and minimised with proper appreciation of geology and other geo-environmental parameters. On the other hand, human induced disasters are the result of in-efficient flow sheets and/or absence of a Disaster Management Plan. All development projects irrespective of financial or physical outlays need to have inherent nucleus of disasters, in general bigger the project larger the nucleus.

In this connection, realising the vulnerability of the country to varied types of natural disasters, the Natural Calamity Relief Act was drafted in 1982 in Nepal by His Majesty's Government with a view to protect life and property and make arrangements for the operation of relief work. This act, already amended twice in 1989 and 1992, is the milestone of disaster management in Nepal. The Ninth Five Year Plan (1998 to 2002) of Nepal underlines the need to strengthen the disaster management capability by adopting various possible means such as making efforts towards prevention, mitigation and reduction of natural disaster through more advanced geological, hydrological and meteorological technology, hazard mapping, vulnerability assessment, risk analysis and early warning system along with provision of well trained and efficient manpower. The plan also stresses the need to strengthen the capability of fire brigade. The plan emphasizes the importance and the need for national and/or international assistance. The Tenth Five Year Plan outlines the objectives, strategies, programmes, working policy and expected achievements related to disaster management. However, Nepal till date does not have a clear cut National Policy on disaster management.

India does have evolved its National Disaster Management Policy[2], although the States are primarily responsible for relief activities. The dimensions of the response at the level of National Government are, however, determined in accordance with the existing policy of financing the relief expenditure and keeping in view the factors like (i) the gravity of a

[2] Please see annexure 11

natural calamity, (ii) the scale of the relief operation necessary, and (iii) the requirements of Central assistance for augmenting the financial resources at the disposal of the State Government.

Further, Government of India recently constituted an Expert Group to examine the related issues and evolve recommendations for improving preparedness and prevention with respect to natural disasters caused by earthquakes, floods and cyclones. The Expert Group examined the current status of work being carried out and recommended the following important points:

1. The first and the foremost is to restructure the National Policy on disaster management reflecting the holistic approach involving prevention, mitigation and preparedness in pre-disaster phase with appropriate additional funding, along with the so far existent policy of the post-disaster relief and rehabilitation under crisis management.

2. Creation of awareness for disaster reduction is urgently needed amongst policy makers, decision makers, administrators, professionals (architects, engineers and others at various levels) financial institutions (banks, insurance, house financing institutions) and NGOs and voluntary organizations.

3. Creating awareness for improving preparedness amongst the communities, using media, school education, and the network of the building centre.

4. Appropriate amendments in the legislative and regulatory instruments (state laws, master plans, development area plan rules, building regulations and bye-laws of local bodies) along with strengthening of the enforcement mechanisms at different levels.

5. Capacity building at local and regional levels for undertaking rapid-assessment surveys and investigations of the nature and extent of damage in post disaster situations.

6. Conducting micro-zonation surveys of large urban areas falling in the disaster prone regions and preparing appropriate preparedness and mitigation plans on an urgent basis.

7. To ensure use of disaster resistant construction techniques in all housing and other buildings to be undertaken under the Central and State schemes.

8. Making mandatory, the use of disaster resistant codes and guidelines related to disaster resistant construction in the houses and buildings in all sectors of the society by law and through incentives and disincentives.

9. To create a suitable institutional mechanism at national/state level to advise and help the existing disaster relief set up in formulation and updating of short and long range action plans for the preparedness, mitigation and prevention of natural disasters (the mechanisms suggested are establishment of a National Scientific and Technical Committee at Central level and Natural Disaster Mitigation Centres at State levels).

10. To promote the study of natural disaster prevention, mitigation and preparedness as subjects in architecture and engineering curricula.

11. To create detailed database on hazard occurrences, damage caused to buildings and infrastructure and the economic losses suffered and ensure its accessibility to interested researchers for effective analysis of costs of disasters and benefits of mitigative actions.

12. To devise appropriate policy instrument and funding support for urgent disaster preparedness and prevention actions in high risk areas including upgrading the resistance of existing housing and related structures and systems.

13. To include R&D (Research and Development) work in disaster preparedness, mitigation and prevention as a thrust area so that adequate funds are earmarked for the schemes of R&D organisations as well as the concerned Central Ministries and State Governments.

However, policy planners are yet to workout a comprehensive disaster management policy for the Himalaya as a whole. Such a task would require sustained cooperation between the three major Himalayan Countries of India, Nepal and Bhutan. Besides, immediate neighbouring countries like Bangladesh and Pakistan should also find place in the formulation of such a policy.

As recommended by the Expert Group appointed by the Government of India, encouraging participation of local community is an important aspect any disaster management and other forms of environmental insecurity. Unless scientists and decision makers involve the sufferers and their traditional knowledge into their formal knowledge the rate of success of any of their ventures would be nominal. Local communities are the primary responders to environmental uncertainties/challenges. It is necessary to inform them about the importance of prevention, preparedness and mitigation of various environmental uncertainties due to natural and human induced forces as against the traditional relief centric approach. Periodic environmental awareness drive/training of the local populace, particularly local youth, is necessary at local/sub-national level to generate environmental consciousness. Such venture must focus on the causes of environmental fallouts and the local community's role and techniques in preparing, preventing and minimising the adverse impact on human security. The communities must be trained, encouraged and empowered to formulate their own environmental plans/policies, rules and regulations to ensure their human security at the local level.

It is also important to rationally involve the media in responsibly spreading environmental awareness through talk shows, interviews and write-ups. Mapping of vulnerable areas and demographic distribution is another important method so as to keep a special watch on the vulnerable regions of the Himalaya. It is important to list down volunteer organizations, non governmental organisations, institutions of higher learning and research and suitably encourage, empower and aid them to work on the various pertinent environmental issues and their implication on the human security.

What the Himalaya also needs is an international summit. Jack Ives (2004) proposes a 'Himalayan Summit' to be organised with participation from all regional sectors- from governments to universities, to citizens' committees and NGOs. He also suggests that the summit should include representation from outside the region and be modelled on the line of the Rio de Janeiro Earth Summit (UNCED) but on a correspondingly smaller scale.

Last but not the least, human security of the Himalaya is a collective concern and we need to address it collectively. It is essential to mention here that the world wide intercourse initiated and prompted by Mountain Forum[3] in the context of mountain areas, including the Himalaya, needs to be appreciated. Environmental issues know no political boundaries. It is one area where nations must cooperate to find collective solutions to the challenges. Nations encompassing the Himalayas need to come together to deal with environmental uncertainties - both physical and human made. The threat of terrorism looms large in the Himalayan region and could trigger disasters across borders. However, landslides, floods, glacial lake outbursts, earthquakes and such other environmental hazards cause more severe devastation across the Himalaya quite frequently. Coherent and comprehensive sub-national, national and international strategies and capabilities to handle environmental uncertainties is the need of the hour. In order to make effective use of capabilities we further need planned bilateral and regional cooperation.

The scientific community should observe carefully the natural processes and anthropogenic activities over time, utilizing rigorous techniques for precise measurement and scientific understanding. Such knowledge will help us improve future assessments and policies and thereby the development paradigm and human security of the region.

[3]see www.mountainforum.org

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ANNEXURES

Annexure I Interview With Professor P. S. Ramakrishnan, 6 October, 2006

P. S. Ramakrishnan, with a variety of experiences as Professor of Ecology at Jawaharlal Nehru University, Founder Director, G. B. Pant Institute of Himalayan Environment & Development, and Professor of Botany/Eco-Development, North Eastern Hill University, is currently attached with the School of Environmental Sciences, at Jawaharlal Nehru University, as a U.G.C. Emeritus Professor. As an internationally renowned ecologist working in the inter phase area of linking ecological and social processes, he directs his researches towards sustainable management of biodiversity and natural resources, with concerns for sustainable livelihood/development of traditional societies. For this work, involving about 400 research publications and 17 research volumes in this area of study, he has received many national and international recognitions, including fellowships of learned academies in India and the Third World Academy of Sciences, and the Honorary Fellowship of the International Association of Tropical Biology (ATB), based in USA.

Professor Ramakrishnan discusses some of the pertinent environmental and developmental issues featuring the Indian Himalaya with **Vimal Khawas.**

V. K. Why the scholarships and academic research on the hill and mountain areas are going down?

P. S. R. By and large the standard of research and scholarship in most of the institutions of the country is going down except for a few exceptions. It is a matter of serious concern. State like Chattisgarh has had few hundred universities though they are being closed down through a supreme court order! Most of these institutions are sprouting over night.

As far as mountain areas are concerned majority of the academic souls do not want to be there; they consider this a punishment posting! For those who are there they are always looking for an opportunity to escape towards plains in the country. Further the kinds of courses that are offered in the institutions of mountain areas are not different from their counterparts in the plains. Mountains have different geo-environmental settings. But hardly any institutions teach relevant courses specific to the region. The courses are mostly not relevant to the local situations. There is no focus on traditional and mountain specific courses. This does not mean that we should not teach textbook knowledge which is also taught elsewhere. We have to arrive at compromises that are in the interests of the mountain people.

One specific argument in this respect is that there are no specific textbooks on mountain issues. There is a need for such textbook/s. We do need traditional subjects to be offered in mountain-based institutions. At least some location specific issues also should figure in, which is not happening at present.

V. K. Why there is no emphasis in the Planning Commission on hills and mountain areas though they occupy so critical positions both in terms of geo-political interest and natural resource base?

P. S. R. The question is closely related to the above discussions we are having. When there are no experts to talk on the specific issues of mountains, they are bound to be neglected. If mountains are to be integrated fully in the development debates and discourses of Planning Commission and at other bureaucratic levels we need to highlight the specific mountain problems; generate awareness on mountain issues; promote locally relevant education; and encourage local leadership. This is the context in which we have not only tried to reach out to various stakeholders through popular articles, audio-visuals, and the recent volume " One Sun, Two Worlds: An Ecological Journey, which is a dialogue between a villager representing 'traditional knowledge', and the scientist representing 'formal knowledge'. We have to take science to society!

Although awareness is much better than before it is still inadequate. We need to start from the kind of education system that is mountain relevant at the top – University level, gradually moving down to the school level curricula development; or may be start at all levels with whatever little we have with us! In this regard 50 per cent or at least 1/3rd of the curriculum should be mountain relevant. We should – promote mountain relevant research; create mountain specific scientific materials; gradually percolate the issues to the masses; create distinct cadre of people with specific knowledge on various mountain issues. We cannot expect a teacher from Calcutta or Chennai, to teach mountain problems to the students in Darjeeling, or in other mountain situations.

- Awareness should start at the highest level of education system. Once the knowledge is created we need to create critical masses of population who will change things at lower levels. The way is to encourage vigorous "reach out programmes"
- We have to work with the local community. Knowledge cannot be built inside the laboratory, alone. Knowledge about the specific issues needs to be gathered by interacting with the local people.
- The collected "traditional knowledge" is not always valid. We need to scientifically validate them using appropriate scientific tools.
- The scientifically validated knowledge can then be passed to the Planning Commission and other relevant authorities in the government.

V. K. Himalaya has often been identified as one of the global bio-diversity hotpots with a very strong base of traditional knowledge. However, governments across the region have been unable to exploit the bio-wealth in an optimum way. Further, we have failed to identify, and document the rich traditional knowledge across both space and time, let alone talk about absorbing such knowledge into the 'formal' knowledge system. Where have we gone wrong and what are your suggestions in this connection?

P. S. R. A very difficult question to answer. Not many people want to venture into the 'unknown'. Trying to decipher 'traditional knowledge' and link it with the 'formal' knowledge system is a difficult task, whilst scientists often look for 'quick fixes'. Every body wants quick results. Unknown has risk associated with it and many people (researchers) are not willing to face it. People keep on working based on the available text-book knowledge. What they need are quick research publications and short cuts for success. The moment they get opportunity they move down from the hills.

- We need to create a local cadre of experts with whatever knowledge base that may be available with us. We can't expect the people from the plains to do this.
- It needs lot more effort. We need to work with the people. We need to go to the field.
- To interact with the local people, researchers have to change their mindset. But they don't change. We often end up doing biophysical research without involving human dimensions. This is where we have gone wrong. Mountain specific research demands integrative research linking the natural with the social sciences!

V. K. Glacial retreat in the Himalaya and its subsequent impact on the ecology, environment and livelihood, in and around the region, is another burning theme that has been gaining importance in the debates and discussions. Some have criticized the concept and lamented such environmental scare mongering has become a common pastime these days. What is your stand in this respect?

P. S. R. Every one now believes that there is 'global warming'. There is no denial of the fact that we have destroyed mountain ecology. Healthy ecosystems act as buffer to cope up with rapid and unpredictable changes in the environment. We have destroyed this buffer because of our greed and vested interests. Mountain people also have colluded in this game play, and have made the situation worse over the years. After all temptations are difficult to resist, and if the people are poor it is even more so! People in the mountains have been made victims of corruption. The large-scale destruction of natural resources has had its impact. In our mountains most of the good forests have been cleared. In my own experience Nainital and Mussoorie are not the same now, as they used to be in the past.

- Whatever is left need to be rigorously conserved with community involvement.
- Major rehabilitation and restoration activity need to be encouraged.
- Understand the traditional knowledge and ensure community participation.
- But we also need formal knowledge. We need to mix both for creating hybrid technologies that will ensure conservation linked with sustainable livelihood/development of local communities, with their participation!

V. K. The recently passed Patents (Amendment) Bill is silent on the protection of traditional knowledge under the justification that plants are completely out of purview of the legislation. This means our time tested traditional knowledge is still vulnerable under IPR regime. How do you react to such recklessness of our decision makers and what are your suggestions to the policy makers in this context?

P.S.R. Traditional knowledge has to be validated and incorporated into science. The validated knowledge has to be documented, and made known widely. CSIR has stepped into the process of doing this. I think the only way is to validate the knowledge and built database. Merely passing resolution is not going to help. Not all-traditional knowledge is patentable, in the first place. In places like Sikkim and Darjeeling Nepalese Alder (utis) is a nitrogen fixer. It is a traditional knowledge available with the locals practicing cardamom farming in the region. How to patent this? Traditional knowledge is a mixed bag!. The people of Darjeeling, for example, may use the traditional knowledge of Sikkim. However, if I use the same traditional knowledge of Sikkim in the plains it may not work. It is very difficult and complex. There is no one solution of rewarding the knowledge of local community. The only thing we need to focus on is promoting local knowledge, and use this knowledge first for the welfare of traditional societies living in biodiversity areas, and then worry about larger benefits to humanity as a whole! This itself is a major step.

V.K. Environmentalists and activists have been crying for quite some time now against the construction of some 168 hydel dams in the eastern Indian Himalayan region and north eastern hills in view of the possible negative geo-environmental impact and ecological wealth of the region. Have the government of India and the respective state governments taken right step by commissioning such capitalistic development ventures in the region?

P. S. R. The question is very complex. I don't know what to say. I don't say that hydel power is not important. I am also not sure whether the government is taking up the issues related to this in a way it should have been taken. Any hydel project that implies large scale uprooting of local people is bad. Hydel projects are often not accompanied by very appropriate natural ecological rehabilitation activity; even if it is done, often it is shabbily executed!. It is very difficult to take a stand. Many people say small-scale projects are fine and environmentally sustainable. But sometimes even small projects can be damaging. Take for example, Rathangchu project in Sikkim. It was a small project yet culturally and environmentally destructive and the Government was forced to abandon it though after much damage already done! It is therefore very difficult to say which project is viable where. It depends upon the cultural and environmental situations of specific geographical locations. Vigorous environmental and socio-economic-cultural analysis needs to be done, before taking conscious decisions, regarding 'development' in the mountains!.

V. K. When GB Pant institute was set up, many people had expected it to be doing pioneering research and policy studies. However we do not find much coming out of this? What is your comment on this?

P. S. R. When research institute comes to mountains even mountain people start thinking that big money is coming and the institution is meant only for creating jobs! That is the culture that has been evolving over a period of time! When the basic objectives of institution building get deflected, where is the hope!

The problem is there are very few people who understand the mountains. And when you promote them, locals too think you are working against them. Further, vested interests push the locals against the interests of the institute making the institution poorer in every possible way! The good people ultimately move out. We know how to create institutions, but don't care much to maintain them! This is the strange situation, we are passing through. The earlier discussions we have had here are all relevant in this discussion too. Many good scientists leave and go out of frustration. We have to induct good people and also know how to retain them, or else institutions start breaking down!

V. K. What are the major development issues and constraints in the North East region of India where you have worked for many years?

P.S.R. Finding a solution to the problem of jhum is one of the major issues in the northeastern region as of now. We never tried in the past to understand the traditional knowledge and use them. The earlier spoken lines again become important here - no knowledge, no right people, no right decision, and the situation remains static or starts going down the drain! Few things are however, happening here and there. We need to build upon those small efforts. The Nagaland NEPED project and interest from other governments to build upon jhum rather than find an alternate are some of the more recent developments. Major issues that need to be taken care in the region include-

- Conserve biological diversity and tangible benefits to the people using the same.
- Adopt a development plan based on traditional linked with formal knowledge, only to the extent required under the given socio-ecological system.
- Understand the value system of the people.
- Open up the region, making the north-easterners part of the centre of the 'globe'!

Very often we think northeast as the remote tribal geographical identity and throw up our hands!. But for the people of northeast such is not the case. Even London is remote from Delhi. Can we afford to dismiss it? Now that the people of northeast are interacting with the neighbouring regions in many ways, things will change for the better, I hope!

V. K. You as the one-man commission on the Rathongchu project in Sikkim put forward a negative view on the project. The project is now stopped for good. The loss to the exchequer has been immense. The report is still not made public. Could you now tell us what were your major findings and recommendations?

P.S.R. Ha! for good or bad! It was too small a project to bring development in the area. Further, it tried to destroy the cultural fabric of the society. It tried to split the society into two halves, destroying delicately built cultural fabric across the Sikkim landscape. It was merely around 35-40 mega watt project but the negative impacts were immense. The Tibetan Buddhists in the area were not happy with the venture. Therefore, my suggestion was to abandon the project. I don't think it is worth promoting something, which goes against societal interests.

I had talked about the promotion of cultural/ecological tourism in the area. I am not sure whether it has happened. Starting right from Kanchenjunga area down to the tropical forest area down below, it is a beautiful unique cultural landscape. It can be developed as a nature resort and eco-tourism activity can be encouraged. There are a variety of options and sustainable alternatives to develop the area. We have to work with nature, and for the tangible and intangible welfare of the human society. That is what 'sustainable development' is all about!

Annexure II Status of Towns/Cities in the Himalaya

Simla: As in the past, Shimla remains one of the most important tourist destinations on the tourism map of India. Tourists visit the city from far and wide including the western countries. In spite of the fact that a large number of hotel rooms have been added over the years, to get hotel accommodation in Shimla remains a problem specifically during the tourist season because the floating tourist population is nearly twice that of the local population. Population growth and geographical spread of the city, particularly after 1966, has resulted in a large number of problems of governance and management. A large number of trees have been cut only to be replaced with multi-storied buildings. Offices are spread out in a rather haphazard manner. Most of the city is littered with solid wastes. Sewers and drains are choked in many places. Vehicular pollution, traffic snarls and bottlenecks, lack of parking spaces and terminal facilities, haphazard growth of offices and residences have serious debilitating effects on the environment of the city. Planning violations, encroachments, unauthorized construction, and growth of slums have defaced this once beautiful city.

Population - Darjeeling Municipality

Year	Population (Lakh)	Decadal Growth (%)
1901	0.17	-
1911	0.19	12.30
1921	0.22	17.12
1931	0.21	- 4.82
1941	0.27	28.51
1951	0.34	23.44
1961	0.41	20.97
1971	0.43	5.47
1981	0.58	34.36
1991	0.71	24.07
2001	1.07	44.63

Source: Data obtained from Darjeeling Municipality, Darjeeling

Darjeeling: The British designed the Darjeeling town in early nineteenth century for the population of about 10,000 probably only the European bureaucrats. The present population of over 1lakh is surely a hazard to the health of the *queen of hills*. The town as a district head quarter acts as the center of all types of economic activity, which attracts the rural folks of the district to migrate to the town for better opportunity. Besides, the invigorating climatic asset of the town compels the people from the surrounding states to migrate and settle permanently in the region. This has made the town more prone to the environmental problems in recent decades.

Shillong: The capital city of Megahalya, which was planned by the British as a hill resort, has undergone substantial change – both in character and form. A tiny administrative unit has now become an unpleasant commercial centre overshadowing the proud title of the *Scotland of the east.* Shillong like any other towns has developed principally as an administrative and commercial centre employing a large number of workers in these sectors. With the growth of commercial activity and with the sustained increase in population the city infrastructure has been utilised to the limit. Population of Shillong as of today stands at around 1,32,836. With the rapid growth of urbanisation, Shillong now faces shortage of water, inadequacy of sanitation and civic services that are strained to the limit. Shillong at present has the problem of a big city including long and unending queues of cars, a long line of kerosene consumers and degraded urban environment.

Gangtok: Gangtok is a rapidly growing hill city dependent on a fragile environment. It is the primary city of a predominantly rural state of Sikkim. Population of greater Gangtok is about 1.2 lakh and distributed between the core (28%), periphery (50%) and outer periphery (22%). The Government of Sikkim reclassified the city limits of Gangtok in 1991, causing the population and the city area to shrink by 60 percent. Rapid expansion following the 1971 merger with India had pushed the urban boundary well beyond the municipal boundary with which it was originally contiguous. Strong public pressure to revert to the original limit led to the reclassification leaving 65,000 residents outside the city boundary and only 25,000 inhabitants in the city core. Land ownership lies at the heart of this situation, as, according to Sikkim legislation, land outside designated urban areas can only be owned by specified groups of people. The definition of the current boundary to exclude large urban areas of greater Gangtok has a significant impact on the provision of services. Responsibility for water and environmental sanitation services rests with the Public Health Engineering Department (urban water and sanitation), the Urban Development and Housing Department (solid waste management), the Rural Development Department (rural water supply and sanitation) and the Irrigation Department (drainage). There is no municipality (Municipality suspended in 1985).

Annexure III Interview With Professor Shrawan Kumar Acharya, April 15, 2007

Dr. Shrawan Kumar Acharya, Professor, School of Planning, Centre for Environmental Planning and Technology, Ahmedabad is a trained Urban and Regional Planner. He has been in the planning field at the teaching, research and consultancy levels for the last 17 years. A permanent inhabitant of Darjeeling Hills, Dr. Acharya has been associated with various urban & regional planning and development projects across the Himalayan region of the country. Prof. Acharya clarifies some of the queries of **Vimal Khawas** with regard to the urban planning and development issues across the hills and mountains of India.

V. K. What is the scope of urban planning in the country in general and hills in particular?

S. K.A. As per the 2001 census nearly 28 percent of India's populations reside in the urban areas. The growth of the economy at 6 to 7 percent per annum in the last decade and also anticipated in the future implies rapid urbanisation. Economic growth and the functional integration of the space economy, because of liberalisation and commensurate development of infrastructure, have brought marginal areas like the hills and mountains under urban processes. The anticipated opening of the trade routes in some Himalayan regions, like Sikkim, implies rapid development of urban areas. In order to reap the benefit of urban economies there is a need to anticipate and plan the growth and development of the urban areas. But planning is required not only to accommodate the anticipated changes but also improve the existing conditions of the hill towns most of which are under severe stress. Moreover hills are environmentally sensitive areas needing special attention. Therefore, scientific urban planning is important and planning of not only individual cities but also system of cities at a regional level is essential.

V. K. What are the areas covered by urban planning?

S. K.A. Planned settlements have been a feature since ancient civilisation. Examples abound in the Indus valley, Ancient Greece and Rome. Urban planning then was more a reflection of power and grandeur. Emphasis was on architecture and aesthetics benefiting the rich and the powerful than the common people. Modern urban planning emerged as a discipline to address the problems arising out of the industrial revolution in U.K and Europe. The degeneration of quality of life as reflected in high incidence of poverty, mortality and morbidity made public health major issues. Town planning sought to address these issues. In the beginning the profession was engineering and architecture oriented because improvement in public health was sought to be addressed by physical improvements in water supply, drainage, housing, roads etc. However towards the 1920s the importance of social sciences mainly, geography, sociology and economics was also realised. After all a city is not only a physical entity but is also a social, cultural, economic and political entity. A good city plan will have to address these issues. Planners like Ebenezer Howard, Patrick Geddes and Louis Mumford have been very strong proponents of multidisciplinary approach to city planning. This tradition has continued and City Planning programmes today, at least in European and American institutes, include much wider discipline. Beginning 1980s the neo liberal agenda has envisaged a much wider and important role of the cities in the development of any country. Cities are being seen as competing productive entities and corporate units in a globalising spatial economy. Because of this, management and governance have become important features in urban planning pedagogy and practice along with physical and socio-economic concerns.

V. K. Has the urban planning institutes located across the metros and other mainstream cities been able to address the urban planning and development issues of hill towns in the country?

S. K.A. To some extent yes, but still lot needs to be done. As a colony India tremendously benefited from the British planning pedagogy and practices. India has good institutions, skilled manpower and professional organisation in the field of planning. The tradition of preparing development plans and the planning legislations are quite rich and have evolved over a period of time. Most hill towns, including Gangtok and Shimla, have development plan and there are town planning departments, independent or within the municipality, to address the planning issues. However, the implementation is weak. Political decisions take precedents over rational planning decisions, which have adversely affected the utility of the plans. Plan making and implementation is also skewed in favour of large cities and towns. Therefore, despite the mandatory requirement small towns, many in the hills, do not have good plans and effective authorities and manpower to execute it. Moreover, hill areas are special zones they require different treatment. Very often planning education and plan making do not address this uniqueness. Same techniques, planning norms and standards, which are applied in other regions, are also applied in the hill region. Professionals and academics are not sensitive to the special requirement of the hill areas. To some extent this is because there are no institutes, which are located in the hill areas. The existing institutes do not have specialisation in hill areas planning except occasional seminar or workshop organised by planning bodies like the Institute of Town and Country Planners. Problems in the hills are still considered to be miniscule compared to other areas. There is also less number of students from the hills pursuing this course. But in the recent days planning of hill towns is getting attention. Environmental problems and deteriorating living environment is forcing government as well as the people to rethink about their habitation. Media, NGOs and international donor agencies like AUSAID, as in the case of Gangtok, are becoming active in supporting planning initiatives in these regions.

V. K. Most of the recent urban planning ventures in our hill towns are attempted by the mainstream urban planners who are not adequately acquainted with the pros and cons of the hills. Is it so because we do not have professional urban planners in the hills?

S. K.A. To some extent it is true that lack of professional planners from the hill area is a concern. In absence of qualified professionals and planning institutes one has to depend on outside experts or consultants especially in an era when the role of the government planning machinery and responsibility has considerably reduced. It is also the effect of liberalisation and globalisation. After the 1990s the role of international planning agencies has considerably increased in India. Many cities in India are being planned by international consultants despite India, as a whole, having a good manpower. It is nothing but the operation of free market economics in the service sector. This is also true in the hill areas.

Local knowledge and acquaintance matters and it helps in planning and addressing issues properly. We certainly need to have more local professionals. But even if there are local professionals there is no guarantee that they will be sensitive to local issues and will prepare good plans. Politics take precedent over technicalities. We also need to remember that corruption rules the day (Planning deals with land!!). Good plans fail because of corruption and political interference besides poor manpower base, institutional and legal bottlenecks.

We also need to understand that the non hill professionals/outsiders, who plan the hill towns, may not be sensitive to the problems of the hills partly because s/he is an outsider but also because he may not have been trained properly in the scientific discipline or he does not give enough time to understanding the region and the development issues (for which the plan is being made!!). The problems become serious in absence of local monitoring and regulatory mechanism of the plan making and implementation process. This is one reason for the proliferation of shoddy consultancy reports, which has no rigour as a professional document. The problem is increasing because consultancy is a big business very often without any accountability. There has to be mechanisms to ensure accountability from the consultants both local and outside.

V. K. What is the future of our hill towns in view of the present rate of urbanisation and unplanned urban development across the hills of the country?

S. K.A. If the present rate of unplanned urban growth takes place in the hills they will get converted to urban ghettos. One can see the ill effects all across the Himalayas like Simla, Darjeeling etc. Congestion, haphazard traffic, pollution, deficiency in basic utilities like water is already a major problem. Increase in urban population will further aggravate the problem. Comparative advantage of hill towns as tourist destination will decline. The present pattern of urban growth has also made all hill towns vulnerable to natural and man-made disaster. High-rise structures in seismic and landslide prone areas are certainly not a rational land use plan. In a way the hill settlements are a high-risk settlements needing urgent attention!

V. K. How should we address our urban development and planning issues in order to put our hill towns into a sustainable tract?

S. K.A. There is still time to avert the catastrophe. The first and foremost thing one needs is the political will to prepare plans and implement them properly. Somebody has to take the lead. Secondly, the citizens will have to wake up to the reality and act as an advocacy groups to address the urban problems. The role of the neighbourhood committees is increasingly becoming important. Urban issues should become core development agenda in the local and provincial elections. Provisions of 74^{th} amendment act needs to be implemented properly and local bodies need to be given power and authority. The role of the state governments should be minimal. Planning, management and governance of urban areas should be emphasised by developing institutions and appropriate laws and legislations. Skilled manpower should be increased. Unlike large cities in other regions hill towns are comparatively small. In fact small towns and weekly markets still play important role in the hills. Proper attention should be paid to the growth and development of these towns. The problems of capital towns like Gangtok are also because of under development of small towns. Along with the individual towns a proper regional settlement plan needs to be prepared to avert the urban crisis in the hills.

There is also a need for planning schools to emphasise on the problems of the hills. Planning schools can also introduce special programmes (short term/ long term) on hill areas planning. Besides the fresh students, mid carrier officials, professionals and college teachers should also be encouraged to enroll in planning programmes. Most of the planning schools in India have special provision to enroll sponsored candidates. The hill states need to take advantage of this provision. The states should also facilitate the Planning schools to undertake research and students studio programme in the hills. Such an interaction will considerably help the states and planning institutes to address the planning pedagogy and practice of and for the hills!

Moreover, states like Sikkim should take initiative in instituting Urban and Regional Planning Schools, with the support of the Central Government and other hill state governments in India. Establishment of such an institution in the North Eastern Region of the country is strategic and important given the need and the development potential of the area. The increasing attention given by the central government in the recent days to the North Eastern states also makes the option viable and possible.

Annexure IV The Deprived Villages[1]

Suruk-Samthar and Yang-Mahakum Gram Panchayats are remotely located geographical units in the southern Kalimpong Hills of Darjeeling district. The region is a part of 22-Kalimpong Assembly Constituency under 4-Darjeeling Parliamentary Constituency. There are about 8 villages accommodated within these two Garm Panchayats with the population of about 10,000.

The Villages suffer from three major fundamental development bottlenecks. They are lack of transport facility (road connection), no electricity and no facility for safe drinking water. The geographical location of the region and more importantly the presence of two major rivers-River Relli and River Teesta- around the vicinity of the region have been the major barrier for many of developmental ventures notably the construction of road network. Hence, this region is economically, politically and educationally the most backward region of Darjeeling Hills. According to a study conducted by Ram Kumar Tamang (2003) as part of his MPhil Dissertation at JNU, Panbu Forest Village under Yang-Mahakum Gram Panchayat is the most backward village of Darjeeling Hills in terms of socio-economic development indicators.

During the British period there was a link road from Kalimpong Town up to River Relli which the villagers used in-order to travel to and fro from their respective villagers and the town of Kalimpong. However, this link road was destroyed by the heavy monsoon downpour and associated landslides of 1950 and 1968. No measures were taken by the government to restore the road.

The Christian Missionary had also constructed a ropeway popularly called Samco Ropeway at a place called 27th Mile to cross the River Teesta that connected villages located in Suruk-Samthar and Yang-Mahakum Gram Panchayats to NH31A. The Ropeway built during 1940s had a distance of about 3 kilometers and helped cross the villagers both the Rivers: Teesta and Relli. In Mid-1990s, however, due to the lack of appropriate maintenance, the ropeway unfortunately met with a major accident. More than 12 people died as a result. Consequently, instead of repairing and re-installing the historic ropeway, the district administration banned the usage of this ropeway putting the future of the villagers in dark.

Today the only connecting medium of NH31A to the villages of the said Gram Panchayats is a manually operated, and often at risk, ropeway. Further, the ongoing construction of Teesta Stage III [low dam] in the area has rendered additional difficulties to the already distressed villagers by frequently aligning and realigning footpaths of the villagers besides damaging the local ecology.

The villagers after traversing the risky-manually operated ropeway have to walk the snaking footpaths through steep gradient of the hills crossing several rivers and streams that often become violent during monsoon.

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[1] The author belongs to one of the villages located in Suruk-Samthar Gram Panchayat. This story is based on his observation and experience.

The villagers have been sustaining such geographical hardship since ages and no initiatives have been taken by the government to connect the villages with proper road network let-alone taking initiatives with regard to other necessary socio-economic infrastructure bases notably electricity, primary health centres, safe drinking water, and adequate primary/secondary schools.

Although NHPC has agreed in principle to construct an over-bridge for the villagers after the completion of Teesta Stage III, the question of constructing road measuring about 5-10 kilometers that stretches from the dam site, where the bridge is supposed to be constructed, till Samthar remains a distant dream to the villagers.

Annexure V Sikkim State Policy of Environment, Forest and Land Use[2]

RESOLUTION

1. PREAMBLE

Article 48A and 55A (g) of the Constitution under Directive Principles of state policy assign duties for the state and all citizens which state that, the state shall endeavour to protect and improve the environment and to safeguard the forests and wildlife and to protect and improve the natural environment including forests, lakes and rivers and wildlife and to have compassion for the living creatures. In Resolution No. 3-1/86-FP dated the 7th December 1988, the Government of India, Ministry of environment and Forests, enunciated National Forest Policy to be followed in the management of state forests in the country. However, over the years, the environment, forests and land in the state of Sikkim have come under serious pressure due to the fact that more than 80% of the land resources of the state are under the management of the Department of Forests, Environment & Wildlife. Due to the increase in human population and cattle population and increase in development activities in the state, the pressure on the environment, forest and land is increasing at a very fast pace. Due to increase in human population, there is increase in demand for land for house construction, agriculture, road construction, hydel projects and other developmental activities. There is also increase in demand for fuel wood for cooking and heating purposes. Due to increase in livestock population, grazing in the forest areas has been increasing. All the above-mentioned activities are likely to create degradation of forests and environment. To overcome the situation and to increase the participation of the local people in the conservation and management of forest resources of the state and to maintain the ecology of the state without hampering developmental activities, it has become imperative to review the situation and to evolve, for the future, a strategy of environment of natural environment. There has been tremendous increase in the air pollution in the urban areas due to the increase in the number of vehicles over the years. Due to hilly terrain, land available for non-forestry purposes is very limited. So there is great demand on this land from various sectors. Land use planning and land management is very important for optimal utilization of land resources in the state. It has thus become necessary to formulate a "State Policy of Environment, Forests and Land Use".

2. BASIC OBJECTIVES

The basic objectives that should govern State Forest Policy of Environment, Forest and Land Use are as under:

- Maintenance of environmental stability through preservation and where necessary, restoration of ecological balance which has been distributed due to various developmental activities, faulty land practices and degradation of forest resources.

[2] Obtained from the Dept of Forest, Wildlife and Environment, Govt. of Sikkim, Gangtok

- Conserving the natural heritage of the state through conservation and preservation of natural forests of the state with vast variety of flora and fauna, which represents the remarkable diversity,.and genetic resources of the state.
- Checking the soil erosion and denudation of the hill slopes in the catchment areas of rivers, streams, lakes, and reservoirs in the interest of soil and water conservation for mitigating landslides, floods, and droughts and for the retardation of siltation of reservoirs.
- Increasing substantially the forest / tree cover in the state through massive afforestation, social forestry programmes especially on all denuded and degraded slopes, regeneration of natural forests through inducing natural regeneration.
- Increasing the productivity of land through improved management practices to meet the needs of increasing human population in respect of food, timber, fuel wood and fodder for the livestock.
- Preventing the diversion of forestlands and good agriculture lands for other purposes.
- Efficient management of land under urban and village settlement to prevent landslides, flooding and damage to roads, bridges, buildings, etc.
- Efficient management of land under agriculture by controlling the use of pesticides and insecticides to prevent pollution of soil and water resources.
- Preventing pollution of air especially in urban area by prescribing emission levels for vehicles / industries and other air polluting industries.
- Encouraging efficient utilization of forest produce and maximizing substitution of wood.
- Encouraging people to use alternative sources of energy for heating and cooking purposes.

3. ESSENTIALS OF ENVIRONMENT, FOREST AND LAND MANAGEMENT

- Existing forests and forestlands shall be protected and their productivity improved. Forest and vegetation cover should be increased and improved on hill slopes, in catchment areas of rivers, lakes and reservoirs to check the siltation of these water bodies.
- Diversion of good and productive forestlands and agricultural lands for other purposes should be discouraged. The productivity of existing forest and agricultural lands should be increased through improved management practices and application of appropriate technology.
- For the conservation of total biological diversity, the area under national parks sanctuaries and biosphere reserve should be fully protected and not diverted for any other purposes.
- Forest tree cover should be increased in the Khasmal and Gorucharan areas through massive afforestation programmes through involvement of local people in the management of these lands.
- Since fuel wood continues to be the main source of energy in the rural areas, the programmes of afforestation should be intensified with special emphasis on increasing the production of fuel wood and tree fodder to meet the requirement of the local people.
- To decrease the pressure on the natural forests, the rural people will be encouraged to undertake plantation of fuel wood and fodder trees on lands which are uneconomical for agricultural and horticultural practices.

- Non-timber forest produce provides sustenance to the tribal population residing in and around the forest area. Such forest produce should be protected, improved and its production increased to generate employment and improve the economic conditions of the local tribals.
- To improve the ecology of agricultural lands, the lands, which are not fit for agriculture due to high degree of slopes, should be used for horticulture crops.
- Diversification in land use by introduction of crops like pulses, oilseeds, vegetables and fodder in the cropping pattern should be encouraged. Double and multiple cropping wherever possible should be encouraged. For diversifying production, mixed farming should be encouraged including dovetailing cultivation with subsidiary occupations like raising livestock and poultry, fish, silk rearing and bee keeping, which will ensure year round of resources and employment potential for the farming family and the livestock.
- Compensatory afforestation and alternate production programmes should be undertaken to ensure that the productivity of agricultural and forest land lost or damaged through unavoidable diversion, is restored.
- Movement of people from rural areas to the urban areas is to be discouraged so that slums are not developed in the urban areas by unauthorized encroachment on the public land and creating unhygienic conditions in the urban areas. Sanitation should be an integral part of the town planning. Safe drainage of domestic and rainwater is the prerequisite of any town planning exercise.
- Arrangement should be made for disposal of solid waste material and garbage, both non-degradable and biodegradable, so as to check choking of drainage systems and silting of rivers and streams.
- Areas which are feeding the water sources through surface runoff / seepage into the ground should be completely protected from all biotic interference for checking pollution and contamination of drinking water particularly in case of heavy domestic water consumption centres.
- Diversion of ecologically fragile and environmentally sensitive areas for other alternative uses should be avoided and wherever such diversion cannot be avoided, environmental safeguards should be the integral part of the project to limit the damage to the environment to the minimum. Environmental impact assessment of all development projects above a certain size should be made compulsory. Treatment of the area damaged due to execution of project / extension of old one, should be the responsibility of the project authority.
- Protection should be the integral part of all afforestation projects. Catchment treatment plan should be imperative for all hydel power, irrigation and water supply projects.

4. STRATEGY

- The national goal is to have a minimum of two-third of area under forest or tree cover in order to prevent soil erosion and land degradation and to ensure the stability of fragile ecosystem. Although about 84% land resources are under the management of the forest department, yet the area under tree cover is only about 44%. Further the density of the tree cover is very low in many areas. The state would strive to increase the area under tree cover further and also improve the density of the existing tree cover.

- A massive need-based and time-bound programme of afforestation and tree planting will be launched with main emphasis on production of fuel wood and fodder on degraded and denuded lands, both forest and non-forest. Afforestation being a time specific activity, the government will ensure technical, administrative and financial approval well in advance for all afforestation projects to ensure the success of these programmes and improve the quality of works.
- An urban forestry programme is a necessity to improve the environment in the urban areas of all the districts through planting of ornamental trees and bushes. Such a programme will increase the scenic beauty of the towns as well as check soil erosion and landslides in these areas.
- Khasmal and Gorucharan lands should be taken up for the development of tree crops and fodder resources. A "Joint Forestry Management Programme" will be launched to improve the condition of the forest crop on such lands. The state government will consider providing assistance for undertaking planting on such lands and the local Village Forest Protection Committee will be responsible for the protection and maintenance of the tree plantation. The revenue saving mechanism between the state and the local villagers will be considered without transferring ownership rights, to undertake block plantation of trees on such lands for production of timber, fuel wood and fodder. Appropriate regulations will be made to govern the felling of trees on private holdings.
- The productivity of the area under agriculture and horticulture should be increased so that total agricultural and horticultural production is increased. Good agricultural land should not be diverted for non-agricultural purposes as far as possible. To maintain the fertility of the land, rotational cropping pattern should be adopted and bio-fertilizers should be added to the soil.
- Modern town planning techniques are adopted in urban settlements. Constructions of buildings and houses not are allowed in landslide prone areas to avoid loss of life and property.
- Laws should be notified in such a way that the arrangement for proper drainage of the buildings, roads, parking places, commercial complexes, factories, etc. from the site to the natural water way should be the responsibility of the owners / constructing agencies.
- There are many endangered species in Sikkim, which require ex situ conservation and propagation in addition to in situ conservation in their respective habitats. Efforts will be made to propagate these species by establishing seed orchards and germ-plasm gardens.
- To save forests, environment and biodiversity from biotic interference (illicit tree felling, poaching, smuggling of forest produce, grazing, fire, etc.) infrastructure development for protection of forests, is the need of the time. The government will invest 10 % of the total outlay for forestry sector for development of infrastructure for forest protection, which includes procurement of patrolling vehicles, firearms, telecommunication development and improvement and construction of check posts.

5. MANAGEMENT OF ENVIRONMENT, FORESTS AND LAND

- Developmental schemes and projects, which are detrimental to the environment and forest growing on steep slopes, land in catchment areas of rivers, lakes and reservoirs, and ecologically and geologically fragile areas should be severely restricted. Further it will be made compulsory for all development agencies to have in built provisions in their project cost for providing alternative fuels (kerosene, LPG, etc.) for their labour force to avoid damage to the forest and environment around forest areas.

- No forest should be worked without the approval of Working Plan by state government and the competent authority in the central government.
- In order to meet the growing needs of timber, fuel wood, fodder and non-timber forest produce, which the forest provide, it is necessary to increase productivity of the existing forest land and enhance the forest cover through application of scientific and technological inputs. Production forestry programmes, while aiming at increasing the forest cover should also be oriented to narrow the gap between supply and demand of the firewood. However no programmes should be started which involve clear felling of the natural forests. Exotic species should not be planted on large scale unless it is established through trial that they have no adverse impact on local environment and vegetation.
- Soil fertility of the land under cultivation should be improved by promoting the use of organic manure, biogas and nitrogen fixing practices. Land along the hill slopes should be terraced to check the erosion of topsoil and for conservation of moisture. Production from the rain fed area should be increased through land water resource management.
- Khasmal and Gorucharan lands should be protected from encroachment. These lands should be developed by planting fodder and fuel wood trees. Suitable fodder grasses should be planted to augment the availability of fodder. Grazing should be allowed only upto the carrying capacity of the lands. Stall-feeding should be encouraged. Status of these lands should be regularly monitored to avoid over exploitation of these lands.
- Special efforts should be made to maintain the ecology of the inland water bodies like lakes, rivers ad streams. Legislation should be adopted to prevent pollution of the water bodies. Water bodies should also be developed for the production of fish to increase the production of food. Water balance studies should be undertaken for considering the requirements of different sectors. Statistics of water resource potential and competing demands for human consumption, agriculture and industry should be collected at regular intervals. Impact of water resource development project for hydropower generation and irrigation or flood control on the land, ecology and society as a whole should be evaluated.
- Soil conservation and watershed management, for increasing productivity, checking soil erosion, retarding runoff, helping moderation of floods, drought and land degradation should be undertaken. Hill slopes should be protected against landslides through modern techniques. Water harvesting measures should be undertaken in the dry areas to increase moisture regime for increasing productivity of dry lands.
- For implementation of urban and rural human settlement programmes, proper planning should be undertaken beforehand. More scientific methods, requiring less areas, should be adopted for disposal of urban waste to avoid damage to lands, water bodies and environment.
- The alignment of the road and transport system should be planned with minimum use of arable lands and good forest areas. Construction of roads should have in built provision for waterways to supplement the natural drainage system, treatment of landslides prone and fragile areas, compensation for crop / forest / land property, etc. likely to be damaged / destroyed and having provision for compensatory afforestation for grater stability of the slopes.

- The industrial units be required to take necessary safeguards to reduce pollution particularly those affecting the health of soil / land and water bodies.
- The mining programmes should contain detailed plan not only for mining operations but also for re-use of land after mining. Land use plan for mining areas should be examined against the cost involved and the social needs of the adjoining areas.
- Catchment area treatment plan should be prepared for the major and medium irrigation and hydel power reservoirs. Watershed management and soil conservation including afforestation should precede or at least be taken up simultaneously with the construction of dams / reservoirs so that their effect is felt by the time the irrigation / hydel project is completed and water is impounded in the reservoir.
- Steps need to be taken to obtain reliable information on the extent of area under direct possession of defense establishments and the extent of areas being required by the year 2020 to meet the future requirement.
- Steps are required to be taken to get the information on the extent of area under direct possession of Border Roads Organization for their camps and also the labour camps. The information is also required to be collected for their future needs for road constructions by the year 2020.
- To check the pollution of air, steps should be undertaken to fix the emission levels also all types of vehicles. Norms also need to be fixed for the air polluting industrial units. Locations of polluting industries near the densely populated areas should not be allowed.

6. ECOTOURISM

To generate revenue without damaging the ecology and environment, eco-tourism will be promoted in protected areas having natural scenic beauty and places of religious importance. Eco-tourism will be strictly regulated by making appropriate rules and regulations. No new area will be opened without thorough scrutiny and evaluation of the impact on the environment by the experts. The government will close those areas for eco-tourism temporarily or permanently, on which eco-tourism is having adverse impact on environment after scrutiny.

7. RIGHTS AND CONCESSIONS

- The rights and concessions if any including grazing should always remain confined to the carrying capacity of the forest. The carrying capacity should be enhanced through total banning of grazing for certain periods, increased investment, silvicultural research and development of the area. Grazing in the forests freely should be discouraged and stall-feeding should be encouraged. Social forestry programme should be started in Khasmal and Gorucharan areas outside the Reserve Forest (RF) to increase the availability of fuel wood and fodder in such areas. Establishment of cattle camps / sheds within the RF should not be allowed.

- The rights and concessions should be related to the assistance provided by the people, residing in and around the forest, in protection of the forests from fires and forest offenders. Demands of the local people for their bonafide use should be the first charge on the forest.

- Wood is in short supply. The long-term solution for bridging the existing gap between demand and supplies lies in increasing the productivity of forests. But to relieve the pressure on the forest for timber, substitution of wood by alternatives is required to be taken recourse to. In case of energy required for domestic purposes fuel wood needs to be substituted with alternative sources like biogas, LPG and solar energy. Fuel-efficient 'chulahs' as a measure of conservation of fuel wood need to be popularized in rural areas. Similarly solar cookers and solar water heaters need to be popularized in the state.

8. DIVERSION OF FOREST LANDS FOR NON-FOREST PURPOSE

- Forest land or land covered with trees should not be treated as source readily available to be utilized for various developmental projects and schemes, but as a national asset which is required to be properly safeguarded for providing sustained benefits to the entire state. Diversion of forestlands for any non-forestry purpose should not be allowed except for developmental projects after the most careful examination and scrutiny by the specialists from the standpoint of social and environmental costs and benefits. Construction of dams and reservoirs for hydel power generation, mining and industrial development, construction of roads and bridges and any other projects of the state government / central government or any other public undertaking of the state government / central government which are consistent with the needs for conservation of trees and forest, which involve such diversion, shall provide in their investment budget, funds for regeneration / compensatory afforestation and compensation for damage caused to the forest crop both on government and private lands.
- Beneficiaries who are allowed mining and quarrying in forest land and in the land covered by the trees should be required to repair, reclaim and re-vegetate the area in accordance with established forestry practices. No mining lease or licence should be granted to any party. Private or public without a proper mine management plan appraised from the environmental angle and enforced by adequate machinery.

9. WILDLIFE CONSERVATION

- Wildlife management plans should be prepared for all national parks and sanctuaries for taking special care for the needs of wildlife conservation. It is essential to provide for 'corridors' linking the protected area in order to maintain genetic continuity between artificially separated subsection of migrant wildlife. Diversion of forestland in national parks and sanctuaries should not be allowed.
- Forest management plan should take special care of needs of wildlife conservation in areas outsides the protected areas.

10. TRIBAL PEOPLE AND FORESTS

- All the remote areas of the state are inhabited by the tribal people. There is a symbiotic relationship between the tribal people and the forests. Tribal people and people residing in and around the forest areas should be involved in the protection, regeneration and development of forests to provide them gainful employment.

- Tribal co-operatives should be involved in protection, regeneration and optimum collection of non-wood forest produce.
- Provision of alternative sources of energy for domestic purposes should be made in tribal areas to reduce the pressure on forests.

11. DAMAGE TO FOREST FROM ENCROACHMENT, FIRES AND GRAZING

- Encroachment on forestland has been on the increase. This trend has to be arrested and reversed by taking effective steps. There should be no regularization of existing encroachments.
- The incidence of forest fires is very high especially in the lower areas in the state. Standing trees, young plantations, natural regenerations, medicinal herbs and shrubs are destroyed by the forest fires. Fires cause maximum damage to the genetic resources and biodiversity. Special precautions should be taken during the fire seasons to prevent and contain the fire in the fire prone areas. Sufficient allocation of funds should be made in ht budget for dealing with the fire. Culprits who indulge in causing fires to the forest should be severely punished.
- Grazing in forest areas is a major problem in the state. Grazing in Reserve Forest area should be severely restricted / banned. Cattle camps / 'goths' should not be allowed in the Reserve Forest areas. Stall-feeding should be encouraged. Adequate grazing fees should be imposed to discourage the people from maintaining large herds of non-essential livestock.

12. FOREST BASED INDUSTRIES

- The private forest based industries should not be allowed near the forest areas. However, to meet the
- Demands of the public the Department of Forests, Environment and Wildlife should establish saw mills and sale depots for timber, firewood and charcoal marketing.
- Farmers should be encouraged the private forest based industries should not be allowed near the forest areas. However, to meet the to grow trees on lands which are not required by them for agriculture / horticulture. Department of Forests, Environment and Wildlife may make arrangement to market the produce through their departmental sale depots.
- At village level small cottage industries run by village co-operatives based on forest produce / wood produced by the farmers may be allowed after scrutiny of the adequate supply of wood by farmers residing in the area.

13. JOINT FOREST MANAGEMENT

Forest protection and conservation programmes cannot succeed without the willing support and active co-operation of the people. It is essential, therefore, to involve people in the development and protection of forests. This can be achieved through formation of Village Forest Protection Committees. Women should be given due representation in these committees to make them more effective. In lieu of the services rendered by these committees, the members of the committees may be considered for sharing benefits arising from such afforested and protected areas. Joint forest management can be undertaken in Khasmal, Gorucharan and degraded forestlands.

14. EXTENSION

Forest and environmental conservation programme cannot succeed without making the people conscious of value of trees, wildlife and nature. Farmers should be motivated to undertake tree plantation of lands not being utilized for agriculture, to terrace the land along the hill slopes and to plant agricultural crops by rotation. Short-term extension courses and lectures should be organized in order to educate farmers and villagers for this purpose. It is essential that suitable programmes are propagated through mass media, audio-visual aids and film shows. Environmental education should be made an optional subject at school level.

15. FORESTRY AND ENVIRONMENTAL EDUCATION AND TRAINING

Forestry is a scientific disciplines as well as a profession. Academic and professional qualification in forestry should be kept in view for recruitment to the State Forest Service and Forest Subordinate Services. Specialized and orientation courses for developing better management skills by in-service training should be encouraged. All personnel dealing with forest and environment should be regularly trained to keep them upto date with latest technology.

16. FORESTRY AND ENVIRONMENTAL RESEARCH

With the recognition of importance of forests for environmental conservation, energy, fodder and employment, emphasis must be given to scientific forestry and environmental research. There is adequate need for strengthening of research base. Some broad priority areas so research and development needing special attention is:

a) Increasing the productivity of timber, fuel wood, fodder and non-timber forest produce per unit area per unit time by the application of modern scientific methods and techniques.
b) Reforestation of barren / degraded forestlands, wastelands and watersheds.
c) Effective conservation and management of existing natural forest.
d) Research related to social forestry for rural and tribal development.
e) Research related to re-vegetation of high altitudes, barren and degraded forestlands.
f) Research related to enhancement of productivity per unit area per unit time of medicinal plants, herbs and shrubs.
g) Research related to wildlife management and management of national parks and sanctuaries.
h) Survey of medicinal plants and biodiversity should be undertaken and status reports should be prepared and updated regularly.

17. PERSONNEL MANAGEMENT

Government policies in personnel management should aim at enhancing the professional competence and status of personnel engaged in management of forests, environment and land. Qualified and motivated personnel should be given incentive by way of granting special increments for doing outstanding work. For removing the stagnation in their services career, the proposal for in site promotion to next grade in the same post may be considered after a certain period of service in the same grade. Seeing the arduous nature of duties, the forestry / wildlife staff has to perform in remote and inhospitable areas, adequate pay scale and promotions to them must be given to keep their morale high.

18. SURVEY OF ENVIRONMENT, FOREST AND LAND AND DATABASE

- There is an urgent need to generate and update database for natural resources of the state without which correct decision could not be taken and optimum utilization of natural resources is not possible. Priority is needed to be accorded to undertake the survey of forest resources, land use and biodiversity in the state on scientific lines. For this purpose, periodic collection, collation and publication of reliable data on prevalent aspects of environment, forest and land management need to be improved with recourse to modern technology and equipment.
- Land is a state subject. State Land Use Board should function as main custodian of data on land use. State Environment and Pollution Control Board should be constituted to regularly monitor the environment and pollution.

19. LEGAL SUPPORT, ORGANISATION AND INFRASTRUCTURE DEVELOPMENT

Appropriate legislation should be undertaken and rules need to be formulated in order to implement comprehensive policy on environment, forest and land use effectively. Organizational restructuring needs to be undertaken periodically. Further, infrastructure by way of construction of adequate number of houses and office for the staff at various levels at various locations need to be developed to implement the policy and various Acts for conservation of environment and forest resources.

20. FINANCIAL SUPPORT FOR ENVIRONMENT AND FORESTRY

The objectives of the Comprehensive Policy cannot be achieved without the provision of budgetary support and investment of financial and other resources on a substantial scale. The government will increase the investment in Forestry sector to 5 % of the total State Plan Outlay for the State. Such investment is fully justified considering the fact that more than 84% of the land resources of the State are under direct management of Department of Forests, Environment & Wildlife and the forest are very important for maintaining the environment and supporting essential ecological processes, life support systems and in preserving genetic diversity. Forest should not be seen as a source of revenue. They are a renewable natural resource. They are lungs of civilization and without protection of forest, environment and land from degradation; no civilization can survive on the earth. They are national assets to be protected and improved for the well being of the people of the country in general and of the State in particular.

Annexure VI Loss of Lives and Property by Different Types of Disasters in Nepal: 2002

Type of Disaster	People			Affected Families	Livestock Loss	Houses Destroyed	Cattle Shed Destroyed	Estimated Loss (NRs '000)
	Deaths	Missing	Injured					
Floods and Lanslides	441	21	265	39309	2024	18181	775	418915
Fire	11	0	6	1387	100	1604	37	94739
Epidemics	0	0	0	0	0	0	0	0
Windstrom	3	0	0	227	0	70	45	4847
Hailstrom	0	0	0	0	0	0	0	7000
Lighting	3	0	0	12	2	1	0	63
Earthquake	0	0	0	0	0	0	0	0
Total	458	21	287	40935	2126	19856	857	525564

Source: CBS 2004: Tables 5.19-5.20

Annexure VII Disaster Casualties in Nepal: 1995-2002

Type of Disaster	People		Livestock Loss	Homes Destroyed	Affected Families	Land Affected (ha)	Estimated Loss (Million NRs)
	Deaths	Injured					
1995	873	1937	2053	10275	134210	41870	1933
1996	895	1523	2480	30014	58320	6060	1579
1997	1160	1120	1191	4825	46050	6060	410
1998	1190	117	1179	15082	36980	320	1230
1999	1466	146	65	4304	17840	180	509
2000	377	162	1017	6886	24900	880	1141
2001	415	132	665	6103	15900	-	526
2002	458	287	2126	19856	40930	10070	525

- = Not available, ha= hectare
Source: CBS 2004: Tables 5.19-5.20

Annexure VIII Important Environmental Aspects of the Countries Encompassing the Himalaya

Country	Natural hazards	Current Environment Issues	International Environmental Agreements	Geo-Strategic Note
India	droughts, flash floods, landslides in the Himalaya, severe thunderstorms common; earthquakes	deforestation; soil erosion; overgrazing; desertification; air pollution from industrial effluents and vehicle emissions; water pollution from raw sewage and runoff of agricultural pesticides; tap water is not potable throughout the country; huge and growing population is overstraining natural resources	Party To: Antarctic-Environmental Protocol, Antarctic-Marine Living Resources, Antarctic Treaty, Biodiversity, Climate Change, Desertification, Endangered Species, Environmental Modification, Hazardous Wastes, Law of the Sea, Nuclear Test Ban, Ozone Layer Protection, Ship Pollution, Tropical Timber 83, Tropical Timber 94, Wetlands, Whaling Signed, But Not Ratified: none of the selected agreements	dominates South Asian subcontinent; near important Indian Ocean trade routes, controls several key Himalayan mountain passes
Nepal	severe thunderstorms, flooding, landslides, drought, and famine depending on the timing, intensity, and duration of the summer monsoons	deforestation (overuse of wood for fuel and lack of alternatives); contaminated water (with human and animal wastes, agricultural runoff, and industrial effluents); wildlife conservation; vehicular emissions	Party To: Biodiversity, Climate Change, Desertification, Endangered Species, Hazardous Wastes, Law of the Sea, Nuclear Test Ban, Ozone Layer Protection, Tropical Timber 83, Tropical Timber 94, Wetlands Signed, But Not Ratified: Marine Dumping, Marine Life Conservation	landlocked; strategic location between China and India; contains eight of world's 10 highest peaks
Bhutan	violent storms coming down from the Himalaya are the source of the country's name which translates as Land of the Thunder Dragon; frequent landslides during the rainy season	soil erosion; limited access to potable water	Party To: Biodiversity, Climate Change, Nuclear Test Ban Signed, But Not Ratified: Law of the Sea	landlocked; strategic location between China and India; controls several key Himalayan mountain passes

Source: compiled by the author

Annexure IX P.M. Prachanda Faces First Crisis As Floods Wreak Havoc
[Source: Indo-Asian News Service, 20 August 2008]

Nepal's Maoist chief Pushpa Kamal Dahal "Prachanda", who was sworn in as the republic's first prime minister on Monday, faced his first crisis within 24 hours as floods ravaged the border area, leaving over 35,000 people homeless.

The 54-year-old former guerrilla chief who on Monday took oath of office and secrecy in the name of the people, strode into the Prime Minister's Office in Singh Durbar, the heart of Nepal's government where key ministries are located, at 10.30am to combat the new crisis.

"The PM has ordered NRs.2 crore (Nepali Rs20m) to be released from the PM's Relief Fund for the flood victims," Maoist lawmaker Kiran Rai said. "He has also ordered medical teams to rush to the area."

Downpours on Sunday night made the Saptakoshi river on the Indo-Nepal border swell ominously and lash the barrage over it, causing two supporting spurts to crumble. The escaping flood water began creating havoc in Sunsari district in Nepal as well as parts of Bihar state in India across the border.

Over 35,000 people became homeless overnight. Though three army helicopters and wooden-rubber dinghies were pressed into service to rescue villagers, over 10,000 still remained marooned. Three people, missing since Monday, were feared to have been swept away by the swirling waters.

Hundreds of villagers were seen piling their salvageable possessions on tractors, cycles and rickshaws and fleeing to neighbouring villages as well as Indian border towns. Nepal's famed Koshi Wildlife Reserve is also said to be under threat from the rapidly advancing waters.

The East-West Highway that connects Nepal with India was flooded in parts and transport had come to a standstill. The optical fibre network laid with Indian assistance to boost communications was badly damaged, disrupting telephone, mobile and Internet services in the Mechi and Koshi zones. Nepal Telecom said it would take at least seven days to repair the network.

Thousands had spent the night under plastic sheets at night while the rain still continued. Prachanda held quick consultations with lawmakers from Sunsari district to discuss flood relief measures. As sufferings increased, charges began to be levelled against India for the disaster.

A Nepali local development officer was reported as saying that the Kushaha barrage, built with the assistance of the Indian government, had used inferior construction material, causing the quick erosion of the spurs.

According to the Koshi river project pact, the Bihar government has to build, repair and maintain all spurs as well as embankments, Nepal's official media said yesterday.

Besides neglecting to repair the critical barrage, Indian officials were also accused of turning a deaf ear to pleas to open the sluice gates when the water level started rising. "Nepal has lost millions due to the delay by the Indian side in opening the sluice gates," Maoist mouthpiece Janadisha daily said Tuesday.

However, a leading politician from Bihar, who is in Nepal to congratulate the Maoist government, said Nepal had failed to allow the Bihar government to repair the barrage. Leading a delegation to Kathmandu to attend Prachanda's swearing-in ceremony, Sharad Yadav, leader of the Janata Dal-United party that leads Bihar's ruling coalition, said he would convey to the new prime minister the desire of Bihar Chief Minister Nitish Kumar to visit Kathmandu. Yadav said Nitish Kumar was keen to meet Prachanda to discuss the sharing of water resources.

Annexure X Disaster Management Authorities & Institutions in India

Central Disaster Management Authority
(Government of India, Ministry of Agriculture, Department of Agriculture & Cooperation, Natural Disaster Management, http://ndmindia.nic.in).

It is the apex body for natural disaster management and mitigation. For effective implementation of relief measures in the wake of natural calamities, the Government of India (GOI) has set up a Standing National Crisis Management Committee under the chairmanship of Cabinet Secretary GOI. A Natural Disaster Management Control Room has been set up at Krishi Bhavan, New Delhi.

For planning for disasters and Emergency preparedness training, Government of India has created few institutes that offer short-term courses. Notable amongst them being the National Center for Disaster Management (NCDM) set up by the Indian Institute of Public Administration and the Centre for Disaster Management set up by Y S Chavan Academy of Development Administration conduct workshops and seminars for civil servants and government officials. NCDM is also the nodal agency for coordinating relief and rehabilitation work during natural calamities. Similarly, the Disaster Management Institute, Bhopal set up after the gas tragedy conducts awareness programs for NGOs and the public at large.

Some universities have recently taken the initiative to introduce a few courses. For instance, IGNOU and the University of Pune offer 6-month certificate courses. Any one who has completed 10+2 is eligible to enroll. The Indian Institute of Ecology and Environment, New Delhi offers another correspondence program in disaster mitigation in affiliation with the Sikkim Manipal University. Spread over 2 years and 10 papers including a thesis, this program is open to graduates in any discipline. The PRT Institute of Postgraduate Environmental Education and Research also offers a similar course in affiliation with the Institute of Open and Distance Education, Barkatullah Vishwavidyalaya, Bhopal.

While these courses have started gaining in popularity, career opportunities are still pretty limited. Openings are mainly found in some government and non-government agencies. Large industrial establishments, particularly those in the high-risk fields like chemicals, mining, petroleum have disaster management cells. The International Red Cross and some UN organizations also empanel trained professionals for working on humanitarian missions to handle major calamities and emergencies.

National Center for Disaster Management, New Delhi
A new center "National Centre for Disaster Management (NCDM)" has been established by the Ministry of Agriculture, Government of India. NCDM is setup in Indian Institute of Public Administration (IIPA) with the objectives of:

1. providing training programs for senior and middle level administrative government officials and to sensitize them for disaster mitigation,

2. coordinate the research activities in different aspects of disaster management at national level.

For further information: NCDM, IIPA, Indraprastha Estate, Ring Road, New Delhi 11002, Fax: (+91-11)331-9954, http://www.ncdm-india.org

National Information Center of Earthquake Engineering- IIT Kanpur, U.P.
A National Information Center of Earthquake Engineering (NICEE) has been set up at the Indian Institute of Technology Kanpur. The Center is sponsored by HUDCO, Telecom Commission, Railway Board, Ministry of Agriculture, Department of Atomic Energy and AICTE. NICEE-India will meet the needs of the country in terms of "information" on Earthquake Engineering. The NICEE-India at IIT Kanpur will eventually aim at being responsible for acquiring and disseminating information and capacity building of the neighbouring nations. Institutes mandate is to create and maintain a good storehouse of information/publications/ other audio-visual materials on earthquake engineering [for further information: http://www.nicee.org].

Disaster Management Institute, Bhopal, M.P.
The Disaster Management Institute established by the MP government in the backdrop of the Bhopal Gas Tragedy, offers training, research and consultancy services on subjects related to prevention, mitigation and management of disasters. It organizes training for working managers and government officials relating to the areas of management of natural disasters such as earthquakes, floods, drought, famine and cyclones; on-site and off-site emergency planning; risk analysis; identification of major hazards etc.

For further inormation: 'Kachnar,' Paryavaran Parisar, E-5, Arera Colony, Bhopal; e-mail: dmibpl@bom6.vsnl.net.in

Disaster Mitigation Institute, Ahmedabad, Gujarat
Disaster Management Institute's mission is to equip the disaster victims- individuals or groups or agencies- with the resource to develop progressive solutions to physical, social and economical challenges of relief and reconstruction of facing them. DMI strives to become a premier centre for disaster mitigation and prevention by assisting and strengthening the decision making process and making the critical and objective analysis available to the policy makers. In the wake of Gujarat Earthquake of January 2001 this Institute provides real life example of the need and necessity of such an institute [for further information: http://www.southasiadisasters.net/].

Environment Protection Training and Research Institute, Hyderabad
EPTRI was set up by Government of Andhra Pradesh with the assistance and support of Government of India. Government of India had also taken the initiative for EPTRI's technical collaboration with Swedish International Development Agency under bilateral assistance. Risk Analysis and Disaster Management Plan is a safety and contingency management plan to safeguard people and property from disasters. EPTRI provides training and consultancy in Risk Assessment and Safety Control. EPTRI has an MoU with Process

Safety Centre of Indian Institute of Chemical Technology (IICT), Hyderabad [for further information: http://www.eptri.com/risk_analysis_disaster.html

Gujarat State Disaster Management Authority (GSDMA)
The Government of Gujarat (GOG) established the Gujarat State Disaster Management Authority on February 8, 2001 to co-ordinate the comprehensive earthquake recovery program. The GSDMA is registered as a society under the Societies Registration Act [for further information: http://www.gsdma.org/aboutus.htm]

Joint Assistance Centre, Gurgaon, Haryana
The Joint Assistance Centre (JAC) was established in New Delhi as an All India Voluntary Agency for assistance in disaster situations in 1970 in the aftermath of the terrible cyclone of November 1977 that devastated the Chirala-Divi region of Andhra Pradesh, killing over 10,000 people [fur further information: http://www.jacindia.org/].

Centre for Disaster Management (CDM), Pune, Maharastra
The Centre for Disaster Management was set up at Yashada (Yashwantrao Chavan Academy of Development Administration), Pune with the support of the National Disaster Management Division, Department of Agriculture and Cooperation, Government of India. The CDM is collaborating with the IGNOU to launch a PG Diploma in Disaster Management in English, Hindi and Marathi. Training programmes on Management of Earthquakes, Workshop on Community participation in Disaster Management, and allied topics are conducted at CDM periodically [for further information: http://www.yashada.org/courses].

Sikkim Manipal University of Health, Medical and Technological Sciences, Tadong, Gangtok, Sikkim
Sikkim Manipal University of Health, Medical and Technological Sciences in association with the Indian Institute of Ecology and Environment offers the Master's in Disaster Mitigation for graduates (any discipline). Disaster mitigation includes activities that prevent a disaster, reduce the chance of a calamitous event, or lessen their damaging effects [fur further information: http://www.sikkimmanipal.net & http://www.ecology.edu/

PRT Institute of Post Graduate Environmental Education & Research, New Delhi
PRT Institute of Post Graduate Environmental Education & Research, (in association with Institute of Open & Distance Education, Barkatullah Vishwavidyalaya, Bhopal offers the two-year Master of Disaster Control to graduates or working professionals through distance learning. The Institute is engaged in training, research and consultancy in the areas of disaster management, risk analysis, sustainable development, environmental impact assessment, pollution control and monitoring with the idea of optimal development of a global sustainable society [for further information:
PRT-I-PEER A-16 Paryavaran Complex, South of Saket, Maidangarhi Marg, New Delhi-110030, http://www.technologyindia.edu/introduction.htm

Indira Gandhi National Open University, New Delhi
IGNOU (through distance education) and Pune University (Diploma) offer Disaster Management courses after Plus Two/ equivalent, which may be completed within six months

to two years. Such programmes provide knowledge on: Disasters (the meaning, factors, significance, causes and effects); Disaster preparedness; Prevention; Mitigation; Relief; Reconstruction and Rehabilitation [for further information: http://www.ignou.org].

National Civil Defence College, Nagpur, Maharastra

National Civil Defence College, Nagpur, conducts various courses in Civil Defence and Disaster Relief Management. The training is useful for NGOs or social work students or volunteers providing support and rehabilitation measures during disasters (natural and man-made), personnel of home guards, paramilitary organizations, civil defence personnel, scientists, meteorologists, and environmentalists as well as functionaries of rural development and primary health centres, administrative services, relief workers, etc [for further information: http://ncdcnagpur.nic.in/prog-offered.htm].

Indian NGO's working in Disaster Management

A state wise list of a large number of Non Governmental organizations working in the area of Disaster Management can be procured from the following site:
http://www.indianngos.com/issue/disaster/disasterngo.htm

Selected International & National organization providing Disaster Management support

- Indian Red Cross Society
- Indian Institute of Tropical Meteorology
- UNDP India
- Tata Energy Research Institute
- Housing and Urban Development Corporation Ltd. [HUDCO]
- Ministry of Urban Development

Annexure XI National Disaster Management Policy of India

Traditionally, relief in the wake of natural calamities has been treated as the primary responsibility of the States. Successive Finance Commissions have also reiterated this position. Even though the States are primarily responsible for relief activities, the Central Government associates itself with measures aimed at ameliorating the sufferings of the people on account of natural calamities. Towards this end, the Central Government, with its resources, physical and financial does provide the needed help and assistance to buttress relief efforts in the wake of major natural calamities. The dimensions of the response at the level of National Government are determined in accordance with the existing policy of financing the relief expenditure and keeping in view the factors like (i) the gravity of a natural calamity, (ii) the scale of the relief operation necessary, and (iii) the requirements of Central assistance for augmenting the financial resources at the disposal of the State Government.

Types of Response:

The Central response can be:

(i) Policy response,. and

(ii) Administrative response.

Policy response:

The policy response to a natural calamity would be provided by the Prime Minister, Cabinet Committees and the Agriculture Minister. The objectives of policy response would be:

(a) to empathise with the sufferings of the people affected by natural calamity., and

(b) to sub-serve long term and short term policy objectives of the Government.

Administrative response:

The response of the administration to a situation arising out of a natural calamity can be on account of:

i. a follow-up of a policy objective of the Government;
ii. the need for an assessment of the situation and for a central response;
iii. States' requests for central assistance; and
iv. the need for information as a governance objective.

Central response:

Central Government's response, at the policy level, to a natural calamity would lead to Central initiatives in the form of:

i. visits of the calamity affected areas by President, Prime Minister and other dignitaries;
ii. activating the administrative machinery for assisting in relief measures; and
iii. setting up a machinery for implementing, reviewing and monitoring of relief measures.

The administrative response at the Central Government level would broadly relate to:-

i. operational requirements; and
ii. provision of Central assistance as per existing policy.

The operational aspects of the administrative response could, further, be classified into:-

i. Primary relief functions, and
ii. Secondary relief functions.

The primary relief functions of the Central Government would relate to:

i. Forecasting and operation of warning system;
ii. Maintenance of uninterrupted communication;
iii. Wide publicity to warnings of impending calamity, disaster preparedness and relief measures through TV, AIR and Newspapers;
iv. Transport with particular reference to evacuation and movement of essential commodities and petroleum products;
v. Ensuring availability of essential commodities at reasonable prices particularly the commodities through the Public Distribution System;
vi. Ensuring availability of medicines, vaccine and drugs;
vii. Preservation and restoration of physical communication links;
viii. Investments in infrastructure; and
ix. Mobilisation of financial resources.

The secondary functions of the Central Government which supplement the States' relief efforts, would relate to:

i. Flood/inflow forecasts from the Central Water Commission;
ii. Relief, rehabilitation and restoration through military aid to civil authorities;
iii. Contingency plans for crops, cattle preservation nutrition and health measures;
iv. Technical and technological inputs for provision of drinking water;
v. Technical assistance in the water budgeting and water management for various uses;
vi Coordination of the activities of the State agencies and voluntary agencies.

Annexure XII The Sikkim Disaster Management Act, 2006[3]

SIKKIM GOVERNMENT GAZETTE

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No. *381LD/06*
Dated: 4.7.2006.

Notification

The following Act passed by the Sikkim Legislative Assembly having received the assent of the Governor on 15th day of June 2006 is hereby published for general information:

THE SIKKIM DISASTER MANAGEMENT ACT, 2006
ACT NO. 15 OF 2006

An Act to provide for effective management of disaster, for mitigation of effects of disaster, for administering, facilitating, coordinating and monitoring emergency relief during and after occurrence of disasters and for implementing, monitoring and coordinating measures for reconstruction and rehabilitation in the aftermath of disasters, in the State and for matters connected herewith or incidental thereto.

Be it enacted by the Legislature of Sikkim in the Fifty-Seventh year of the Republic of India as follows:-

Chapter I Preliminary

Short title, extent commencement

1. (i) This Act may be called the Sikkim State Disaster Management Act, 2006
(ii) It extends to the whole of the State of Sikkim.
(iii) It shall come into force on such date as the State Government may, by notification in the official Gazette, appoint.

Definitions

2. In this Act, unless the context otherwise requires, -

[3] S.G.P.G - *205lGszettel150 Nosl Dt:- 7. 7.2006.*

a. "Affected area" means the area declared as such under clause (2) of section 16 of this Act;
b. "Authority" means the Sikkim State Disaster Management Authority established under section 5 of this Act;
c. "Capacity building" means building of capacity to cope up with any disaster and includes:
    i. Identification of existing resources relevant to any disaster and to be acquired for the purpose of this Act;
    ii. Acquiring and creating resource, organization and training of groups in local community; and
    iii. Coordination of such training;
d. "Commissioner" means Relief Commissioner for Disaster Management Department in the State;
e. "District Collector (DC)" or "District Magistrate (DM)" means an Officer in charge of an Administrative District as notified under the provisions of Criminal Procedure Code 1973;
f. "Disaster" means an actual or imminent event, whether natural or otherwise occurring in any part of state which causes, or threatens to cause, all or any of the following;
    i. Widespread loss or damage to property, both movable or immovable; or
    ii. Widespread loss of human life or injury or illness to human beings; or iii. Widespread loss of livestock or illness to livestock; or
    iv. Damage or degradation of environment;

    and any of the effects specified in sub- section (a) to (d) is such that it is be beyond the capacity of the affected community to cope up with using its own resources and which disrupts the normal functioning of the community;
g. "Disaster Managemenf' means a continuous and integrated process of planning and implementation of measures, with a view to:
    i. mitigating or reducing the risk of disaster;
    ii. mitigating the severity or consequence of disaster; iii. capacity building;
    iv. emergency preparedness;
    v. assessing the effects of disaster;
    vi. providing emergency relief and resource; and
    vii. post - disaster rehabilitation and reconstruction;
h. "emergency preparedness" means the state of readiness which enables stakeholders to mobilize, organize and provide relief to deal with an impending or actual disaster or the effects of disaster;
i. "Local Authority" means a municipal corporation,municipal council, urban local bodies, Zilla Parishad, Gram Panchayat, legally recognised traditional institutions or any other institution declared by State Government;
j. "mitigation" means measures aimed at reducing the impact or effects of a disaster;
k. magistrate means judicial magistrate.
l. Prevention" means measures, the object of which is to avoid the occurrence of disaster:

m. "reconstruction" means repair and reconstruction of a property undertaken after a disaster;

n. "rehabilitation" means any activity the object of which is to restore normalcy in condition caused by a disaster;

o. "relief" means measures taken during or immediately after a declaration of disaster to diminish, or alleviate any suffering, pain, injury or distress or hardship caused on account of disaster;

p. "Secretary" means Secretary for disaster management Department in the State; q. "Stakeholder" includes-

- the State Government;
- any statutory functionary;
- voluntary agencies;
- any other person! agency identified by the State Government;
- which participate in any manner in activities related to disaster management.

Chapter II
Authorities for Disaster Management

3. For the purpose of carrying out the objects of this Act, the following shall be the authorities, namely:-
   (a) The State Government;
   (b) the Sikkim State Disaster Management Authority,
   (c) Heads of Government Departments,
   (d) Commissioner! Secretary, Disaster Management Department,
   (e) District Magistrate! District Collector in charge of a District;
   (f) Sub-Divisional Magistrate;
   (g) Block Development Officer;
   (h) Local Authorities.

Chapter III Functions of State Government

4. (1) The State government shall ensure that all the authorities specified in section 3 and stakeholders shall take such measures, as are necessary or expedient for the purpose of managing a disaster and mitigating its effects.

(2) In particular and without prejudice to the generality of the provisions of sub section (1) such measures may include the following: -
   (a) ensuring that appropriate policies and guidelines are developed;
   (b) revamping the Land Revenue Department to include all the aspects of Disaster Management and redesigning it as Disaster Management Department with enhanced areas of responsibilities to include mitigation, prevention and preparedness;
   (c) ensuring the involvement of all departments of Government, local authorities, and any other organization, whose services are required for Disaster Management;
   (d) mainstreaming Disaster Mitigation/ prevention into the development

process;

(e) promoting techno-legal regimes for safe construction practices;

(f) ensure that State Building Codes are modified to incorporate the BIS codes/ National Building Codes;

(g) enhancing the capacity of Urban Local Bodies to enforce compliance of technolegal regimes;

(h) ensuring that the State search & rescue team is constituted, equipped and made functional;

(i) ensuring that capacity building institutions are identified and made functional;

(j) ensure that State Relief Code is modified to incorporate mitigation, preparedness and planning measures and rename it as State Disaster Management Code;

(k) ensuring that the State Administration and local authorities shall take into consideration the guidelines laid down by the State Government while planning its activities;

(I) ensuring that State Response Plan, Emergency support function structure are prepared and tested;

(m) ensuring that State and District Emergency Operation Centers are established, equipped and made functional;

(n) ensuring that a comprehensive communication and technology network is established and maintained;

(0) developing simplified user friendly warning protocols up to the district level and ensuring its communication to community;

(p) facilitating procurement related to disaster management of materials, equipments and services in connection with the disaster management and ensuring their quality; (q) ensuring that disaster management plans at State /District! gram pancahayWillage are prepared and training for managing the disaster is imparted;

(r) putting appropriate Standard Operating procedures for Incident Command System at each level for professional management of disaster;

(s) evolving a policy in conformity with the existing guidelines for receipt of funds from outside Government for Disaster Management;

(t) promoting adequate risk transfer, risk sharing and cost sharing mechanism;

(u) ensuring that adequate funds are available for Disaster Management; (v) ensuring appropriate recovery measures;

(w) taking such steps and issuing such direction as may be necessary to prevent escalation of the disaster or to alleviate, contain or minimize the effects of the disaster;

(x) promoting scientific studies into the area of disaster risk reduction and ensuring its application in better disaster management;

(y) institutionalizing knowledge and lessons learnt in the process of disaster management;

(z) promoting regional co-operation in terms of man, material and knowledge sharing in the field of disaster management by involving North Eastern Council.

(3) Subject to provision of this Act, the State Government, may in exercise of its power and performance of its function under this Act, issue -a direction in writing to a person or authority for the purpose of avoiding an imminent damage arising out of a disaster or mitigation of its effects and such person or authority shall comply with such direction.

(4) Subject to the provision of this Act, the State Government may in exercise of its powers and performance of its function, under this Act suspend operation of any executive order if such executive order prevents, hinders or delays any necessary action in coping with disaster.

5. Establishment of State Disaster Management Authority

(1). The State Government shall. by notification in the official gazette, establish an Authority in the name of the Sikkim State Disaster Management Authority with effect from such date as may be specified in the notification.

(2). The Authority shall consists of Chairperson and not more than twenty other members as follows, namely-

a. The Chief Minister of Sikkim, Ex officio, who shall be the Chairman,
b. Seven Ministers nominated by the Chief Minister,
c. The Chief Secretary of the State, ex- officio;
d. The Additional Chief Secretary, Ex-officio;
e. The Commissioner/Secretary, Disaster Management Department, Ex officio;
f. The DGP of the State, ex officio;
g. Such other officers of the State Government as may be appointed by virtue of their office.
Provided in case of proclamation under article 356 of the Constitution, the Central Govt. may nominate five members in place of SI. No. (a) and (b) above till its operation.

(3) a. The Authority shall take appropriate action to facilitate all the actions specified in section 4 above.
b.The authority shall lay down policies and monitor mitigation, prevention and preparedness and also oversee response.

Chapter IV
Function of Departments of the State Government

6. (1) The Government Departments of the State shall: _
(a) Provide assistance to Disaster Management Department, the District Collector/ District Magistrate and the local authority in setting up of

communication centers, drawing up contingency plans, capacity building, data collection, identifying and training personnel, and carrying out the activities of disaster management;

(b) Carry out relief operation under the supervision of Commissioner/District Collector;

(c) Assess the damage and carry out reconstruction and rehabilitation activities in accordance with the guidelines framed by the State Government.

(2) Every Government Department shall: -

(a) Prepare a disaster management plan as specified by the State Disaster Management Department.

(b) Co-ordinate preparation and the implementation of plan with other Departments, local authorities, communities and stakeholders;

(c) Conduct regular review and update the plan;

(d) Submit to the State Disaster Management Department the Disaster Management plan and amendment thereto.

(3) State Urban Development Department shall ensure the establishment of appropriate techno-legal regimes and its compliance in close co-ordination with State Disaster Management Department.

Chapter V
Power and Functions of the State Disaster Management Department

7. (1) The State Disaster Management Department shall generally take appropriate measures to fulfill the action spelt out in section 4 of the Act.

(2) The State Disaster Management Department shall: _

(a) Act as the central planning, coordinating and monitoring body for Disaster Management and post disaster reconstruction, rehabilitation, evaluation and assessment;

(b) Carry out the decisions of the State Government and State Disaster Management Authority for Disaster Management;

(c) Assist the State Disaster Management Authority as and when required by the Authority;

(d) Assist the State Government in formulation of policy relating to emergency relief;

(e) Provide feedback to the State Government, the Authority and Government Departments on progress and problems in Disaster Management;

(f) Promote general education and awareness on Disaster Management, emergency planning and response;

(g) Take specific measures in conformity with national road maps or State road maps for Disaster Management, whichever is applicable;

(h) Advice the District Collectors in carrying out Disaster Management activities;

(i) Formulate the mechanism for disaster mitigation analysis of all the projects/ schemes conceptualized! implemented in vulnerable areas;

(j) Assist the State Government in putting up appropriate Techno-Legal/ Techno-financial framework in place to mitigate the effects of earthquake and other disasters;

(k) Prepare suitable rehabilitation policy and recommend it to State Government for adoption;

(I) Assist the District Collectors in carrying out the Disaster Management activities in the concerned District;

(m) Co-ordinate the DM activities wherever two or more Districts are affected due to Disaster;

(n) Incorporate the local best practices in the field of Disaster Management and institutionalize the lessons through appropriate documents.

Chapter VI
Powers and Functions of the District Collector/District Magistrate

8. (1) During the period in an affected area the District of the Collector may issue directions to the officers of the Government departments and Local Authority in the affected areas, to provide emergency relief in accordance with Disaster Management Plans.

With Disaster management plans.

(2) The District Collector may: -

(a) make arrangements for release and use of available resources;

(b) regulate the traffic to, from and within the area affected by a disaster; (c) the movement to facilitate the Disaster Management activities;

(d) remove debris;

(e) conduct search and rescue operations;

(f) make arrangement for the disposal of the dead bodies by appropriate means;

(g) provide alternative shelter;

(h) provide food, medicines and other essentials;

(i) take possession and make use of any property, vehicles, equipment, buildings and means of communication on such terms and conditions as may be prescribed;

(j) construct temporary bridges or other structures;

(k) demolish unsafe structures, which may endanger the public;

(I) coordinate the relief activities;

(m) direct and compel evacuation of all or part of the population from any affected area for the purpose of preservation of life and such evacuation and for such evacuation use such force as may be necessary;

(n) disseminate information to the public to deal with the disaster.

(3) The District Collector shall: -

(a) ensure that actions for prevention of a disaster or mitigation of its effects or preparedness to cope up with such effects are carried out in accordance with guidelines as maybe prescribed;

(b) ensure the establishment, functioning of fully equipped District Emergency Operation Centre with the support of State Government;

(c) ensure management and implementation of India Disaster Resource Network;

(d) ensure the training of DistricV Sub Division / Gram Panchayat/Ward/Village officials, local bodies, community in Disaster Management;

(e) ensure that the District Disaster Management plans are prepared, revised and updated;

(f) facilitate and coordinate with local authorities to ensure that pre disaster and post disaster management activities in the District are carried out;

(g) facilitate Information, Education and Communication activities for the communities, local bodies, officials;

(h) ensure linkages between Disaster Management activities and planning;

(i) ensure that communication systems are in order;

(j) ensure that the Fire Deptt has kept fire fighting equipments functional;

(k) coordinate the relief, rehabilitation and reconstruction activities.

(l) ensure the conduct of mock drill periodically;

(m) exercise such powers as may be prescribed! delegated by the State Government in carrying out Disaster Management activities;

Chapter VII
Function of Local Authorities

9. Functions of Local Authorities

The local Authorities shall: -

(a) Ensure that its staff official members are trained in Disaster Management;

(b) Ensure that all the buildings within its jurisdiction follow the earthquake resistant design;

(c) Ensure the upkeep of all its relevant resource for its use;

(d) Carry out relief operations in the affected area subject to directions of the District Collector/ State Government;

(e) Carry out reconstruction and rehabilitation activities in accordance with the guidelines;

(f) Constitute and maintain Disaster Management Committee and Disaster Management Teams;

(g) Prepare Disaster Management plan in accordance with guidelines, update and revise it;

(h) Implement the plans in close coordination with the State Government and the District Collector;

10. Functions of State Government Departments

(1) Each Department of the Government in a district shall prepare a Disaster Management plan for the district and the District Collector shall ensure that such plans are integrated into the Disaster Management plan for the whole of the district.

(2) This plan will incorporate all features of Disaster Management as prescribed by the State Government.

(3) Each Department of the Government in a District shall be responsible for effective implementation of the plans drawn up in this behalf.

Chapter VIII
Duties of Search and Rescue Teams, Police, Fire Services, Home Guards, Civil Defense

11. (1) Where an area is declared as disaster prone area or disaster affected area under clause (a) of sub-section (2) of section16 as an affected area, the members of-

(a) Search and Rescue Teams
(b) Police Force
(c) Fire Services
(d) Home Guards
(e) Civil Defense

Shall perform the following function under the supervision of the Commissioner/ District Collector namely;
(a) giving of warning;
(b) carrying out search and Rescue operations and (c) carrying out relief and rehabilitation operations.

(2) If a disaster occurs in any area the senior most officer from amongst the members of organizations specified in clauses (a) to (e) and of local authority and Department of the Government in such area shall report to the District Collector and carry out any instructions which the District Collector may issue for providing emergency relief.

(3) The Departments of the Government in the State shall generally carry out the functions specified in its Disaster Management plan as directed by the Commissioner/District Collector.

Chapter IX
Duties of Communities, Private Sector Enterprises & other Agencies or persons

12. Duties of Community group and youth organisation
Each community group and youth organization, such as the National Cadet Corps, organizations, National Service Scheme, Nehru Yuva Kendra may-

(a) assist the State Government, the Commissioner and the District Collector in all Disaster Management activities;
(b) participate in capacity building, vulnerability reduction programmes and training activities;
(c) assist in rescue and relief operations under the supervision of the Commissioner and the District Collector;
(d) provide such assistance to the Commissioner and the District Collector and take such other steps as may be necessary for Disaster Management.

13. Duties of Factories and Public Sector Enterprises
Each factory as defined under the Factories Act 1948, shall-

(a) assist the State Government, the Commissioner and the District Collector in all Disaster Management activities;
(b) ensure that onsite and offsite plans are made in conformity with the local Disaster Management plans and tested for the implementation.
(c) take such other steps under the supervision of the Commissioner and the District Collector as may be necessary for Disaster Management;

14. Duties of voluntary agencies
All voluntary agencies, including Non Governmental Organizations, which desire to participate in Disaster Management activities, may-

(a) participate in capacity building, vulnerability reduction programmes and training activities;
(b) assist in relief operations under the supervision of the State Government, the Commissioner and the District Collector.
(c) provide such assistance to the Commissioner and the District Collector as may be necessary for effective Disaster Management.

15. Duties of citizens
It shall be the duty of every citizen to assist the Commissioner, the District Collector or such other person entrusted with or engaged in Disaster Management whenever his aid is demanded generally for the purpose of Disaster Management and particularly for the following purposes namely –

(a) Prevention,
(b) Response,
(c) Warning,
(d) Emergency operation,
(e) Evacuation,
(f) Recovery.

Chapter X
Declaration of area as Disaster Prone Area or Disaster Affected Area

16. (1) Where there is threat of impending Disaster or where a Disaster has occurred.
   (a) in an area spread over more than one District, the Commissioner, and
   (b) in an area restricted to a District, the DC may immediately make a report to that effect to State Government.

(2) (a) The State Government on receipt of such report shall declare such area as Disaster prone area or Disaster affected area through notification in the official Gazette and use other means to give wider publicity.
   (b) Where the State Government decides not to make declaration under clause (a),it shall send communication to the Commissioner or, as the case may be, the District Collector.
   (c) A notification under clause (a) shall specify the period not exceeding fifteen days during which the area shall, for the purpose of this Act, be the affected area:
   Provided that the State Government may extend such period from time to time by any period not exceeding fifteen days at anyone time.

(3) During the notified period the Commissioner or the District Collector, as the case may be, within an affected area perform such function related to-
   (a) Prevention,
   (b) Response.
   (c) Warning,
   (d) Emergency operation,
   (e) Evacuation, and
   (f) Recovery.

Chapter XI
Offences and Penalties

17. Offences and Penalties
Whoever: -
   (a) Without reasonable cause prevents or obstructs any officer of the State Government or Local Authority or Commissioner or the District Collector from carrying out functions under this Act; or
   (b) Without reasonable cause refuses to comply with the direction given by an officer of the State Government or of Local Authority or the Commissioner or the District Collector while carrying out his functions under this Act; or
   (c) Falsely predicts the occurrence of a Disaster without any scientific basis and thereby creates panic in the community; or
   (d) Makes a false claim for assistance for reconstruction or repair from any officer of the State Government or Local Authority or the Commissioner or the District Collector, shall on conviction be punishable with imprisonment for a term, which may extend to three months or with fine, which may extend to five thousand

rupees or both.

18. Cognizance of offence

(1) No magistrate shall take cognizance of offence under section 17 except on a complaint in writing made by an officer specially authorized in this behalf by the State Government or the Commissioner or the District Collector.

(2) Notwithstanding anything contained in section 200 of the Code of Criminal Procedure 1973 it shall not be necessary in respect of the offence referred to in sub section (1) to examine the authorized officer or the Commissioner or the District Collector.

Chapter XII
Miscellaneous

19. Power of entry

The Commissioner or the District Collector generally or specifically authorized by the State Government / Authority in this behalf, may, at all reasonable times, enter upon any land and there do such things as may be reasonably necessary for the purpose of lawfully performing function imposed upon them by or under this Act.

20. Power to Issue directions

(1) The Commissioner or the District Collector for the purpose of performing functions under this Act and for and for reasons to be recorded in writing issue an order directing a person to do or abstain from doing a specified thing within the affected area in which the emergency relief measures are being undertaken.

(2) Any person on receipt of such order shall comply with the same.

21. Protection of Act taken in good faith

No suit, prosecution or other legal proceedings shall lie against the State Government or any officers of the State Government or any other person for anything, which is in good faith done or intended to be done in pursuance of this Act or any rule, regulation or order made there under.

22. Power to make rules

The State Government may make rules for carrying out the purposes of this Act.

23. Saving

Save as otherwise provided in this Act, no decision made in exercise of any power conferred by or under this Act shall be called in question in any Court.

By Order
R.K. Purkayastha (SSJS) LR.
- cum- Secretary Law Department Government of Slkklm
File No.16 (82) 2006

Annexure XIII Not Just A Force of Nature at All

[Editorial, Hindustan Times, August 27, 2008]

The floods are back in Bihar. And this time the governments — the state and the Centre — can't just blame the rainfall. If anyone can be blamed for the breach in the Kosi barrage in Nepal and the calamity that has followed, it is New Delhi. Under a 1954 treaty with Nepal, the safety and maintenance of the embankment is India's responsibility. But clearly, this has not been done. The result of such a lackadaisical approach is that 50,000 people in Nepal and 2.5 million people in Bihar's five affected districts — Supaul, Saharsa, Madhubani, Darbhanga and Khagaria — have been left homeless. No wonder that Chief Minister Nitish Kumar has said this isn't a flood but a "catastrophe".

But what he or the Centre is shying away from saying is that this flood is man-made. No amount of finger-pointing at Kathmandu will change this. What is more intriguing is that Indian engineers have claimed that they could not carry out the maintenance works due to lack of cooperation from the Nepalese administration and labour strikes in Nepal. If this was the case, why didn't the authorities flag off the issue on an urgent basis? Why weren't they ready for a disaster? Moreover, the water flow in the barrage was much less than its usual capacity when the breach happened. This exposes the kind of maintenance that was done.

The other question that will be asked now is the efficacy of embanking a river. The Kosi, an embanked river, is known to carry a lot of silt. Over the years its silt load has increased, raising the riverbed. Once a river is embanked, it will find the path of least resistance. And this is what has happened — the river has gone back to its old course. This hullabaloo about the river changing its course shouldn't surprise us. This is not the first time it has happened. So nature has conspired with man to bring devastation.