Report of the Task Force

on

THE MOUNTAIN ECOSYSTEMS
[Environment and Forest Sector]
for
Eleventh Five Year Plan




PLANNING COMMISSION
GOVERNMENT OF INDIA
November 2006

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PREFACE

The detailed guidelines which were received from the Co-chair of the Steering Committee for Eleventh Five Year Plan for Ministry of Environment and Forests, soon after the task of constitution of the Working Groups and Task Forces was completed towards the end of August, 2006 , admitted itself of "the long delays" which had incurred in setting up of the groups and suggested commencing deliberations on the terms of reference "right away". The Task Force was given to understand that its deliberations were " to focus on the issues that are currently dealt with at policy and programme level in the Ministry of Environment & Forests", and recommendations of the Task Force for new programmes were also to suggest " the issues of requirement for and possible ways of mobilizing the resources."

The Task Force has tried its best to stay not only within the broad contours drawn by the letter received from the Co-chair at the very outset but also the time-frame agreed to subsequently, at the time of the mid-term review held on the 10th October, 2006.

The Task Force in its analysis and recommendations on integration of various sectors is of the firm view that the multi-faceted requirements of Indian mountain ecosystems can never be addressed by looking at it sectorally viz. agriculture, forestry, environment etc. but only through a holistic manner, working towards a mountain policy through an institutional mechanism which is over-due in India. At the national level such an institutional mechanism cannot be less than a full-fledged Ministry of Mountain Development and at the sub-national level certain administrative structures which facilitates convergence of available resources. Constitution of such a Ministry has also been considered essential to safe-guard the mountain ecosystem/state from the internal and external threats (Chapter 4). Those who are conversant with the inexorable progress of the Mountain Agenda might wish to see this realized during this Five Year Plan itself. The administrative structure suggested for the mountain and forest-predominant states, is easily one which both the Planning Commission and the Ministry of Environment & Forest may not consider as unusual as a similar approach (Agriculture Production Commissioner / Development Commissioner) has already delivered the intended results in the 1960-70s (food-self sufficiency).

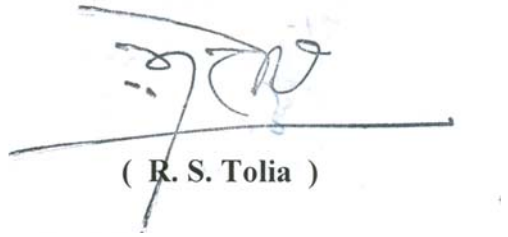
The Task Force was fortunate to receive ready and very willing co-operation of its members, all of them persons highly knowledgeable in their pertinent discipline. They brought with them not only their own knowledge and invaluable insights but also that of the extensive knowledge-net-work to which each of them seem to belong to. I extend my grateful thanks to each one of them for their co-operation and hard work. The Task Force was singularly lucky in having received fullest support, co-operation and guidance from Prof. A.N. Purohit, a member of the Steering Committee, at every stage of its deliberations.

Dr. Gopal Singh Rawat, a member of the Task Force, cheerfully and very methodically co-ordinated work relating to collection, collation and final processing of this Report.

Words fail me to thank him adequately. Dr. S.K. Khanduri, Director(Forestry), Planning Commission took more than adequate care of all which the Task Force could ever desire form the Planning Commission end. I thank him on behalf of the Task Force for the assistance rendered. Sri H.V. Lalringa, Secretary, North Eastern Council, deserve our grateful thanks for the consultations he organized and courtesies extended during our visit to the north-eastern part of the country. The insights gained during the visit are all over the Report, including some of our major recommendations. For the crafting and composition of report Prakash Upadhyaya and Rajesh Naithani deserve our appreciation

I do earnestly hope that the endeavor of the Task Force contribute in some ways towards improving health and well – being of both the mountain ecosystems and the mountain people.

30th November, 2006
Dehra Dun, Uttaranchal



Chairman, Task Force on Mountain Ecosystem

EXECUTIVE SUMMARY

1. A Task Force on Mountain Ecosystems for Environment and Forests sector for the Eleventh Five Year Plan (2007-2011) was set up by the Planning Commission, Government of India. The Office Memorandum constituting the Task Force, with its five Terms of Reference, is annexed (Annexure 1). The Task Force convened two full meetings, at Dehra Dun, on and respectively; in between visited the headquarters of the North Eastern Council (NEC) for consultations with the officials, experts and developmental practitioners; ICAR campus at Bara Pani, NE Hill University, Shillong and held discussions on the topics covered by the ToR with a wide range of environment scientists, educators and activists, both in NGOs and CBOs. The Task Force also visited IIRS, Dehra Dun and RRSSC, Shillong and University of Agriculture & Technology, Pantanagar in its round of consultations. Individual members of the Task Force remained in continuous touch, both electronically and otherwise, and were encouraged to contribute electronically to the drafting committee of the TF, as the time given to the Task Force was admittedly very brief.

2. The mountain ecosystems in this report include all the geographical limits of Himalaya and North-eastern states within Indian territory, collectively termed as Indian Himalaya Region (IHR). This region covers nearly 18 % of the country's geographical area which include 11 Indian states and two hill districts of West Bengal. The area is spread over four Biogeographic zones *viz*., the Indian Trans-Himalaya, the Greater Himalaya, North-east India and parts of Upper Gangetic and entire Brahmaputra flood plains.

3. The IHR, a land of many superlatives, is recognized as one of the important global 'Biodiversity Hotspots'. It encompasses a diverse array of ecosystems, varied environmental conditions and unique cultural landscape. The region plays an important role in shaping the regional climate, carbon sequestration and provides numerous Ecosystem services (Box 1.2) to man kind. Yet, the mountain people suffer from socio-economic marginality, inaccessibility, and lack of livelihood opportunities.

4. An analysis of current knowledge and status of sustainable use of mountain ecosystems (**TOR 1**) reveals that the floral and faunal surveys conducted so far cover only higher taxa and lower groups have been left out. Similarly, ecosystem functioning and valuation of ecosystem services have been paid little attention. A number of gaps have been identified in natural resource management, *albeit* there are quite a few wise resource use practices and new initiatives both at community and management levels. Recommendations for better resource management include: (i) subsidy for fossil fuel to the hill communities, (ii) modernize forest and wildlife management, (iii) strengthen agro-forestry in the region in the light of Shillong Declaration, (iv) improve PA-People relationships, (v) participatory resource management, and (vii) more research on the ecosystems services and functioning in the mountain areas (Chapter 1).

5. Chapter 2 deals with an analysis of available information on potential impacts of climate change on the mountain ecosystems (TOR 2). The existing information on the subject is inadequate to develop predictive models on ecosystem response to climate change. Major recommendations for the IHR (besides recommendaqtion for strict adherence of Kyoto Protocol at the country level) include: Establishing a network of meteorological stations and adequate infra-structure for integrated climatological research across the IHR; Revamping Clean Development Mechanism across IHR; Monitoring glacial recession and extending glaciological programmes to Eastern Himalaya; Disease surveillance and developing forecasting system for vector borne diseases; Bio-prospecting for future crops, and Long term ecological research on climate – endangered species - ecosystem relationships (Chapter 2).

6. A thorough review of Institutional and individual capacities available to address issues related to conservation and sustainable use of mountain ecosystems (TOR 3) reveals that while there are a number of Government Institutions and Universities working in the IHR with varying capacities, capabilities and geographical coverage, very little efforts have been made to harness their expertise for the conservation and development of IHR. Certain priority areas have been identified for capacity building *viz.,* Training on EIA Procedures, Green Roads Engineering, Technology for management of hazardous waste, Mountain Hydrology, Water Harvesting Technology, and Rangeland Management. New Institutes visualized are Mountain Farming System Research and Centre for Mountain Studies.

   All organizations working in the IHR are required to be brought together to address the vital environmental issues. This could be possible through (i) giving new role to local traditional institutions based in rural areas, (ii) crating a synergy amongst different organizations, mountain scholars, and social workers, and (iii) recognizing social institutions, social sanctions, local culture and traditional knowledge systems (Chapter 3).

7. In order to integrate concerns relating to mountain environment including integration of ministries (TOR 4) the TF feels that the sectoral approach which has been taken so far would not be of much use to integrated mountain environment and development. Since creation of a separate Ministry of NER has already brought some integration in the area, there exists a strong case to enlarge the scope of this existing Ministry to be renamed as **Ministry of Mountain Development** incorporating the three states of NW Himalaya viz. Uttaranchal, Himachal Pradesh and Jammu & Kashmir. This would be the most logical step for an integrated planning of the Himalayan region at the national level to be supported by constituting Forest & Rural Development Commissioner Branch at the state level. Detailed analysis of has been given along with integrated programmes for IHR (Chapter 4).

8. Chapter 5 reviews the new EIA guidelines issued by MoEF in 2006 and suggests certain measures to strengthen the State Environment Impact Assessment Authorities (SEIAAs) including strict compliance of EMPs and CAT Plans. While the new Notification gives more autonomy to the states for clearance of development projects, none of the Himalayan states have so far notified SEIAAs.

There is a need to promote Integrated River Valley Authorities for management of river basins, considering upstream and downstream inflows and withdrawals by season, interface between land and water, pollution loads and natural regeneration capacities to ensure maintenance of adequate flows, in particular for maintenance of in-stream ecological values, and adherence to compliance of EMPs. The income accruing out of the 12% free power to the host-state ought to be dedicated to the development of catchment development and it should be made mandatory as a sanction condition and its monitoring also needs to be strengthened.

Based on a critical analysis of existing policies and procedures recommendations have been given developing rules for use of timber species planted under Agroforestry (in revenue land); evolving policies on NTFP and MAPs collection, Livestock Grazing in IHR; Cadastral surveys for rehabilitation of people and reducing conflicts in NER; Policy on traditional hunting in NEHR and case of wild pigs in NW parts of IHR; Policy on sharing benefits from HEPs with the local communities; Policy on collection of lichens and mosses from the mountain forests and revisiting Hanumantha Rao Committee Report on the definition of geographical limits of cold deserts that has kept the cold arid regions of Uttaranchal and as a result various schemes for desert development have not reached such areas.

It is reiterated that only way to integrate the concerns relating to fragile mountain ecosystems into other sectors (ministries, departments) and drawing up of a Mountain Policy is to upgrade the Ministry of DONER to **Ministry of Mountain Development** by incorporating the three states of NW Himalaya (Chapter 4). Appropriate administrative and resource allocation mechanisms have been suggested. Any other attempts at 'coordinating' various schemes / programmes of related Ministries/Departments in the name of 'systems of integrating concerns relating to fragile mountain ecosystems' are bound to be non-productive and fail.

Summary of recommended administrative arrangements, programmes and activities is given in following Table (Table 1.0).

Table 1.0: Summary of Recommended Administrative Arrangements, Programmes and Activities

Biodiversity (BD) Environmental Conservation	Mitigating Impacts of Climate Change	Strengthening Institutions	Integration of Various Sectors	EIA, Laws, Policies & Practices
Value Ecosystem Services & Mountain BD; Provide fuel subsidy to mountain people	Establish Network of Meteorological Stations across IHR and initiate an Integrated Study on Climate Change	Strengthening the Existing Government Institutions; Establish Centres of Excellence	Establish Legal and Institutional Mechanism - **Ministry of Mountain Development**	Strengthen SEIAAs; Bring uniform and transparent EIA Policy for the IHR
Modernize Forest & PA Management	Intensify recession of glaciers; Extend Glaciology program to EH	Technical backing to line departments viz., Forest, Panchayati Raj Institutions; PWD)	In states create FRDC Type of Administrative Structures	Notify ESAs in IHR (Priority ESAs: Rivers, Glaciers, wetlands)
Improve PA – People relationship; Establish Community Conservation Reserves	Map and monitor GLOF, flash floods and hill aquifers	Link Traditional Knowledge System with the Formal Knowledge System – Learn from the Farmers	**Integrate** Rangeland Mgmt and Wildlife Conservation	Evolve policies on: MAP collection, Livestock Grazing Plantation of exotics Traditional hunting Disaster Mgmt
Enhance Natural Regeneration of Forests	Promote use of modern technology to harness renewable energy resources	Evolve mechanism to attracting and retaining the talent in IHR	**Integrate** Watershed develpt, Rural Livelihoods and BD Conservation	Customary Laws and Codification, Land consolidation and settlement of forest villages
Link BD Conservation with Rural Livelihoods	Revamp Clean Development Mechanism; Plan Green Cities, Green Industries	Initiate new centers on Green Roads Engineering, Mountain EIAs, Hydrology, Water Harvest Tech. Rangeland Mgmt, Hydropower Engg	**Integrate** Eco-tourism as livelihood for the mountain people; Mountaineering with purpose	Revisit Hanumanta Rao Committee Report on the definition of cold deserts
Habitat Restoration and Species Recovery Program ; Control and Utilization of Alien Invasive Species	Integrated Disease Surveillance & Forecasting System for Vector borne diseases	Strengthen CBOs viz., Van Panchayats, VCs, Environmental Education & Community Forestry for the CBOs	**Integrate** Agro-forestry and Community Forestry in NEHR	Non-lapsable budget as in NEHR – adopt all across IHR
Participatory Resource Management - Community Forestry for NEHR	Initiate Studies on impacts of HEPs on local and regional climate	Encourage better coordination between the Centre and State research and development agencies	**Integrate** Organic Farming and Integrated Pest Management	Deploy revenue out of 12% free power to CATP
Conservation of Agri-biodiversity; Promote organic farming; Begin Village BD Registers	Initiate Bio-prospecting for future crops	-	-	Evolve and implement Policies on Urban Environmental Restoration in IHR:
Participatory Action Research on Mountain Environment, BD & Ecosystems	-	-	-	-
In the States create F.R.D.C. type Administrative Structures				
Establish Ministry of Mountain Development to coordinate and execute all the Policies and Programmes in IHR				

ACRONYMS USED IN THE REPORT

AIS	-	Alien Invasive Species
BARC	-	Bhabha Atomic Research Centre, Mumbai
BD	-	Biodiversity
CAT	-	Catchment Area Treatment
CADA	-	Command Area Development Agency
CDH	-	Conservation, Development & Harvest
CDM	-	Clean Development Mechanism
CPA	-	Central Plan Assistance
CPR	-	Common Property Resources
CR	-	Conservation Reserve
CSIR	-	Council of Scientific and Industrial Research
DBT	-	Department of Biotechnology
DST	-	Department of Science & Technology
DRDA	-	District Rural Development Agency
EIA	-	Environmental Impact Assessment
ES	-	Ecosystem Service
EH	-	Eastern Himalaya
GBPIHED	-	GB Pant Institute of Himalayan Environment & Development
FRDC	-	Forest and Rural Development Commissioner
GBPUAT	-	GB Pant University of Agriculture & Technology
GIS	-	Geographical Information System

GoI	-	Government of India
HADP	-	Hill Area Development Programme
HESCO	-	Himalayan Environmental Studies & Conservation Organization.
HEP	-	Hydroelectric Project
ICAR	-	Indian Council of Agricultural Research
ICFRE	-	Indian Council of Forestry Research and Education
ICIMOD	-	International Centre for Integrated Mountain Development
IDPL	-	Indian Drug and Pharmaceutical Ltd
IFAD	-	International Fund for Agricultural Development
IHR	-	Indian Himalaya Region
IKS	-	Indigenous Knowledge System
IIRS	-	Indian Institute of Remote Sensing
INTACH	-	Indian National Trust for Art and Cultural Heritage
JFM	-	Joint Forest Management
LWRM	-	Land and Water Resource Management
MAPs	-	Medicinal and Aromatic Plants
MIDC	-	Meghalaya Industrial Development Corporation
MoEF	-	Ministry of Environment and Forests
MDoNER	-	Ministry of Development NER
MPCA	-	Medicinal Plant Conservation Area
MoD	-	Ministry of Mountain Development

NBSAP	-	National Biodiversity Strategy and Action Plan
NEC	-	North East Council
NEHU	-	North Eastern Hill University
NEHR	-	North-Eastern Hill Region
NGO	-	Non-Governmental Organization
NGRI	-	National Geophysical Research Institute
NRM	-	Natural Resource Management
NTFP	-	Non-Timber Forest Produce
PA	-	Protected Area
PC	-	Planning Commission
PSRA	-	Permanent Seed Resource Area
PWD	-	Public Works Department
R & D	-	Research and Development
RF	-	Reserved Forest
SBSAP	-	State Biodiversity Strategy and Action Plan
RRSSC	-	Regional Remote Sensing Service Centre
TF	-	Task Force
USF	-	Unclassed State Forest
WH	-	Western Himalaya
WP	-	Working Plan
WIHG	-	Wadia Institute of Himalayan Geology
WII	-	Wildlife Institute of India

INTRODUCTION

The Himalaya and adjacent mountain ranges in the north-east region within Indian territory, collectively known as Indian Himalaya Region (IHR), represent highly fragile and vulnerable **Mountain Ecosystems** in the country. These ecosystems, among others, have been accorded high priority for conservation and development by the Planning Commission (PC) during the 11th V Year Plan. Accordingly a Task Force was set up (Annexure 1) by the PC with the following Terms of Reference:

1. Review the current status of knowledge on various environmental aspects of conservation and sustainable use of mountain ecosystems and recommend correctives.

2. Assess the potential impacts of climate change on mountain ecosystems and recommend required new or remedial measures of dealing with these impacts.

3. Review the institutional and individual capacities available to address issues related to conservation and sustainable use of mountain ecosystems and recommend how they may be adequately strengthened.

4. Assess the current issues and systems of integrating concerns relating to fragile mountain ecosystems into other sectors (ministries, departments) and to recommend required new or remedial measures.

5. Review the current EIA procedures, laws, policies and practices as being applied in the mountain ecosystem context and recommend corrective measure to address significant issues that specifically arise in the context of these fragile ecosystems.

The TF arranged a series of consultation meetings with the policy planners, academicians, NGOs, conservationists and natural resource managers in the region. The TF noted that presently the PC is in the process of evaluating the implementation of plans proposed under the Hill Area Development Plan (HADP) and Western Ghats

Development Programme (WGDP) with a view to assess the impact of the programme and also to bring improvements wherever required. The task of evaluation has been entrusted to the 'Planning and Evaluation Organization' of the PC and the report of which is expected to be out before the commencement of the 11th V Year Plan (2007-2011). Hence the present TF on the mountain ecosystems has not included Western and Eastern Ghats in this report.

The TF has reviewed the mid term appraisal of the 10th V Year plan which points out that in order to maintain healthy environment it is important to (i) Prevent land degradation, (ii) Controlling floods and droughts, (iii) Prevent desertification, (iv) Conservation of fragile ecosystem, (v) Prevention of deforestation, (vi) Conservation of BD, and (vii) Mitigating water and air pollution. Most of these issues are relevant to the Mountain Ecosystems and accordingly, due attention has been paid while recommending corrective measures in this report. The TF has analyzed the recommendations of earlier committees and TFs on the mountain ecosystems (Annexure 2) and feels a urgent need for coordination and integration of policies and programmes for the IHR at a much higher level than attempted before.

The main report has been presented in following five chapters, each corresponding with the given TORs. A few lessons and replicable practices are given along the text in the form of Boxes. Appropriate tables and annexures including proceedings of a recent meeting of the Forest Ministers from the Himalayan States (Annexure – 7: Doon Charter) and progress made in understanding the age-old traditional practice of shifting cultivation, as brought out in the Shillong Declaration (Annexure 8) have been given.

1.0 STATE – OF – THE - ART ON INDIA'S MOUNTAIN ENVIRONMENT

1.1 Physical Environment

1.1.1 General

The Himalaya and adjacent hill ranges in the north-eastern India represent a complex array of physical and geo-political environment, well known for geo-hydrological, biological, aesthetic and cultural values. The region, collectively referred to as Indian Himalaya Region (IHR) in this document, encompasses a series of lofty ranges many of which exceed 7000 m above sea level, alpine meadows, lake basins, cold deserts, inter-montane valleys, deep gorges, snowfields, glaciers and alluvial plains. Some of the Asia's mighty rivers namely Indus, Sutlej, Ganges, and Brahmaputra and their numerous tributaries flow through these ranges which support a myriad of human civilizations along their fertile valleys.

Although the main Himalaya and the hills of North-eastern states have a number of similarities in their physiography and ecology, they differ inherently in terms of origin and evolution. The former ranges, geologically young and tectonically active, were formed as a result of massive collision between Eurasia and the northward-drifting Indian plate nearly 40 million years ago. As the Indian plate is still moving northward, the Himalayan ranges continue to be pushed upwards at the rate of about 5 cm / year. On the other hand the Khasi, Jaintia and Patkai ranges of North Eastern Hill Region (NEHR) are of ancient origin.

1.1.2 Glaciers and hydrology

The main Himalaya is divisible into four morpho-tectonic belts each with peculiar lithological features. The outermost range, popularly known as Shivalik or Outer Himalaya, represents the youngest range comprising fragile sandstones and siltstones. The second range, Lesser Himalaya consists of meta-sedimentaries superposed by older blocks or nappes. The highest range i.e., Higher Himalaya or the Himadri comprises the crystalline rocks which are sparsely vegetated and largely covered by glaciers and snow. The mountain ranges north of the higher Himalaya, frequently termed as trans-Himalaya or cold deserts, are dry, exposed and frequently devoid of green vegetation cover due to extremely harsh climatic conditions.

The higher Himalaya houses largest snow mass outside the polar region and also gives rise to most important glacier systems in the world. These glaciers form the source of most of north India's river systems, which form the life line for the millions of people living in their lower basins. Hence they are regarded as important 'water towers' on earth. According to the Geological Survey of India, there are more than 5000 glaciers in the Indian Himalaya covering about 38,000 km^2 area. The distribution of glaciers in the Himalaya is uneven due to complexity of mountain ranges, altitudinal variation and different climatic environment.

Generally, the north-western Himalaya has higher concentration of glaciers as compared to the eastern Himalaya. Some of the important glaciers are listed in below.

Table 1.1 : Important glaciers of IHR and their location

SN	Name of Glacier	Length Km.	Geographical /Location	Altitudinal Range
1.	Siachen	72	Karakoram	3800-7000
2.	Hispar	62	Karakoram	3400-6000
3.	Baifo	69	Karakoram	3500-6200
4.	Batura	59	Karakoram	3600-6200
5.	Kolahai	06	Kashmir	3600-5100
6.	Machai	08	Kashmir	3400-5000
7.	Shishram	06	Kashmir	3800-5200
8.	Liddar	05	Kashmir	3600-5200
9.	Bara Shigri	30	Himachal	4000-6200
10.	Chhota Shigri	09	Himachal	4000-6000
11.	Sara Umga	17	Himachal	3900-6000
12.	Parvati	08	Himachal	4000-5800
13.	Samudra Tapu	09	Himachal	4000-5900
14.	NorthNanda Devi	19	Uttaranchal	4000-6000
15.	SouthNanda Devi	19	Uttaranchal	4100-6100
16.	Trisul	15	Uttaranchal	3900-5800
17.	Gangotri	30	Uttaranchal	4000-6200
18.	Dokriani	05	Uttaranchal	3900-6200
19.	Chorabari	07	Uttaranchal	3900-6200
20.	Gantotri	19	Uttaranchal	4100-6200
21.	Chowkhamba	12	Uttaranchal	4000-5900
22.	Satopanth	13	Uttaranchal	4000-6200
23.	Pindari	08	Uttaranchal	4200-5600
24.	Milam	19	Uttaranchal	3900-6200
25.	Zemu	26	Sikkim	4400-5900
26	Khangchendzonga	16	Sikkim	4200-6000

The Himalayan rivers carry enormous silt and fertile soil that influences agro-economy in the plains. The perennial river system of the Himalaya is fed by melt water contributions from snow cover, glaciers and permafrost regions. The total amount of water flowing from the Himalaya to the plains of the Indian subcontinent is estimated to be about 8.6×10^6 m^3 per year (IPCC, 2001); out of which the contribution of snow to the runoff of major rivers in the eastern Himalaya is about 10% (Sharma, 1993) and more than 60% in the western Himalaya (Vohra, 1981). In the IHR besides rivers, streams, lakes, ponds, groundwater through springs are the main sources of water for drinking and household consumption. In recent years, attention has been drawn towards decline in the discharge of springs.

The IHR exerts a considerable influence on weather patterns throughout the South Asia. The moisture-laden monsoon wind from the Indian ocean is blocked by the Great Himalayan range or funneled through the Ganges and Brahmaputra valleys. The winds deluge the eastern extent of the mountain range, while the western extent remains relatively drier. The water flows back into the Indian Ocean along the rivers that drain the southern slopes, carrying with them sediments eroded from the unstable, steep mountains. The

sediments are deposited along the foothills to form extensive and highly productive alluvial plains of unconsolidated sediment traversed by innumerable braided rivers.

1.1.3 Natural Hazards

The Himalayan frontal arc is one of the seismically active regions of the world. The 50 km wide zone between the Main Boundary Thrust (MBT) and the Main Central Thrust (MCT), is seismically most active. This zone is also known as the Main Himalayan Seismic Belt in which the massive earthquakes (M>8) have been occurring along the detachment surface that separates under-thrusting Indian plate from the Lesser Himalaya. In addition to four great earthquakes of magnitude exceeding 8 (1897 Assam, 1905 Kangra, 1934 Bihar-Nepal and 1950 Assam) another 10 earthquakes exceeding magnitude 7.5 have occurred in the Himalayan belt during the past 100 years. The regions between the epicenters of these earthquakes, known as the seismic gaps, are the potential sites for future big earthquakes.

The IHR is prone to landslips, landslides, flash floods and other changes in the surface topography owing to high seismic activity and fragility of the land mass. Recurrent landslides cause heavy damage to property, disruption of road communication and loss of human lives every year. Notable among such events are Malpa landslide in the Kali valley (1998), Varunavrat landslide in Uttarkashi (2003) and a series of landslides and flash floods in the Satluj valley during 2000 and 2005. The landslide and other mass movement activities are essentially periodic, generally limited to the monsoon rainfall which acts as trigger for inducing the slope instability. The number, frequency and damage due to landslides are determined mainly by geological, geo-morphological, hydrological, landuse, climatic and anthropogenic factors. In the IHR the damage caused by the landslides is estimated to be more than Rs. 50 every year, causing more than 200 deaths annually which is about 30% of the total such losses worldwide (Annexure : 3).

The atmospheric temperature increase brought about by global climate change has resulted in the shift of monsoon pattern accompanied by an increase in intensity of rainfall and cloudbursts and heavy landslides during recent years (Sah and Mazari, 1998). Earthquakes are also responsible for generating landslides on an extensive scale and further augmentation of the same during the monsoon period, as is evident in many parts of the Garhwal Himalaya during recent earthquakes. Among the four belts in the IHR, rock falls and avalanches are common in the Higher Himalaya due to high relief. On the other hand, the Lesser Himalaya, a belt of medium-high relief features comprising sedimentary rocks overlain by nappes of crystalline rocks, is prone to landslides and other mass movements.

The IHR is also susceptible to hazards like glacial lake outburst floods (GLOF). The occurrence of GLOF in high mountains poses many problems for inhabitants and their infrastructure such as heavy loss of human life, damage to agricultural crops and property and destruction of hydro-electric projects. GLOF also causes rapid filling of reservoirs. Damage to settlements and farmland can take place at very great distances from the outburst source. Avalanches are other glacial hazards. Although the avalanche zone lies in

the snow-clad Higher Himalayan belt which is sparsely populated, nevertheless this hazard poses dangers on highways which pass underneath.

1.2 Biological Diversity

Owing to an unique biogeographic location i.e., at the junction of Palearctic and Indo-Malayan Realms, wide altitudinal range, topographic variation and numerous habitats, the IHR harbours a rich array of flora and fauna. The region as a whole, and NEHR in particular, is regarded as one of the global biodiversity hotspots (Box 1.2). A brief review on the current knowledge on the flora and fauna of the region follows :

1.2.1 Flora

Traditionally, the IHR has been recognized as distinct phytogeographic zone with two sub-divisions viz., Western Himalaya (WH) and Eastern Himalaya (EH). Floristically the WH has been well explored compared to EH. A review of existing information on the Himalayan Flora reveals that there are approximately 10,000 species of vascular plants in the IHR, that forms more than 50 % of the Indian Flora. Of these, about 3,160 species are endemic or near-endemic. Most dominant families of flowering plants in the IHR include Orchidaceae (750 species), Asteraceae (734 species), Poaceae (520 species), and Fabaceae (507 species). Five families viz., Tetracentraceae, Hamamelidaceae, Circaeasteraceae, Butomaceae, and Stachyuraceae and over 90% of the species in Berberidaceae and Saxifragaceae are endemic to the IHR. The genera endemic to IHR include *Jaeschkea, Parajaeschkea, Drimycarpus, Listrobanthes, Megacodon, Pseudoachranthera, Pseudostachyum, Pteracanthus, Sympagis, Catamixis, Physolena, Pottingeria, Roylea, Trachycarpus* and *Triaenanthus*. *Drimycarpus* and *Parrotiopsis* are monotypic genera that represent arborescent taxa, while *Listrobanthes, Megacodon, Pseudaechmanthera, Pseudostachyum, Pteracanthus* and *Triaenacanthus* are shrubs. A large number of orchids, many representing neo-endemic taxa, have been recently reported from Sikkim and Arunachal Pradesh, which indicate need for further explorations in the region.

Inventories on the lower groups of plants from the IHR are far from being complete. It is estimated that there may be about 13,000 species of fungi and around 1,100 species of lichens in the IHR. Information on algal flora for the IHR is scanty.

Based on the distribution of rare endemic and threatened species, several localities have been identified as important areas for plant conservation. These are Drass and Surru Valley in Ladakh; Kishenganga, Liddar Valley, Bhaderwah in Kashmir; Dhauladhar, Bushahar, Narkanda and Churdhar in Himachal Pradesh; Chakrata, Valley of Flowers, Nandhaur Valley, Didihat-Sandev and Gori Valley Area in Uttaranchal; Tista Valley, Zemu, Pangolakha, Singalila in Sikkim; Neora Valley in West Bengal; Tirap, Lohit, Kamlang, Abor and Mishmi hills in Arunachal; Khasi and Jaintia hills in Meghalaya; Blue mountains and Patkai hills in Mizoram and Nagaland.

1.2.2 Fauna

Most of the information available for this region pertains to larger vertebrates, especially large mammals and birds that are easily observed. Smaller mammals, reptiles, amphibians, and fishes have been under sampled, while the insects have been largely ignored, with the exception of a few studies of the Himalayan Lepidoptera.

Over 240 mammal species have been described across the IHR, of which 12 are endemic. The endemics include the golden langur (*Trachypithecus geei*), which has a very restricted range in the Eastern Himalaya, and the hispid hare (*Caprolagus hispidus*) and Pygmy hog (*Sus salvanius*), species restricted to grasslands in the Terai Duar savannah and grasslands. The mammalian fauna in the lowlands is typically Indo-Malayan, consisting of langurs (*Semnopithicus* spp.), Asiatic wild dogs (*Cuon alpinus*), sloth bear (*Melursus ursinus*), gaur (*Bos gaurus*), and several species of deer, such as muntjac (*Muntiacus muntjak*) and sambar (*Cervus unicolor*). In the alpine area typical species are snow leopard (*Uncia uncia*), black bear (*Ursus thibetinus*), and a diverse ungulate assemblage including blue sheep (*Pseudois nayur*), takin (*Budorcas taxicolor*), argali (*Ovis ammon*), and Himalayan thar (*Hemitragus jemlahicus*).

Around 750 bird species are recorded from across the region, with 20 endemics, including: eight species in the Family *Timaliidae* (babblers, wren babblers), five *Phasianidae* (pheasants, partridges, and quails), two each in *Aegithalidae* and *Fringillidae*, and a species each from *Turdidae, Sittidae,* and *Sylviidae* (Grimmet et al., 1999). Four Endemic Bird Areas (EBAs), as defined by Bird Life International are represented in the IHR. In the WH there are 11 bird species restricted entirely to it, including the Himalayan quail (*Ophrysia superciliosa*), the cheer pheasant (*Catreus wallichii*), and the Western tragopan (*Tragopan melanocephalus*). The endemic birds of EH consist of rusty-throated wren babbler (*Spelaeornis badeigularis*), snowy-throated babbler (*Stachyris oglei*), chestnut-breasted partridge (*Arborophila mandelii*), rufous-throated wren babbler (*Spelaeornis caudatus*), white-throated tit (*Aegithalos niveogularis*), and orange bullfinch (*Pyrrhula aurantiaca*) and a recently discovered babbler from Arunachal Pradesh. The black-necked crane (*Grus nigricollis*), a large bird of cultural and religious significance to the hill - people after spending winters in the Himalayan region, migrates into the wetlands of the Tibetan Plateau.

Systematic surveys of reptiles and amphibians (Herpetofauna) are lacking for this hotspot, but Ghosh (1996) indicates that there are 29 reptiles and 35 amphibians endemic to Himalaya. Some of the endemic herpetofauna in the region include *Agama tuberculata, Laudakia himalayana, Phrynocephalus theobaldi, P. Reticulatus, Cyrtodactylus stoliczkai, Scincella ladacense, Bufo viridis, Scutiger occidentalis, Scinella himalayanum* and *Coluber rhodorachis*.

It is estimated that there are approximately 270 species of fishes in the IHR of which 33 species are endemic. The high-altitude drainages have fewer fish species than the lowland rivers. Approximately 270 species of fishes are known to occur in the IHR of which 33 are endemic. Most diverse groups include minnows and carps (*Cyprinidae*; 93 species), the

river loaches (*Balitoridae*; 47 species), the sisorid catfishes (*Sisoridae*; 34 species). The genus *Schizothorax* (snow trout) is represented by at least six endemic species in the high mountain lakes and streams. The two other endemic genera related to snowtrout are *Ptychobarbus*, and the Ladakh snowtrout (*Gymnocypris biswasi*), a monotypic genus now thought to be extinct, are unique to the IHR. Among the various species the famous sport fish, the golden mahsheer (*Tor putitora*), is of great conservation significance for the region.

BOX 1.1: BIODIVERSITY OF EASTERN HIMALAYAS

The NEHR of India is a treasure house of biological and cultural diversity. The region harbours about 7000 – 8000 species of vascular plants (50% of India) and has over 60% of its total geographical area under forest cover. There are more than 225 tribal communities with rich indigenous knowledge systems. The region is considered as 'Cradle of Angiosperm Development' due to the fact that a large number of primitive flowering plants such as *Tetracentron*, *Magnolia*, *Michelia*, *Rhododendron*, *Camellia*, and orchids are found in this area in abundance. Many monogeneric families such as *Coriariaceae*, *Nepenthaceae*, *Turneraceae*, *Illiciaceae*, *Ruppiaceae*, *Siphonodontaceae*, and *Tetracantraceae* are found in this area. Of about 1230 species of orchids found in India, 825 species are represented in the NEHR, many of which have high horticultural importance e.g., *Paphiopedilum fairieanum*, *P. venustum*, *P. insigne*, *P. villosum*, *P. spicerianum*, *P. hirsutissimum*, *Anoectochilus sikkimensis*, *Cymbidium eburneum*, *Vanda coerulea*, *Renanthera imschootiana*, *Pleione maculata*, *Dendrobium nobile*, *D. hookerianum*, and *Dendrobium. densiflorum*.

NEHR and Sikkim altogether harbour over 80 species of Rhododendrons, 58 species of bamboos, and some of the unique plants, e.g., largest root parasite, *Sapria himalayana*, a giant orchid *Galeola falconeri*, insectivorous plants, *Drosera burmanii*, *Drosera peltata*, *Aldrovanda vesiculosa* and the endemic *Nepenthes khasiana*.

So far 3,624 species of insects, 50 molluscs, 236 fishes, 64 amphibians, 137 reptiles, 541 birds (excluding migratory birds) and 160 mammalian species have been reported from the NEHR. The golden langur (*Presbytis geei*) and the brow-antlered deer (*Cervus eldi eldi*) of Manipur are two endemic mammals. Other animals like the hispid hare (*Caprolagus hispidus*), the pigmy hog (*Sus salvanius*) and the great Indian one horned rhinoceros (*Rhinoceros unicornis*) now survive in scattered, isolated pockets. Malayan or Chinese species such as the clouded leopard (*Neofelis nebulosa*), the marbled cat (*Felis marmorata charltoni*), the golden cat (*Felis temminicki*), the spotted linsang (*Priondon pardicolor*), the large Indian Civet (*Viverra zibetha*), the binturong (*Arctictis binturong*), the crabeating mongoose (*Herpestes urva*), the red panda (*Ailurus fulgens*), the ferret badger (*Melogale moschata* and *M. personata*), the hog badger (*Arctonyx collaris*), the bay bamboo rat (*Cannomys badius*), the hoary bamboo rat (*Rhizomys pruinosus*) and the hoolock gibbon (*Hylobates hoolock*) have their range of distribution, starting from this region.

(Source: North-east Ecoregional, BSAP)

1.3 Ecosystem Services and Diversity

The abrupt rise of the mountains from less than 500m to over 8,000m results in a diversity of ecosystems that range from sub-tropical to alpine and arid types. The complexity of topography, geology and relief features, coupled with intensive biotic influence, have given rise to a variety of ecosystems. The combined effects of geological processes and total flow of ecosystem services and goods from the IHR have not yet been fully ascertained. Some of the well recognized ecosystem services from IHR are given here (Box 1.2).

Box 1.2: Ecosystem Services from the IHR

Ecosystem services, in a strict sense, are all the services generated as a result of interaction and exchange between biotic and abiotic components. Within ecosystems, the interacting organisms help to mediate flows of energy and material which contribute towards many ecological services and goods to all the organisms including human beings. Some of the invisible but essential services include viz., formation of soil and humus, buffering pH, decomposition, carbon sequestration and balance of gases in atmosphere, stabilization of climate and mitigation of climatic change, nutrient cycling, facilitation, assembly of community and succession (in a way it does ecological healing), water and air filtration, flood and drought control, regulation of water supply and services such as of recreation, aesthetic and religious values. Ecosystem goods and services include food, fibre, resin and drugs derived from medical plants. The total value of the ecosystems (services *plus* biodiversity) at global scale is estimated to the tune of US$ 33 billion, nearly 1.8 times of the global GNP.

The Ecosystem services rendered by the IHR have not fully been ascertained. One of the major services rendered by the IHR is soil fertility in the lower reaches from the Himalayan forests. Among the contributions of the Himalaya are the monsoon pattern of rain, high round the year humidity, mild winters and slow lapse rate of temperature with increasing altitude. These influences are reflected in high biodiversity, forest cover up to considerable altitude, dominance of evergreen forest, rapid soil formation, and agriculture round the year. Some of the ecosystem services provided by the IHR are:

1. Rapid soil formation, particularly in oak forests, thus nursing crop-fields both in hills and plains by providing soil and nutrients.
2. Controlling erosion and flood peaks in plains.
3. Maintaining water flow in rivers which contributes to pollution control and help maintain aquatic diversity and soil water storage.
4. Maintaining native crop diversity through human efforts, thus allowing evolution to take place (global importance).
5. Organically produced food (through human efforts, utilising forest services).
6. Carbon sequestration and climate stabilization (global importance).
7. Stabilisation of climate (regional and global importance).
8. Forest services of local use are:

    a. Formation of fertile soil utilized in crop-fields.
    b. Retention of water as spring water which is the only water source in most areas.
    c. Water filtration that serves to keep the spring and lake water clean.
    d. Organically produced food.
    e. Restoration of landslide sites through the process of succession in which N_2 fixer woody species like alder (*Alnus nepalensis*) and *Coriaria* (a bush) play important facilitating role.

(Source : Prof. S.P. Singh, F.N.A.)

A number of ecosystems along the altitudinal and rainfall gradient have been recognized within IHR, each with a complex structural and functional diversity. The major ecosystems, their distinguishing features, state of their health and management are described below:

1.3.1 The Forest Ecosystems

Wide elevational, rainfall and topographic gradients in the IHR have given rise to various forest formations (Champion & Seth 1968; Singh & Singh 1992). The entire spectrum of ecosystems from Tropical forests in the floodplains, to Subtropical, Temperate and Alpine forest ecosystems in the high mountains are found more or less parallel to each other across the length of the Himalaya.

The sub-tropical belt (below 1000m) is represented by the evergreen and moist deciduous forests, woodland and savannah. Characteristic species in the Terai-Bhabar tract is sal (*Shorea robusta*) and in the NEHR other dipterocarps e.g., *Dipterocarpus retusus, D. turbinatus, Shorea assamica*. Low-lying areas, subject to floods during the monsoon, support mixed evergreen forests. Here subtropical evergreen broadleaf forests are dominated by tree taxa (*Castanopsis, Schima*) derived from subtropical East Asia. This elevation supports a high diversity of trees, with variation in community composition dependent on aspect, disturbance regime, and human-use patterns. Adjacent and to the north of the subtropical forest is a band of subtropical pine forest dominated by Chir pine (*Pinus roxburghii*) in the outer Himalaya and Khasi pine (*Pinus khasiana*) in Meghalaya.

Temperate humid forests, equivalent to "cloud forests", thrive at elevations of EH where moisture tends to condense and remain in the air during the warm, moist growing season, from April to November. These forests are dominated by evergreen broadleaf trees such as oaks (*Quercus* spp.) and members of Lauraceae in the lower part (2,000-2,500 m) and a mixture of conifers (such as *Tsuga* and *Taxus*) and broadleaf species (*e.g. Acer, Betula, Magnolia*) at higher altitudes (2,500-3,000 m). The cloud forests in the east are rich in epiphytes, represented by several dicotyledons and a variety of mosses, ferns, and orchids, and provide rich nesting habitat for many bird species. Dwarf bamboos (*Sinarundinaria* and *Himalayacalamus spp.*) in the under-story form food for the charismatic red panda (*Ailurus fulgens*). The temperate forests in the WH are much more open and dry dominated by conifers such as Chir pine and a few oaks. At higher altitudes there are extensive areas under blue pine (*Pinus wallichiana*), chilgoza pine (*Pinus gerardiana*), silver fir (*Abies pindrow*) and spruce (*Picea smithiana*).

In the WH there are a number of species with European affinity and have peculiar traits such as pines that drop their leaves every year and look almost deciduous for a brief period (pines typically have leaves that last more than one year), evergreen maples (maples are almost always deciduous), tree rhododendrons (the genus is typically shrubby) and so on. Even more importantly, ecosystem properties even above 2,000m in the Himalaya often resemble tropical ecosystems rather than temperate systems. For example, the turnover time of organic matter and nutrients (approx 2 years) is closer to that of tropical wet forests (0.5-2.5 years) rather than forests of the temperate regions (17 years). The WH has been well studied by the ecology group at Kumaun University between 1980-2005.

The North-Eastern region has the most diverse types of forest ecosystems in the country. The forest cover of the region is more than three times higher than the national average (19.4%). Per capita forest cover in northeast region (0.52 ha) is much higher than the national average (0.076 ha).

The forest cover assessments made for different North-Eastern states by Forest Survey of India (FSI) indicates that in many NE hill states there has been a decline during 1997 – 2001, albeit subsequently there is a slight improvement in recent years (Table 1.2).

Table 1.2

Distribution of forest cover in various states of IHR (area in km^2)

State	1997	1999	2001	2003
Arunchal Pradesh	68,602	68,847	68,045	68,019
Assam	23,824	23,688	27,714	27,826
Himachal Pradesh	12,521	13,082	14,360	14,353
J & K	20,440	20,441	21,237	21,267
Manipur	17,418	17,384	16,926	17,219
Meghalaya	15,657	15,633	15,584	16,839
Mizoram	18,775	18,338	17,494	18,430
Nagaland	14,221	14,164	13,345	13,609
Sikkim	3,129	3,118	3,193	3,262
Tripura	5,546	5,745	7,065	8,093
Uttaranchal	23,243	23,260	23,938	24,465

(Source: FSI)

1.3.2 The Cold Deserts (Alpine Arid Ecosystem)

The rainshadow areas north of Great Himalayan range especially in much of Ladakh, Lahul and Spiti, inner ranges of Uttaranchal (Nilang, Malari, Lapthal, Upper Johar, upper Byans) and a small portion of Sikkim plateau represent this ecosystem. The characteristic features of this ecosystem are sparse vegetation cover (<15 %), low primary productivity and extreme aridity. Major vegetation formations in this area are scrub steppe dominated by *Artemisia - Caragana, Ephedra - Juniperus, Salix - Myricaria,* and *Lonicera - Rosa* communities. A few patches close to the valley bottoms with moist clayey soil support herbaceous communities such as *Potentilla - Geranium* type, *Festuca - Stipa* grass communities and sedge meadows. A considerable area falls under typical desertic formation with less than 5 % vegetation cover characterized by scree slopes, very high altitude (>4800 m) pioneer environments and other rocky slopes dotted with mosses, lichens and a few hardy plants such as species of *Stipa, Melica, Christolea, Sedum, Draba,* and *Saussurea*.

1.3.3 Alpine Meadows of the Greater Himalaya

The alpine zone in the Himalaya is separated by a distinct treeline (3500+200 m in the Western and 4000+200 m in the eastern Himalaya). This is the zone of treeless vegetation with highly specialized growth forms. The major vegetation types in the alpine zone include alpine scrub, alpine herbaceous formations locally known as `*Bugyal*' in Uttaranchal, `*Kanda'* or `*Thach*' in Himachal Pradesh and `*Marg*' in Kashmir. The alpine meadows are the natural herbaceous formations, generally located above the alpine scrub or immediately above the treeline in the absence of latter. The meadows comprise a large number of herbaceous communities rich in medicinal and aromatic plants (MAPs) with varying proportions of tussock forming grasses, and sedges. The treeline is usually marked by birch - rhododendron (*Betula utilis - Rhododendron campanulatum*), fir (*Abies pindrow*) or brown oak (*Quercus semecarpifolia*) forests.

The alpine arid areas and alpine meadows of the Greater Himalaya have been traditionally used by a large number of local and migratory pastoral communities as summer grazing ground. Hence they have frequently been described as **Alpine Rangelands**.

1.3.4. Grassland Ecosystems

Most of the grasslands in the temperate, sub-tropical and tropical belts in the IHR are anthropogenic in nature i.e., derived as a result of frequent fire and forest clearing. The alluvial grasslands along the foothill valleys are among the tallest in the world. These grasslands are rejuvenated by silt deposited by the rivers that flow down from the mountains and regenerate rapidly following the annual monsoon floods. As the floodwaters recede, grasses such as *Saccharum spontaneum* and pioneer trees such as *Trewia nudiflora*, *Dalbergia sissoo, Acacoa catechu* and *Ehretia laevis* begin to colonize the area. In the Bhabar tracts the grasslands are called Chaurs which support a large number of wild herbivores. The temperate grassy slopes, locally called '*Ghasnis*' in Himachal Pradesh and Uttaranchal are managed by the local communities for hay production.

1.3.5 The Riverine Ecosystem

The drainage system in the IHR can be broadly grouped into three main river systems *viz.* the Indus, the Ganges, and the Brahmaputra. The average annual flow in the three river basins in Indian territory alone is estimated at 1009 milliard m^3. The major drainage system of the WH are Indus, Jhelum, Chenab, Ravi, Sutlej, Ganges, Yamuna, and Sharada. While in the EH major river systems include Tista, Brahmaputra System and Irravady. The riverine ecosystems are of considerable ecological and conservation interest as they support a diverse array of flora and fauna besides serving as lifeline for human societies along their basins.

1.3.6. The Wetlands

The margins of shallow lakes, river courses and man - made water bodies in this region represent the wetland ecosystems. Many of the high altitude wetlands serve as breeding

grounds of migratory birds during summer months. The wetlands also support a highly productive and dynamic ecosystem. On the basis of their origin, the Himalayan lakes can be classified into four groups: (i) Glacial lakes which are formed in and around glaciers; (ii) Structural lakes, formed by folds or faults due to movements in earth's crust (*e.g.* Nainital lake in Uttaranchal), (iii) Remnant lakes which were originally structural but represent the remnants of vast lakes (*e.g.*, Tso Moriri, Tso Kar, Pangong Tso in Lakdakh, and Dal lake in Kashmir), (iv) Natural dammed lakes i.e., temporary water bodies formed along the river courses due to deposition of rocks or debris *e.g.* Gohna Tal in Garhwal, Uttaranchal. It is estimated that there are over 2000 small or large wetlands in the IHR, including reservoirs, tanks, lakes, seasonal swamps and other categories (Table 1.3):

Table 1.3

Distribution of various Wetlands of IHR

State	Reservoirs & tanks	Lakes & oxbow lakes	Seasonal waterlogged	Swamps & marshes	Unclassified
Arunachal Pradesh	0	386	396	24	396
Himachal Pradesh	7	85	0	0	176
Jammu & Kashmir	4	24	14	0	38
Sikkim	0	160	-	0	67
Uttaranchal	1	36	-	0	0
Assam	20	35	25	53	2
Meghalaya	3	6	0	0	10
Manipur	14	3	3	5	0
Tripura	2	1	2	0	0
Nagaland	3	2	0	0	4
Mizoram	4	0	0	2	3
Total	**58**	**738**	**437**	**84**	**696**

(Source : Wetland Atlas of India, SACON)

1.3.7 Agro-ecosystems

Agriculture and animal husbandry have been age old land use practices in the IHR. A considerable area in the WH is under settled agriculture (terrace farming). Traditional millets, cereals and pulses along with horticultural crops are grown in many areas. In HP, with good network of roads, horticultural crops have become a major source of revenue. It is established that at least seven units of forests are needed to sustain one unit of agriculture in the mountains. Leaf litter from the broad-leaf species such as oaks and alder, in particular, along with the dung of cattle graze the forests form the main source of nutrients to agricultural fields. Most of the terraced areas are rain fed.

In the NEHR shifting cultivation or slash and burn agriculture, locally known as *jhum,* is the main form of agriculture. The jhum cultivation involves clearing of vegetation, and then slashing and burning the plant parts including debris. After 2-3 years of cropping, the land looses its fertility and the farmer shifts to another piece of forested land for cultivation. During the fallow period natural vegetation regenerates and nutrients are regained. The period of fallow varies from 3 to 15 years, depending upon the system of practice (place, population and land ratio, and tribe). In Nagaland average fallow period is between 7-9 years. The period between cultivation and coming back again to the same plot, after completion of intervening fallow period, constitute one jhum cycle. With rising population, the jhum cycle in most areas, which used to be 10 – 15 years earlier is now reduced to only 2-3 years in many areas. Tiwari (2005) has identified four categories of Jhums in NEHR:

(i) *Traditional Jhum*: Practiced in the interior areas where human population has not increased much. This is generally sustainable but may not fulfill all the needs and aspirations of a modern livelihood. Traditional *jhuming* helps conserve forests as the land is rotated in land use between a long fallow period with forest followed by a short cropping phase. The traditional *jhum* has survived the test of time for thousands of years and it enabled the people to live in harmony with nature in the most hostile rugged environment, often amidst dense moist evergreen forests teeming with wild life. Examples of traditional S.A. can be found in the buffer zone of Nokrek Biosphere Reserve, Garo Hills, Meghalaya and in Nongching village of Nagaland.

(ii) *Distorted Jhum:* As population increases, the villagers are forced to reduce the fallow period in order to allot jhum land to newly married couples. In such cases the fallow period is reduced to 1-3 years which is not enough for regeneration of the land, resulting in degradation and encroachment on steep slopes. This type of Jhum is neither productive nor sustainable. Examples: many parts of Mizoram, parts of Arunachal Pradesh, Manipur hills and in West Khasi Hills of Meghalaya.

(iii) *Improvised Jhum:* This includes recently adapted cultivation of cash crops in Jhum fields, e.g. green peas in Pomlakarai, Meghalaya and indigenous Kolar Beans (Rajma) in high altitude villages of Nagaland where rice cannot be grown. Such practices help in maintenance of soil fertility and also bring cash income to the family. Another example of improvised Jhum comes from the village Lazami, Nagaland where the farmers practice unusually long cropping phase, unique weeding system with almost no fallow period, and

(iv) *Modified Jhum:* During past decade two externally funded development projects were implemented viz., Nagaland Environmental Protection and Economic Development, Kohima and India Canada Environment Facility (NEPED – ICEF) in Nagaland, and North- Eastern Region Community Resource Management Project

(NERCORMP) funded by IFAD and NEC in Meghalaya, Manipur, and hill districts of Assam. Each of these projects had a major component on improvement of jhum. While NEPED has excelled in improving the livelihoods through promotion of tree husbandry and cash crops; the NERCORMP has done exceptional work in institution building and microfinance. These projects have demonstrated that through multi-pronged external intervention, productivity levels of Jhuming can be improved.

Jhum cultivation has not only been the main source of livelihood for most of the hill - tribes in NEHR, this practice has also played a critical role in conserving agri-biodiversity and traditional knowledge system (TKS). A study reveals that in Chetheba area of Phek district in Nagaland at least 167 crop varieties (including 12 rice varieties) are cultivated in a typical jhum field. On an average anywhere between 16 to 18 species of food crops are cultivated in Jhum fields. A brief statistics on Jhum agriculture in NEHR (Table 1.4) and the administrative classes of forests under Jhum (Table 1.5) are given below:

Table 1.4

Extent of Jhum Agriculture (km^2) and number of families practicing it in NEHR

State	Area under Shifting Agriculture (km^2)			No of Families
	Task Force MOA, 1983	Satapathy, 2003	NRSA, 2005	Task Force MOA, 1983
Arunachal Pradesh	700	2610	1613.13	54000
Assam	696	3100	3930.97	58000
Manipur	900	3600	4816.68	70000
Meghalaya	530	2650	743.83	52290
Mizoram	630	450	4017.9	50000
Nagaland	192	6330	1917.9	116046
Tripura	223	1080	395.26	43000
Total	**3869**	**19820**	**17435.67**	**443336**

Table 1.5

The administrative classes of forests under Jhum in NEHR

State	Administrative classes of forests where S.C. is practiced	Ownership and Control	Area (km^2)	% Geogr. Area of the state
Arunachal Pradesh	Unclassed State Forests (USF)*	State Forest Department	32039	23
Assam	USF (District Council)	District Council	5713	7.28
Mizoram	USF (with permission of Village Council)	State Forest Department/ Village Council	5240	25
Manipur	USF	State Forest Department	11288	50.5
Meghalaya	USF	Traditional Durbars, District councils	7146	32
Nagaland	USF	Village Councils	7813	47
Tripura	USF	State Forest Department	2195	21

* **Unclassed State Forests (USF) :** The USFs are loosely under the dual control of the Revenue and Forest Departments, the former being responsible only for issuing Land Possession Certificates (LPC). These are claimed variously as private, clan and communal property and have been traditionally under the control of the community. Though termed as forest and even included in the statistics, the USF areas are not under the control of the Forest Department as the land does not vest with the state. No survey and demarcation has been conducted in these areas as there exists no well defined land statute.

1.4 Conservation and Resource Use Pattern

Notwithstanding the apparent remoteness and inaccessibility, much of the IHR has suffered from human-induced biodiversity loss. People have lived in these mountains for thousands of years. Now, with better access to global market economies, dependence on natural resources, economic expectations and aspirations of the people have increased in recent years. Access has also encouraged immigration into montane areas from outside in some regions as in Arunachal Pradesh and in fertile alluvial *Terai* and *Duars*. As a result, more productive ecosystems which are also bio - diversity rich regions are becoming over - crowded and in many places it has resulted in breakdown of cultural and social traditions.

Steady increase in human population has been responsible for extensive clearing of forests and grasslands for cultivation, and extensive logging and extraction of timber. Although the upper elevation limit of cultivation is approximately 2,100 m, the land above is often cleared by pastoralists for livestock during the summer months. The conversion of forests and grasslands for agriculture and settlements has led to large-scale deforestation and habitat fragmentation. Wood extraction for fuel and fodder also contributes to loss of

undergrowth and regeneration, and changes in species composition. Besides habitat loss and degradation, poaching is rife across the Himalayan mountains; tigers and rhinoceros are poached for their body parts, which are much prized in traditional Chinese medicines, while the snow leopard and the red panda are hunted for their beautiful pelts. The remoteness of the Himalayan region and the open borders have facilitated this illegal trafficking.

Approximately 15% of the IHR has one form of legal protection or the other. In Assam; Manas and Sonai Rupai were first established as wildlife sanctuaries in 1928 and 1934, respectively, and are among the earliest contemporary protected areas in Asia (IUCN, 1990). Other protected areas are of relatively recent origin, being established during the past three to four decades. However, many hill tribal communities have traditionally recognized and protected sacred groves, which have been effective refuges for biodiversity for centuries. Today, several PAs such as Nanda Devi, Valley of Flowers, Manas and Kaziranga have been distinguished as World Heritage Sites for their contribution to global biodiversity. However, political unrest manifested as insurgencies has plagued many parts of IHR. Several PAs and forests that harbor wildlife also serve as refuges for insurgents, who indulge in indiscriminate poaching and felling of trees.

Many Protected Areas which that lie adjacent to each other, across national borders, present promising opportunities for trans - boundary conservation activities. The Royal Manas National Park in Bhutan and Manas Tiger Reserve in Assam, India is one such Trans – boundary conservation complex. The biological corridors also provide great opportunities for linking the protected areas across international boundaries and create habitat linkages. One such example can be between Bardia in Nepal and Katerniaghat in India. An innovative strategy for creating Conservation Landscapes in the Himalaya will not only help conserve the region's species and ecological processes that sustain biodiversity, but also will help build regional cooperation.

Recent years have witnessed a trend across the IHR, in particular in the North-east, to introduce cash crops such as tea, coffee, rubber, or ginger. Western Himalaya have moved towards horticultural crops and off – season vegetables. While horticulture and cash crops bring better economic incentives to the farmers, use of excessive chemical fertilizers and pesticides could prove detrimental to bio – diversity conservation. Amidst race for high yielding variety there are, however, examples from the IHR where farmers have been advocating conservation of local crops (Box 1.3).

Box 1.3: Beej Bachao Andolan (Save the Seeds Movement) in Uttaranchal

The advent of green revolution (GR) in the mid-1960s swiftly changed the nature and character of Indian agriculture. It was something which people, at that time, actually welcomed and even looked up to. And in the beginning, the hybrid seeds, agrochemicals (fertilizers and pesticides, *etc.*), cash crops, monoculture, irrigation and mechanization, appeared to be living up to that hope. But, within a mere decade or two, the ill effects of these new agricultural practices began showing up. The crops became vulnerable to diseases and failure, the land got impoverished and the people's food security was severely jeopardized. The new agriculture made the farmers dependent on external resources, thereby inflating the cost of farming, which effectively marginalized the smaller farmers and took them away from agriculture. These ill effects were more stark in the mountain areas, for which GR was neither suitable nor, in fact, even intended.

In the late 1980s, *Beej Bachao Andolan* (BBA), led by Mr. Vijay Jardari, emerged in the Henwalghati region of district Tehri Garhwal as a collective of farmers and activists, in response to the threats posed by the new agriculture. The movement was essentially a socio-environmental response seeking the very survival of the small farming community. In doing so, BBA has taken seeds – local and traditional varieties of seeds - as the symbol of its struggle, to underline the life and death of the traditional agro-ecosystem and the farming community. Because seeds, like forests and water, have been traditionally seen as a common property of the people, not to be sold but used, reused and exchanged, these have always been a vital link in the hill agro-ecosystem. In fact, the industry and market forces themselves which had high stakes in the spread of GR packages and technologies, had understood this power of the seeds very well and made seeds their main 'weapon for invasion'. It was only appropriate then that BBA too mount its constructive protest with seeds as its main 'shield', the lodestar for the rejuvenation of indigenous knowledge systems and resurgence of traditional agriculture. The *Andolan* is a classic case of a sustained, holistic, constructive protest and positive action through peace and non-violence, drawing on one's inner strengths and resources based on Gandhian thoughts.

Like the Chipko movement, BBA too is spreading today more as a school of thought and as a philosophy. A philosophy that treats agriculture not in isolation but as an integral part of an ecosystem and that includes the forests, the water, the animals and ultimately, the human beings.

(Source : Biju Negi, Dehra Dun)

Non Timber Forest Produce (NTFP), especially Bamboo, and medicinal and aromatic plants (MAPs) continue to be major source of livelihoods for people in the IHR. NEHR harbours nearly 70% of the growing stock of bamboo in the country having nearly 30,504 km^2 area under its cover. Besides a number of traditional uses, bamboo can be used as raw material in various industries such as food, building & construction, paper, handicrafts and cottage. Due to the absence of requisite processing facilities more than 90% of available bamboo is presently wasted. In order to minimize this large scale wastage of raw material, bamboo processing units may be taken up in the NEHR with adequate share of benefits to the local communities. In the absence of well established cultivation techniques most of the MAPs are still harvested from the wild. Efforts are needed to evolve Best Harvesting

Practices / Best Collection Practices for MAPs. Models have emerged which simultaneously provide for Conservation, Development and Harvesting (see Box 1.4).

Box 1.6B: Conservation, Development & Harvest Plans of Medicinal and Aromatic Plants in Uttaranchal

The medicinal and aromatic plants (MAPs) are an extremely important natural resource for sustaining livelihoods in mountain states such as Uttaranchal. However, these resources need to be utilized on a sustainable basis in the long run. Keeping this in view, the Govt. of Uttaranchal has promulgated the concept of CDH Plans in the year 2003 (vide D.O. No. 913/FRD/2003 dated 23.08.2003) for scientific management of MAPs in the state. This would involve rapid inventory and mapping of MAPs following an uniform and standard procedure throughout the state. The Ranges having greater potential of MAP production would develop **CDH** plans. It is visualized that in each such range there would be three management units: (i) **Conservation area**, set aside for the *in-situ* conservation of native MAPs where no commercial extraction would be allowed but monitoring and protection would be strengthened; (ii) **Development area**, where intensive management and propagation of commercially useful MAPs would be undertaken through nurseries and seedlings would be taken out for cultivation; and (iii) **Harvest zone** where local people would be allowed to sustainably harvest the MAPs, and would be encouraged to participate in the management of the area. For all the management units initial inventory (listing, presence-absence, and amount available) and mapping of MAPs would be essential. Some of the conservation areas rich in MAPs which represent original ecosystems in different eco-climatic zones would be declared as **Medicinal Plant Conservation Areas (MPCAs)** which would be brought into national network of MPCAs.

Following these directives the Uttaranchal Forest Department (UAFD) has completed the rapid mapping exercise (**RME**) in various ranges and CDH plans are underway. Based on the field data 7 sites have been identified as conservation areas termed as Permanent Seed Resource Areas (PSRAs) for 7 rare species of MAPs. For the development of MAPs a herbal garden has been established at Muni-ki-Reti for large scale multiplication of plant propagules. The harvest of MAPs has been streamlined and now there is a complete transparency in trade due to disposal of material by public auction at pre-designated depots. Starting from Rs 2 Crore, the turnover is now above Rs 9 crore, major amount going directly back to the collectors.

(Source : S. Chandola, CWLW Uttaranchal)

1.5 Recommendations

Based on the analysis and discussion in the preceding paragraphs the Task Force makes the following recommendations :

1.5.1 Value Ecosystem Services and Mountain Biodiversity

It is essential to recognize the biodiversity values and ecosystem services rendered by the Himalayan mountains (**Box 1.2)** and incorporate them appropriately into 'the national accounting' systems, thus encouraging the local people to conserve natural forests and other ecosystems. This may include, for example, providing cooking gas at a subsidized price to the people living in the mountains, or national support to generate sufficient

hydroelectricity in the hills to meet the people's energy need for cooking and heating. Like the Twelfth Finance Commission the Eleventh Five Year Plan should provide for it.

1.5.2 Modernize & Democratize Forest and PA Management

Modern forestry must be ecologically sound with the goal of conserving biodiversity and ecosystem integrity. The 'sustainable yield of goods' is no more the overriding factor. To deal with this situation, the forestry services need to be modernized by enhancing technical expertise of the foresters in terms of forest and PA management, preparation of Management and Working Plans need far greater attention. The decadal – period of the Working Plans needs revisiting and these Plans should be seen as an instrument of change, and not status quo. The revised Guidelines for Working Plans need incorporate digitization of all past Working Plans and these should also involve all stakeholders and exhibit more transparency in formulation. Similarly, PA managers in the region need to be trained regularly in Wildlife Management, use of modern tools of resource mapping, evaluation and monitoring and stakeholder participation.

1.5.3 Improve PA – People Relationships

There is a need to involve local communities in the management of PAs, especially Biosphere Reserves and Conservation Reserves. Through local peoples' participation only it would be possible to conserve the crucial corridors, migratory routes and flagship species at a landscape level. Develop innovative models for management of natural resources and biodiversity outside PAs involving local communities. Encourage establishment of **Community Conservation Reserves (CCR)** wherever proposed PA boundaries are difficult to negotiate. In the Scheduled Areas such as Nagaland, where communities hold rights and ownership over forests and other resources, and where the communities have already established CCRs, due recognition and support mechanisms needs to be developed and extended.

1.5.4 Enhance Natural Regeneration of Forests

Over-emphasis on plantations, protection of individual trees (e.g., complete ban on tree cutting over 1000 m altitude), and promotion of a few fast growing individuals (plus trees) have trivialized the importance of natural regeneration, which is the basis for the perpetuation of forests. Hence it is recommended that necessary changes in the forestry practices be brought about to safeguard the process of regeneration (seed crop, seed germination, seedling recruitment and establishment, and their maturation into trees). The three natural clusters of states to improve understanding of regeneration process for forest species are NWH, EH and NEHR. There exists a need to focus on low cost natural regeneration, with the help of rural communities rather than undertaking costly plantation schemes. Additional strategies for conservation and management of forests in NEHR, based on MoEF's Expert Committee report, is given in Annexure : 4.

1.5.5 Linking Biodiversity Conservation with Rural Livelihoods

Biodiversity must be necessarily linked with local livelihood strategies. Be it the quest for fuel wood for cooking and heating, leaf fodder for cattle, or the open grazing of domestic animals, all these are responsible for significant forest degradation and biodiversity losses in the Himalaya. Unless concerted and serious efforts are made towards finding alternatives for these biomass products, preserving ecosystems will be difficult. There is an urgent need to develop enterprise-based livelihoods and raising of living standards of the communities through better management of NTFPs including MAPs and other cash crops. Conservation, Development and Harvest (CDH) plans for MAPs, as is being attempted in Box 1.4 should be replicated all over IHR. Ecotourism and agro-forestry based development models and biodiversity (oak-silk) linked enterprise development initiatives need up-scaling.

1.5.6 Participatory Resource Management (PRM)

Pro – active action is required in involving the local communities, especially the hill women in resource management. The hill women need to be provided labour-saving tools and alternatives from the day-to-day drudgery (of water, fuel wood and fodder collection) to playing an active role in PRM. Sensitisation of the bureaucracy, scientists and decision-makers, including community leaders is needed so that they can effectively collaborate in joint – initiatives and extend support. 'Participation' includes not just local communities, but a broad spectrum of academics, activists and opinion-makers. In this context, Joint Forest Management (JFM) needs to be revamped across the IHR by constituting Village Forest Committee (Van Panchayats) under Forest Development Agency (FDA) scheme. The structuring of FDAs needs re-visiting, it needs to be broad-based. All funds for afforestation schemes should be routed through the FDAs in order to increase community participation in increasing the forest cover by 2012.

1.5.7 Initiate Species Recovery and Habitat Restoration Programme

Action oriented research on restoration of degraded ecosystems and recovery of threatened species, involving local communities and frontline staff within forest department need to be initiated. Important habitats such as alpine meadows, timberline ecotone as habitat for Himalayan musk deer and riverine forests must be accorded highest priority for conservation and restoration. Recovery of degraded ecosystems, especially those infested by alien invasive species (AIS) such as Lantana camara, Eupatorium adenophorum, Mikania micrantha and Parthenium hysterophorus need to be given highest priority, for an integrated weed research and management.

1.5.8 Conservation of Agri-biodiversity and improved farming system

Promote on-farm conservation of indigenous crop varieties and germ-plasm. The mountain farmers need to be encouraged to take up their own 'Seed Production Programmes', in

various eco-climatic regions. ICAR laboratories and Agricultural Universities in the region need to encourage organic farming, undertake development of packages of practice and integrated pest management through their Krishi Vigyan Kendras (KVKs) across the IHR. Similarly, pastoral production systems and animal husbandry needs to be organized on scientific lines in IHR. Local breeds need to be preserved and characterized for their specific traits like efficiency of feed conversion, disease resistance, energetic efficiency, as well as draught – power as mountains are not amenable to mechanical inputs. Building upon traditional Jhum agriculture and related TKS towards innovative Jhuming as being practiced in parts of Nagaland (see Shillong Declaration available on section 1.3.7- iii & iv above) needs to be carefully studied for adoption and adaptation.

1.5.9 Research and Monitoring

Prepare a research priority matrix for each sub-region (trans-Himalaya, WH and NEHR) covering the information gaps (e.g., biodiversity of microbial fauna in different climatic zones), allocate adequate funds and execute coordinated and scientific research through Universities and Institutes. Participatory action research is also required in the area of Agro-techniques for MAPs so as to promote their conservation, cultivation and commercialization.

2.0 CLIMATE CHANGE AND MOUNTAIN ECOSYSTEMS

2.1 Background

As "Water Towers", Mountains are the source of over 60-80 percent of world's fresh water; repositories of nearly half of the world's biodiversity 'hot spots', destinations for recreation, areas of cultural diversity, knowledge and heritage. They provide food, energy, non-timber forest produce (NTFP) and timber. Deforestation, and imprudent infrastructural development have led to their degradation. The number of people living in mountainous region is estimated to be 1.2 billion, with 90% of these population residing in ***developing and transition countries*** (poorest and food-insecure populations), one-third in China and two-thirds in Asia and the Pacific. Nearly 10 % of the world population is directly dependent on the mountain resources such as water, forests, agriculture and NTFP for their livelihood.

Fragility of mountain ecosystems and their vulnerability to adverse effects of climate are well established. Increasing anthropogenic pressures and natural perturbations on the mountain ecosystems result in the depletion of natural resources, increase the recurrence of natural hazards and adversely affect the livelihoods of the local people, with far reaching implications at local, regional and global level. Therefore, there is an urgent need to safeguard the health of this region. Sustainable mountain development has been stressed all over the world since 1992 (Chapter 13 of Agenda 21: Managing Fragile Ecosystems: Sustainable Mountain Development : UNCED).

Throughout the IHR there is a perceived change in the patterns of precipitation and shifts in weather regime. However, in order to determine the degree and rate of climatic trends, there is a need for long-term data sets which are lacking for most of the Himalayan region. Barry (1992) states that 19 out of the 30 principal observations on climate change are in Europe and there is none from the Himalayan region. Hence, scientific knowledge on climate change and its impact on mountain ecosystems needs to be incorporated in our land use planning and natural resource use policies.

This chapter examines apparent and possible impacts of climate change on IHR, mitigatory measures and priority areas on climate research.

2.2 Apparent and Potential impacts of climate change on the mountain Ecosystems

The mountain ecosystems not only influence the atmospheric circulation significantly, but also exhibit a great deal of variation in local climatic patterns. Hence, they are likely to get affected most by the global climate change. However, the impacts of climate change on mountain ecosystems cannot be predicted with reasonable accuracy due to lack of long term and time – line studies. In the mountain regions even small changes have the potential to produce significant effects, particularly in the marginal environments that are under stress. Various Ecosystems within the IHR (see paragraph 1.3 in Chapter 1) have evolved under certain climatic regimes. Some of the ecosystems are more susceptible to climate change, compared to others, due to extreme sensitivity of constituent elements. Some of the apparent changes in the IHR due to climate change include shrinking of glaciers, glacial lake outburst floods, and shifts in the boundary of certain ecosystems (e.g., treeline). Some of the major impacts are taken up for consideration, which deserve urgent attention:

2.2.1. Impact on Glaciers

i. Himalayan glaciers cover approximately 23,000 km^2, being one of the largest concentrations of glacier-stored fresh water apart from the polar regions. Glaciers are the products of climate and climate change; truly reckoned as veritable thermometers of global warming.

ii. Surveys based on satellite images and ground investigations by ISRO's Space Application Centre (SAC) Ahmedabad have established that in Himachal Pradesh alone, the glaciers have reduced from 2,077 km^2 to 1,628 km^2 – an overall deglaciation of 21 % in four decades. According to SAC as many as 127 glaciers of less than 1 km^2 size have lost 38 per cent of their geographical area since 1962. The larger glaciers, which are progressively getting fragmented, have receded by as much as 12 per cent which is truly alarming.

iii. Data on glacial recession from the IHR are available only for last 150 years. These reveal that the Himalayan glaciers are retreating at an average rate of 18-20 m yr^{-1} (Mazari 2006). The rate of retreat of some important Himalayan glaciers is presented below:

Table 2.1: Snout recession of Himalayan glaciers*

Name of glacier	Period of measuring	Period (in years)	Recession (in m)	Average rate (m/yr.)
Milam glacier	1849-1957	108	1350	12.50
Pindari glacier	1845-1966	121	2840	23.40
Gangotri glacier	1962-1991	29	580	20.00
Tipra bank glacier	1960-1986	26	325	12.50
Dokriani glacier	1962-1991 1991-2000	29 09	480 161.15	16.5 18.0
Chorabari	1962-2005	41	238	5.8
Shankulpa	1881-1957	76	518	6.8
Poting	1906-1957	51	262	5.13
Glacier no-3 Arwa	1932-1956	24	198	8.25
Bara Shigri	1956-1963	07	219	31.28
Chhota Shigri	1987-1989	03	54	18.5
Sonapani	1909-1961	52	899	17.2
Kolai	1912-1961	49	800	16.3
Zemu	1977-1984	07	193	27.5

(* The Department of Science and Technology, GOI, under the Himalayan Glaciology Programme (HGP) has been carrying out a multidisciplinary study on the mass balance, recession, ice thickness, glacial discharge, sediment transfer, isotopic and chemical characteristic of snow, ice and melt water and geomorphology mapping under the leadership of Wadia Institute of Himalayan Geology since 1986. During the first phase information has been generated on Chhota Shigri glacier in Himachal Pradesh, Dokhriani in Bhagirathi Valley and Chorabari in the Alaknanda basin of Uttaranchal. These glaciers are being monitored regularly to detect the changes).

iv. Such a rapid depletion of ice caps and faster glacial melts in the IHR is bound to adversely affect India's freshwater balance which could have catastrophic consequences for both, consumptive and non – consumptive users of water.

2.2.2. Disturbances in hydrological functions

i. Increase in ambient temperature can have strong influence on local weather pattern. It is predicted that there would be an upward shift in various climatic zones with slight rise in temperature. Also, there is an increasing evidence that winter precipitation in the form of snow fall has declined over the years.

i. Increase in glacier melting is likely to increase runoff and glacial lake outburst floods (see paragraph 1.1.2). Reduction in the Crysphere can also alter upstream hydrology, stream flow, primary productivity and mountain farming. Other consequences of

reduced hydrological functions include shortage of drinking water, reduction in agricultural and hydropower production.

ii. Impacts of reduced catchment capabilities in IHR is likely to be far more serious on cities, towns and villages downstream including Himalayan foothills that depend completely (or partially) on mountain streams and rivers.

iii. Increased atmospheric temperature would mean higher rainfall and reduction in snow fall leading to more erosion, increased run-off and loss of surface soil on steeper mountain slopes which would accelerate the rates of siltation and flash floods.

iv. Water provided by the hill aquifers in the form of springs is responsible for sustaining domestic livestock and agricultural activity since the ancient times. Already access to safe potable water is limited in the IHR. Under the changed precipitation conditions, leading to increased run-off and less infiltration; coupled with removal of forest cover, has already started showing signs of depleted hill aquifer regimes in the IHR.

2.2.3. Impact on crop and livestock productivity

i. Shifts in precipitation patterns coupled with elevated temperature would have direct impact on crop productivity. As the glaciers disappear and summer runoff diminishes, much of the catchment areas are likely to face aridity.

ii. Changes in climate would affect the quality of horticultural crops such as apple and apricots. There may be shifts in fruit belts but there exists very little scope for expansion.

iii. Flowering and fruiting phenology of many species would alter. It is known that late snowfall affects the processes of pollination indirectly. Relative immobilization of bees is triggered due to low temperatures brought about by late snowfall.

iv. Rangeland and pastoral production system is likely to get affected likewise. Positive factors such as carbon dioxide fertilization and better water use efficiency are contrasted by negative feed back such as deficiency in water and higher fluctuation in temperature. Rangeland forage quality and quantity would be seriously affected, suggesting an increased requirement for feed supplements for livestock.

v. At higher altitudes increased temperature and heat stress may influence livestock production. As livestock diseases are much influenced by climate change, transmission of wind borne Foot and Mouth Disease viruses may increase.

vii. There is a strong correlation between the climate change, failure of crops and deforestation inducing clearing of more areas for *Jhum*) in the NEHR.

2.2.4. Effect on forests and biodiversity

i. Climate change is likely to enhance the frequency and intensity of forest fires in the mountains, exacerbating problem of carbon emissions, haze and habitat destruction. The factors listed for plants and crops in general also largely apply to forests.

ii. A depletion of soil moisture may cause productivity of major species to decline. Productivity of moist deciduous forests could also be reduced.

iii. Global climate change has prompted serious concern over the potential consequences to the world's ecological systems and wildlife. Changes in habitat will have an impact on indigenous flora and fauna, and their ability to adapt to changing climatic conditions. Climate-related hydrological changes to a species' habitat are likely to become more and more pronounced as the global mean temperature of the earth rises; resulting in changes in salinity, water temperature, increase in sun exposure in areas due to evaporation, melting ice, and various other interconnected ramifications.

2.2.5. Implication for human health

Understanding of the impacts of climate variability and change requires information at multiple levels. As in case of several other sectors, data on health surveillance in IHR are not readily available, making predictions and comparisons difficult. Some of the widely accepted implications for human health are perceived as follows:

i. Increased ambient temperature is likely to cause thermal stress, resulting in discomfort, physiological stress, and ill health.

ii. The existing problem of water quality is likely to be further exacerbated by climate change. The risk of water-borne diseases will increase. Already access to safe water is quite limited in the IHR.

iii. Climate change will also affect infectious diseases transmitted by insects, i.e. vector-borne diseases such as malaria, dengue, and schistosomiasis. These diseases are sensitive to temperature as well as to land-use changes.

2.2.6: Impact on other aspects of Human Society

Climate change is likely to have direct impact on forestry, agriculture and other land use practices in the IHR. For example, a change in precipitation and species composition could enhance the frequency and intensity of forest fires in the mountains, exacerbating problem of emissions, haze and habitat destruction. Similarly, with changed hydrology and cropping pattern the agricultural production is likely to be affected. Due to lower discharge of the river systems generation of hydropower will become more expensive, particularly as concept of run-of-the-river schemes is being preferred over big dams.

More energy is going to be required for refrigeration and cooling, to combat discomfortable temperature regimes. It may appear to be a scenario not inherent to the mountain systems, but a change over is already witnessed in many parts of the IHR. Climate change is predicted to severely affect the tourism industry in view of shorter duration winter snow and lower river discharge in summer. High temperatures are also likely to affect the tourist trend leading to crowding of smaller resorts having comfortable temperature levels, but its consequences on the environment are likely to be substantive. This is already witnessed in many parts of the IHR and is likely to aggravate further.

The poorer sections of the society in the IHR are less prepared to address the impacts of climate change as compared to richer brethren. This, coupled with inequities being caused by economic globalization, is likely to enhance gaps between 'haves' and 'have-nots' further. Malnutrition due to reduction in food quality and quantity is likely to increase in IHR.

2.3 Information gaps and need for networking

Existing information on the biota and abiotic variables in the Himalayan Ecosystem needs to be collated and reorganized in a concerted manner to establish linkages between current climatic patterns and ecosystem goods and services. This would require effective coordination and networking among local and regional institutions as well as individuals. Other gaps in existing and extant information include:

i. Response of vulnerable and endemic species: As endemic species often require special micro-habitats for survival, they are extinction prone under changing climatic regime. A well coordinated study on rare and endemic taxa of flora and fauna and their vulnerability to climate change would be imperative for the IHR.

ii. Snow-Vegetation relationships in the alpine habitats: The retreating glaciers impact on species and ecosystem levels. The fringe habitats in high altitude regions, such as timberline and snowline, are under direct influence of such changes. So are the specialized elements which are adapted for varying snow fall / snow cover regimes. There is acute paucity of information on this aspect.

2.4 Remedial measures for dealing with impacts

As a signatory to Kyoto Protocol, India is committed to follow the major principles (Box 2.4) as incorporated in the National Environmental Policy, NEP 2006. While adherence to these principles across the globe is expected to have positive impacts on mountain environment, the mountain people themselves will have to get well adapted and suitably equipped to deal with the resultant consequences of climate change. This would require a series of technological interventions backed by scientific research and socio-economic

adaptations. It would be imperative to reconcile the perceptions on climate change issues as seen by the researchers, policy makers the mountain people, a majority of whom are too poor to take any mitigative steps. (See chapter 3 for poverty in the mountains.) Mountain communities in view of their multiple disadvantages and poverty, will need a very pro – active and integrated package of assistance, particularly in capacity building.

Other recommended programmes in the IHR are as follows:

2.4.1. Establish Network of Meteorological Stations across IHR

Create infrstructure for climate change research, especially a network of meteorological stations across IHR, and initiate an integrated study on climatology through coordinated effort among various institutions, garner technical (forecasting, monitoring, mapping ,and training for professionals) political and financial support for the said programme. Models need to be developed using composite data to predict the changes and quantify their impact in the various ecosystems of the IHR for better management strategies.

2.4.2 Intensify monitoring of glacial recession

Glaciers in selected regions within the IHR need to be monitored on continuous basis for determining the trend of the impact global climate change. Extend studies on glaciers to the Eastern Himalaya.

2.4.3 Map and monitor GLOF, flash floods and cloud burst affected areas and hill aquifers

Monitoring these parameters using remote sensing as well as ground truth information would be vital to predict the natural hazards along the glacial rivers. This calls for strengthening the mountain hazard mitigation measures in all Himalayan States. (also, see BOX 5.4). Improved dialogue at national and regional levels should be precipitated on how to address flood risk and disaster preparedness in general, and flash-flood management in particular. National capabilities need to be strengthened to improve preparedness at the at –risk villages and community levels.

2.4.4 Use of modern technology

Promote the use of modern technology in harnessing the renewable energy resources such as wind, mini-hydro, bio-energy and solar energy.

2.4.5 Evolve better water conservation strategies

Promote rain – water and water harvesting structures and better management practices of water – use in the IHR. It has been established that the amount of runoff depends on the interplay of weather conditions. Preparedness in predicting future trends could contribute to more effective, forward-thinking management of major dams and thus allow a better long-term control of water for irrigation and power supplies.

2.4.6 Revamp Clean Development Mechanism (CDM)

As part of the Clean Development Mechanism participatory afforestation and reforestation activities on identified waste – lands (1990) need to be taken up as projects. Planted forests (especially native species) may help to counteract negative effects of climate change on natural forests. CDM may include low-impact harvesting in forests, improving shifting cultivation and better soil conservation measures. Eligible projects are not coming up fast – enough, suggesting a serious revamping of capacity building not only of forest officials & institutions but covering private sector, NGOs & CBOs.

Greater thrust needs to be given to identification of ways and means to counter emissions of greenhouse gases and socio-economic vulnerability of mountain people to climate change. Some of the measures include promotion of Green Industries, improved mountain farming practices, soil storage of carbon and improved fertilizer use. Burning of huge agriculture – residue (paddy) in states like Punjab, controlled forest – fires, controlled firing of forest undergrowth needs urgent and alternate solutions.

2.4.7 Integrated Disease Surveillance and Forecasting System

With change in mountain climate several vector born diseases are likely to enter the higher altitudes. There is an urgent need to initiate integrated disease surveillance and forecasting system for vector borne diseases across the IHR.

2.4.8 Bio-prospecting for future crops

Local germplasm of the mountain areas needs to be conserved on farms. Virtually all native cultivars of food crops embrace prominent natural traits such as drought tolerance and disease resistance. Marginal crops, such as finger millet, barnyard millet, proso-millet, foxtail millet, amaranth, buckwheat, chenopod, rice bean, horse gram, etc. are such resilient food crops. Modern biotechnological tools could be of immense help in developing super-crops with introduced traits of mountain crops.

Box 2.4: The Kyoto Protocol

The agreement was signed at Kyoto, Japan in December 1997. The protocol states that the industrialized countries will reduce their collective emission of green house gases (GHGs) by 5% compared to the year 1990. The goal is to reduce overall emissions of greenhouse gases namely carbon dioxide, methane, nitrous oxide, sulphur hexafluoride, HFCs and PFCs over the five-year period between 2008-2012. Following are the ways to achieve this:

i. Enhancement of energy efficiency in relevant sectors of the national economy.
ii. Protection and enhancement of sinks and reservoir of GHGs not controlled by the Montreal Protocol of 16 September, 1987 and promoting sustainable forest management practices, afforestation and reforestation.
iii. Promotion of sustainable forms of agriculture in the light of climate change considerations.
iv. Research on, and promotion, development and increased use of, non and renewable forms of energy, of carbon dioxide sequestration technologies.
v. Progressive reduction or phasing out of market imperfections, fiscal incentives, tax and duty exemption and subsidies in all greenhouse gas emitting sections and promotion of policies and measures, which limit or reduce emission of GHG's
vi. Limitation and reduction of methane emissions through recovery and use in waste management and transport and distribution of energy.

(Source : MoEF)

The Task Force recommends following research themes

i. Mapping and monitoring of potential glacial lake outbursts floods (GLOF) needs to be undertaken as a regular programme in the Himalaya using state-of-the-art technology coupled with field work. Collaboration of GBPHIED and ICIMOD will facilitate early mainstreaming.

ii Develop empirical models, depicting climate change scenarios for key glaciers and subsequent river discharge, with reference to changes in hydrology, primary productivity of various ecosystems, biodiversity and mountain farming. Accordingly evolve adaptation strategies for various ecosystems.

iii Hill aquifer mapping and periodic evaluation needs to be carried out to estimate the water resources for domestic, livestock, agricultural and industrial consumption. Cover entire IHR with BARC environmental isotope – based mapping exercise in collaboration with HESCO.

iv. Launch an integrated long term ecological research (LTER) to establish baseline data and to detect the changes in species composition and adaptation in the context of global warming/climate change. The studies should also include changes in phenology, habitat alteration, fragmentation and resultant migration of species.

v. Promote research on sensitive species (plants, animals and micro-organisms) and their response to climate change, especially on the sub-alpine and alpine taxa. With increasing aridity in the western Himalaya some of the sensitive species and communities are likely to vanish locally. It is imperative to document the relationship between climatic patterns and species response to it, in order to predict future distribution of biota. Ecological models will have to be evolved defining exposure-response equation between climate variability and changes in climate sensitive species.

vi. Distribution of climate-sensitive diseases are required to be identified, relationships between climate and health quantified, and climate-sensitive health determinants and outcomes (with special emphasis on the most vulnerable populations) precisely estimated. Estimate burden of climate-sensitive health determinants and outcomes, especially for vulnerable populations

vii. Other areas of research and key questions on climate change in the IHR include: Eco-physiology and current distribution of sensitive species; Adaptive mechanism of various species to changed climatic conditions; Identification of species having better CO_2 sequestration potential for cold deserts; Research on transgenic plants for efficient CO_2 sequestration in various eco-climatic regions; Strategies for combating ill effects of climate changes and efficiently deploying species of CER credits; Response of microbial fauna and soil environment to climate change; Research on impacts of off-season vegetable production; and Changes in species composition in various ecological zones and responses of C_3 and C_4 grasses. Contiguously, what are the data requirements for meteorological, environmental and socio-economic indicators? Where does indigenous knowledge come in? What are the costs and benefits of implementing short, medium and long term mitigatory measures?.

3.0 INSTITUTIONAL CAPACITIES AND ARRANGEMENTS

3.1 Background

A large number of institutions and individuals are working in the IHR in the area of Forests, Environment Natural Resource Conservation, Human Resource Development and Basic Sciences with varying capacities, capabilities and geographical coverage (see Annexure : 6). However, the existing capacities as is commonly percieved have not been utilized to the full potential for the benefit of mountain development. At the same time there are a number of emerging fields which need recognition and institutionalization, given the depleting natural resource base and changing socio-economic conditions. There is also a need to pool the existing human resources in the region in order to multiply the benefits that could accrue from the existing resources. This review covers current expertise available in the IHR, priority areas for capacity building and potential of networking in addressing the issues which confront the mountain ecosystems.

3.2 Review of Institutional Capacities and Gaps

The Institutions dealing with conservation and management of natural resources in the IHR can be broadly divided into following categories: (i) Government institutions dealing with research and development, (ii) Non-government Organizations (NGOs) with local, national and international mandate, and (iii) Community based organizations. Notwithstanding a wide ranging mandates, and often overlapping objectives, there exist wide gaps between the researched information and their intended transfer to the fields. Further, there is an apparent want of coordination, networking and cohesiveness among the institutions working for conservation and development in the mountains. Lack of adequate manpower, funds, infrastructure, communication, incentives and remoteness are considered major causes of weak delivery systems. A brief analysis of the institutional capacities and gaps follows:

3.2.1 Government Institutions

i. The oldest research organizations working on the inventory of flora and fauna in the region include the Forest Research Institute (FRI) now under Indian Council of Forestry Research and Education (ICFRE), Botanical Survey of India (BSI) and Zoological Survey of India (ZSI) with a wide geographical coverage in the IHR. These organizations have excellent Library, Herbarium, Museum and Databases on floral and species. These organizations seem to have become top heavy with low turn over of young scientists and researchers. This problem has already been highlighted in the course of preparing re-structuring plans for organizations such as the ZSI and the BSI (MoEF 1999). When contrasted with the approach followed by the ICAR institutions their interaction with other stakeholders seems next to non – existent (see recommendations in chapter 4).

ii. The MoEF has established an autonomous Institute i.e., GB Pant Institute of Himalayan Environment and Development (GBPIHED), with an overall mandate of dealing with the environment and conservation issues in the IHR. It is a key Institution charged with inter-disciplinary studies. The results of project studies of the institution will also have implications at higher level cross-cutting issues such as climate change and land degradation. A large number of publications by GBPIHED researchers are noted in peer-reviewed publications such as Current Science indicating a higher dissemination of research outputs than other institutions. However, this fall far too short compared to what Himalayas deserve and need.

iii. Other institutions of Central Government with a national mandate but also covering the IHR, include Wildlife Institute of India (WII), Geological Survey of India (GSI), Forest Survey of India (FSI), institutions under the Council for Scientific and Industrial Research (CSIR), Indian Council for Agricultural Research (CSIR), National Bureau of Plant & Genetic Resources (NBPGR), and National Remote Sensing Agency (NRSA). NRSA, CSIR and ICAR have a number of research laboratories in the IHR. Institute of Himalayan Bioresource Technology (IHBT), Palampur, a CSIR laboratory, has been established under the aegis of the National Bioresource Development Board (DBT, GoI). This Institute is engaged in survey, mapping, inventory, characterizing and sustainable utilization strategies for important economic species of the Western Himalayan Zone; Bioprospecting of microbes, molecules and genes; Introducing novel economic flora; *Ex-situ* conservation of various species; Plant adaptation studies in response to low temperature and for efficient C sequestration.

iv. Wadia Institute of Himalayan Geology (WIHG), under DST, has been actively involved in geological researches in the IHR. Its charter of work also includes environment and natural resources. Defence Research Development Organisation (DRDO) is working on high altitude crops, vegetables and animal husbandry. The Snow and Avalanche Study Establishment (SASE, HP) is dedicated to avalanche control measures and studies. Besides, the Indian Army has established a few Eco-Task Forces for restoration of degraded areas in the IHR. Like the ICFRE institutions, and unlike the ICAR institutions, involvement of other stakeholders, including states is minimal in case of these institutions also.

v. A number of conventional and technological universities in the region (Box 3.2) have been carrying out research and academic activities especially in the area of human resource development in the region. In addition, various State Council of Science & Technology (SCS&T), state boards on medicinal plants, biodiversity, bamboo, research wings have been active in research and development activities in the region.

Theoretically speaking while the basic scientific competence could be said to be available in the region, to deal with various issues related to forestry and environment, yet many aspects still remain left – over. For example, notwithstanding a number of institutions working on biodiversity, there is a paucity of taxonomic skills particularly in lower groups of plants and animals. The commitment and dedication of various agencies also varies considerably. Further, there exists no formal mechanism of coordination between the policy planners and research institutions, except in some of the ICAR institutions. Even within the research institutions there is often a lack of coordination between the administrative and academic functionaries.

Most of the Universities located in the IHR are not well equipped to deal with conservation linked sustainable development issues. This immediately calls for an integrated and inter-disciplinary approach among all professionals working in the areas of natural and social sciences. There also exists a clear need to develop a knowledge system by linking traditional knowledge with the formal knowledge system.

3.2.2 The Non-Government Organizations (NGOs)

i. There has been a considerable growth in the number of NGOs dealing with natural resource management (NRM) and social activism in the IHR. Major strength of NGOs has been their close association with local communities, documentation of traditional resource use and indigenous knowledge system.

ii. A few international NGOs such as the International Snow Leopard Trust, Snow Leopard Conservancy, IUCN and the World Wide Fund for Nature – International (WWF) have focused mainly on protection of certain species such as tiger, elephant, chiru, snow leopard or wetland birds. Although flagship/ charismatic, large-vertebrate centric approaches deserve due attention and continue to be pertinent to a large extent, there appears a need for more focus on conservation of overall ecosystem.

iii. Some of the National NGOs, such as WWF – India, Bombay Natural History Society, National Conservation Foundation (NCF), Kalpavriksha etc., have played an yoe – man's role in motivating the local NGOs, researchers and particularly the local communities, in the area of nature conservation.

Quite a few local NGOs have made significant contribution in the area of sustainable and ecologically sound development, setting up grass-root level organizations. Besides the well – known Gandhian Dasholi Gram Swaraj Mandal (Chipko Movement) notable among them are Ladakh Ecological Development Group (LEDeG), Himalayan Environmental Studies and Conservation Organisation (HESCO), Central Himalayan Rural Action Group (CHIRAG), Himalayan Action Research Centre (HARC), INHERE, WDO, Grassroots, TERI, Central Himalayan Ecological Association (CHEA) and Peoples' Science Institute (PSI). HESCO focuses on income generation and upliftment of the hill people from a number of rural initiatives including readaptation of gharats or traditional watermills and other rural technologies, utilisation of weeds such as lantana,

medicinal plant conservation, etc. PSI has initiated several projects such as watershed development, microfinance and inventorying of traditional forestry and water practices in Jammu and Kashmir, Himachal Pradesh and Uttaranchal, particularly in and around Dehra Dun where this institute is situated. HARC, INHERE, WDO have worked on promoting organics, bio – diversity and human capacity building, especially hill – women. In the North-east India there are, relatively speaking, a limited number of NGOs dealing with the environment and nature conservation. One of them is The Missing Link (TML India), well known for its work on Upland agriculture, Policy Advocacy on NRM, Development Communication and Capacity Building in EH including Eastern Nepal, Bhutan, and NEI.

3.2.3 Community Based Organizations (CBOs)

i. One of the oldest CBOs dealing with the management of common property resources in the IHR are the Van Panchayats (forest council or forest committee). These were created to Kumaon in 1920s following agitation against British attempt to convert village commons into reserved forest areas. The landmark Van Panchayat Act 1931 handed over control of designated community forests to elected Van Panchayats (VPs) in place of the State Forest Department (SFD). The Uttaranchal VPs probably represents one of the largest experiments in common property management in collaboration with the state (both SFD and State Revenue Department) (Box 3.3), (pre – dating JFM initiatives by six decades).

ii. In Meghalaya Village Dorbars play an important role in running of the day-to-day administration. It comprises mainly elderly men in the village. The ladies are restricted from taking part in the deliberations of the durbar. All issues pertaining to the village are discussed, debated and decided by the Dorbar. The Dorbar is represented by the *Tymmen Shnong* or *Waheh Chhnong* (Village Headman) in the Khasi and Jaintia Hills respectively and the *Nokmas* in Garo Hills. In many villages specific forest areas are earmarked as village forests or community forests, where fuel wood extraction, thatch grass collection and materials for house construction are permitted. Certain Village Dorbars are also the custodian of sacred groves and community forests.

iii. In Nagaland, the Village Councils (VCs) are the traditional institutions, akin to the *Dorbar shnongs* of Meghalaya in some ways but very different in their role, functions and status. The VCs are traditional institutions given special recognition and status by Article 371 A of the Indian Constitution and they are the overall managers of both natural resources, as well as, administration and development of the villages. The Village Councils also exist in the tribal areas of Mizoram, Arunachal Pradesh, Assam and Tripura. As in case of VCs, these Councils have final say on the common property resources, within the jurisdiction of the concerned village.

iv. In Arunachal Pradesh, Manipur, Tripura etc, the VCs do not exist officially in view of specific state legislations, as well as now the introduction of the

Panchayat Raj system. This is not the case in Nagaland. Arunachal Pradesh has the *Kebang* – which are traditional assemblies. They continue to play a very vital role in the community but legally it is now through the Panchayati System (Arunachal has adopted the 3-tier system and they have Gram Sabha, Anchal Samiti and Panchayat). Some states have the Autonomous District Councils, which manage natural resources and other assets together with the traditional village institutions.

v. Recently established CBOs, include Natural Resource Management Groups (NRMGs) established by the IFAD funded NECRMP project, in the six hill districts of Assam, Manipur and Meghalaya. These are community based institutions which have been constituted to counter iniquitous situations like Meghalaya where women are prevented from Dorbars, are thus not a party to important decisions. An NRMG consists of two adult members (one male and one female) from each household in the village and the group is duly acknowledged by the Village authorities (who have to convey their acceptance to the project). All decisions related to NRM are decided in a participatory manner.

3.3 Priority Areas for capacity building

Based on the above analysis and other inputs made available to the Task Force, a matrix has been developed giving the current strengths and capacities. Some of the themes deserving to be initiated / strengthened include: Training on EIA Procedures, Green Roads Engineering, Technology for management of hazardous waste, mountain hydrology, water harvesting technology, risk engineering, hydropower engineering, community forestry in NE. New Institutes visualized are Mountain Farming System Research Centre and Centre for Mountain Studies.

3.4 Recommendations

All the organizations working in the IHR are required to be brought together to address the vital environmental issues. This could be possible through (i) giving new role to local traditional institutions based in rural areas; (ii) creating a synergy amongst different organizations, mountain scholars, and social workers; (iii) empowerment of rural organizations, rangeland/ livestock-dependent marginal communities; (iv) building up a social environment in favour of gender equity; (v) recognizing social institutions, social sanctions, local cultural values, knowledge system; (vi) capacity building of local organizations and conservation-oriented social movements. Task Force's recommendations are as follows:

3.4.1 Strengthening existing institutions

There is an urgent need to revamp the existing programmes for the mountain ecology and conservation within the existing institutions and also enlarge the mandates of such institutions which have dedicated to research and development agenda in the mountains. Each Institute located in the region needs to be mandated with thematic areas, including

policy analysis and advocacy. There is an overdue need to disseminate the research findings through appropriate outreach programmes. The Research institutions need to develop partnership with the development agencies at regional/state/district levels in order to strengthen outreach and make research agenda demand driven. (see ICAR approach in chapter 4).

3.4.2 Technical backing to line departments

Several line departments such as Public Works Department (PWD), Panchayati Raj Institutions (PRI), Forest and Agriculture departments will need technical backing by the experts and Institutions working in the region. The State Forest Departments require modernization (see section 1.6.ii). This paragraph would (i) provide a mechanism for wider dissemination and outreach of research finding dissemination, (ii) build up a cadre of technical service providers among the NGO sector, (iii) complement outreach by government extension agencies, and (iv) ensure that the primary stakeholders have access to appropriate and latest mountain technologies research findings.

3.4.3 Linking Traditional Knowledge System with Formal Knowledge System

Mountain communities are rich repositories of traditional knowledge, practices and resources. Traditional knowledge and practices have evolved through generations of empirical experimentation. Farmers selection of practices, technologies and resources function on the simple principle of survival, as farmers simply cannot afford failures, unlike the scientific community; for farmers, the luxury of failures is at the cost of survival. The knowledge repository among communities has to be judiciously tapped and built upon. The involvement of mountain communities in technology development, conservation and management of mountain resources needs to be strategically formalized. Decentralization and devolution of powers and functions should be encouraged to make traditional institutions active partners in conservation and sustainable use of mountain resources.

3.4.4 Attracting and retaining talent

Institutions located in the mountain areas chronically suffer from the lack of high quality aspirants to fill vacancies and once recruited, find it difficult to retain them. One reason for this is the obvious difficulties associated in postings, particularly in regard to their children's education, health facilities etc. In many instances, although the appointees would like to continue and serve in the mountains, despite their dedication and love for mountains, education or health considerations of family members force them to seek alternate employment in locations with better facilities. Only out of the box solutions could remedy these, and remedied they must.

3.4.5 New Curricula and Programmes

Universities and colleges in the IHR need to be activated, rejuvenated suitably funded to undertake basic inventories on NWFP, biodiversity and ecosystem ecology. The Universities also need to revise their curricula and initiate specialized courses on various relevant aspects related to demographic change, phenomenon of out – migration, women drudgery issues connected with integrated mountain development. This will imply linking knowledge systems which would ensure community participation and integration of various disciplines. In this context, it would be appropriate to form a formal **Consortium of Universities in the Himalayan Region** to facilitate exchange of the scientific information, expertise and information. Sharing of existing expertise and faculty also has to be systematized. The Task Force observed a surprising lack of exchange between the institutions of WHR and NER in this age of IT and communication revolution. This must be bridged immediately.

3.4.6 Strengthen the Van Vanchayats

Van Panchayats in IHR need to be strengthened; creating space for undertaking cultivation of various economically and commercially viable species.

3.4.7 Coordination between Centre and State Agencies

As **s**everal Central Government institutions e.g., ICFRE, FSI and NRSA are involved with regular monitoring and mapping of forest cover and natural resources for preparation of national database local institutions and state agencies should be formally involved and are charged with the role of ground-truthing and field data collection. This will in turn enhance their capabilities.

3.4.8 Other recommendations

These include: (i) Strengthening DC's and VC's in the NER in terms of NRM, (ii) Promote women, young scientists and rural youth in Environment planning, (iii) Establish a network of long term ecological research (LTER) sites and ensure wider participation by various institutions in the IHR, (iv) Enhance disaster management capabilities and generate awareness and preparedness for disaster prevention and mitigation, combined with the latest available technology for early warning and forecasting, (v) Strengthen the institutions dealing with soil and water conservation. Water harvesting, drinking water and sanitation are the major issues throughout IHR yet there are very few institutions dedicated to these issues.

Networking and developing partnerships among the civil society, research organizations, CBOs and NGOs have been reiterated time and again in various plans and policy documents. However, integration of various policies and programmes across such a large geographical region and ensuring participation of multiple stakeholders has not been possible under the existing institutional capacities and mechanisms. Hence, this TF

recommends establishment of a full fledged **Ministry of Mountain Development** for coordination of various activities in the IHR (see chapter 4).

Box 3.3 Van Panchayats in Uttaranchal

Van Panchayats (forest councils or forest committees) were introduced to Kumaon in 1920s following agitation against British expansion of control over forest areas. The landmark Van Panchayat Act 1931 handed over control of designated community forests to elected Van Panchayat (VP) members in place of the State Forest Department (SFD). The VP probably represents one of the largest experiments in common property management in collaboration with the state (both SFD and State Revenue Department). In this an elected body, called forest committee or forest council holds responsibility of using and managing village forest resources. However, the various activities are under the control of rules of the Revenue Department, and the SFD is supposed to provide technical inputs. In a way, the village forest is a resource, used by a definite user group (the village people) and is liable to degradation due to over use. Though called village property, the land in reality belongs to the State; however, village people consider it as a collective property and resent government interferences. It is not a common property of Hardin (1968) with open access and no rules for governing the use of or control over a resource. Most community forests were initiated on degraded sites, officially on a kind of civil/soyam forest, falling under administration of the Revenue Department. But unlike Civil Soyam forests the community forests are not open-access forests. Depending on the number of households in a village, there are generally 5-9 elected members in a VP, who elect a "*Sar panch*" from among themselves. Elections are held after 5 years. At least one Scheduled Caste and women members should be elected to the committee.

Responsibilities: The responsibilities are laid out in the law as following: (i) To ensure that only those trees that have been considered silviculturally fit for cutting by the SFD would be cut, (ii) To ensure that the village forest land is not diverted to any other use, (iii) To erect and maintain boundary pillars, (iv) To carry out the directions and execute the orders given to it by the State Revenue Department (SRD) (on the advice of SFD) to maintain, improve and exploit the forests, (v) To utilise the forest produce to the best advantage of village community and of the right holders, recognised by established customs or permitted by the SRD, (vi) To close generally at least one-fifth of the grazing area to promote conservation and (vii) To protect the forest from fire, illicit felling and damage to trees due to lopping.

Functioning: A watchman is appointed to guard the forest, and his salary (generally only Rs.200-400 per month) is paid by the community. He is authorised to take action against offenders. In some villages, households watch the forest on a rotational basis. The VP may grant permission for cutting grass, grazing and collection of fallen wood, and may charge fees for these provisions with the permission of the Government. The other rights include extraction of pine resin for domestic and medicinal purposes and disposing of trees with the permission of SRD (on advice of SFD). The trespassers can be fined up to Rs.50, and up to Rs.500 with the permission of SRD. If rules for grazing are violated cattle can be detained up to 48 hours, and the VP has the right to disallow the use of privilege of any person found guilty. Within these limits, each VP makes its own rules and regulations as per needs and wisdom. Motives for forest management are founded upon expectations of immediate product returns as well as to make sacrifices for forest conservation (e.g. foregoing community forest use). Desire to prevent outsiders from using forest and to become self-sufficient in firewood, leaf litter (for manuring) and fodder is said to be the driving force for the development of community forests in some villages with a high level of success.

(Source : Forest Department, Uttaranchal)

4.0 INTEGRATING VARIOUS SECTORS FOR MOUNTAIN DEVELOPMENT

4.1 Background

Various stakeholders working on mountain related issues, from local communities, NGOs, governments and international organizations share a common view of the importance and uniqueness of mountain areas and cultures. It was their collective conviction and the partnerships they forged prior to Rio which was instrumental in gaining chapter status for mountain under Agenda 21 and in maintaining close collaboration throughout the post-Rio period. The concept of sustainable mountain development, nearly fifteen years since the United Nations Conference on Environment and Development (UNCED), can now been considered as comprehensively mainstreamed. As is well known now there existed little recognition that mountain regions require special consideration, prior to the Rio Earth Summit, despite their importance in terms of biological or landscape diversity, provision of water and other renewable resources, and protection of vital downstream interests. (see preceding chapters for their unique contributions and potential.) Increased awareness, thanks mainly to the process set in motion by UNCED, Chapter 13 of Agenda 21,' Managing fragile ecosystem: sustainable mountain development', has resulted in a multi-sectoral and a more comprehensive approach to address mountain development issues and this needs to be strengthened and deepened during the eleventh five year plan. For growth to be inclusive, as is the objective of this Plan, mountains must get their due share and recognition.

4.2 Integrating various sectors for the mountain environment and development

Mountain areas, their problems and needs, continue to be dealt with mainly in a sectoral context (e.g. agricultural or forestry and environment), and often within a national planning framework. This has tended to marginalise these areas and provide inadequate emphasis to mountain specific issues which may require special attention. A multi-sectoral, more comprehensive approach to addressing mountain development issues is a concept which is at least a decade old (Mountains of the World: a Global Priority: B. Messerli J.D.Ives, p 447). The two programme areas of Chapter 13 consist of (a) Generating and strengthening knowledge about the ecology and sustainable development of mountain ecosystems; and (b) Promoting integrated watershed development and alternative livelihood opportunities. The task of integration of various sectors has to focus mainly on the following objectives:

(i) Raising awareness of the importance of, and improving understanding of, sustainable mountain development issues at global, regional, and national levels;
(ii) Protecting natural resources and developing technical and institutional arrangements for natural disaster reduction;

(iii) Strengthening a global information network and database for organizations, governments, and individuals concerned with mountain issues;
(iv) Strengthening country capacity to improve planning, implementation, and monitoring of sustainable mountain development programmes and activities;
(v) combating poverty through the promotion of sustainable income-generating activities and improvement of infrastructure and social services; in particular to protect the livelihood of local communities and indigenous people; and
(vi) Formulating and negotiating regional or sub-regional mountain conventions and possibly developing a global mountain charter.

The thinking about sustainable mountain development has led to an increasing recognition of the importance of mountain areas in terms of biodiversity conservation, economic potential and protection of downstream interests. This, in turn, has led to a greater willingness to address development and conservation needs through investment programmes in areas which have traditionally been neglected in national level development planning.

Extant literature on sustainable mountain development has highlighted attention towards several issues and emerging priorities which have hitherto been discussed in rather general terms and which must be discussed in a regional and national context. These issues and priorities inter alia suggest actions and programs for integration of efforts of various sectors, both in the plan and non-plan sector, in the Indian context. These issues and emerging priorities are:

4.2.1 *Ministry of Mountain Development and Mountain Policy*

Given the disadvantaged economic and political position (carving of hill districts of UP into Uttaranchal into a separate political entity in 2000 complete the process of over-coming political marginalization of the mountains in the Indian Himalayas) that most mountain regions occupy vis a vis the lowlands, it is absolutely critical that mountain scholars and planners turn their attention to the formulation of workable policies which is informed by the best possible mountain science. Such a Policy will need to be sensitive to the complex trade-offs that will inevitably occur in the process of sustainable development. It is clear that global societal interests in ecosystem functioning (hydrological cycles, bio-diversity maintenance, clean air) cannot be addressed and paid for by the small-holder mountain farmers who are often on the brink of starvation, or at least face severe seasonal food shortages. The policy implication of this is that that the larger society will have to compensate the local mountain people for their efforts to save the mountain environment.

While institutional arrangements at global and regional levels have emerged and contribute to progress in achieving and improving communication net-working and in providing an information clearing house function (Mountain Forum, ICIMOD), the same cannot be said to have happened within nations with substantial mountain areas. Today India has as many as 11 States out of 28 which are mountainous yet there is no institutional mechanism in India to undertake this important task. However, with the up-gradation of the Department of Development of North Eastern Region (DONER) into a full-fledged Ministry, the North

East Region Council and constitution of hill districts of UP into Uttaranchal, there exists a case to constitute a Council for the North Western Region and bring it under this new Ministry. The Ministry of NER could be renamed as the Ministry for Mountain Development, responsible for, among other things, development of an over-due Mountain Development Policy. Constitution of such a Ministry would signal recognition of mountain areas as worthy of special attention, needing specific mountain policy, as distinct from the main-land (low-lands/plains). The main function of the proposed Ministry of Mountain Development would be to create a greater awareness of the 'Mountain Agenda' and improving co-ordination of efforts, from various Ministries/Departments, International Funding Agencies, fostering of Public Private Partnerships, net-working amongst R&D institutions, internationally and nationally, to protect fragile mountain ecosystems and promote sustainable mountain development.

Presently Ministry of Environment & Forests is charged with the responsibility of implementation of policies and programs relating to conservation of the country's natural resources. While implementing these policies and programs, the Ministry is guided by the principles of sustainable development and enhancement of human well being. The Ministry also serves as the nodal agency in the country for the United Nations Environment Program (UNEP), South Asia Co-operative Environment Program (SACEP), International Centre for Integrated Mountain Development (ICIMOD) and for the follow-up of the United Nation's Conference on Environment and Development (UNCED). The Ministry is also entrusted with the issues relating to multilateral bodies such as the Commission on Sustainable Development (CSD). Global Environment Facility (GEF) and regional bodies like Economic and Social Council for Asia and Pacific (ESCAP) and South Asian Association for Regional Cooperation (SAARC) on matters pertaining to environment.(India, 2006: Publication Division). Given such diverse responsibilities the most crucial function of co-ordination, and thus marshalling of requisite funds from various related Ministries and Departments etc. remains not adequately addressed. This has perpetuated the sectoral approach to mountain development (just Environment & Forestry) to the sad detriment of the attention due to the mountains of India. How, woefully inadequate this has remained in the Ministry would be obvious from a review of budgetary analysis of the Tenth Five Year Plan of the Ministry of Environment & Forestry (Annexure: source : MoEF and Planning Commission).

During the Tenth Five Year Plan (2003 -2007) the Ministry of Environment & Forestry through its 74 schemes, with a total outlay of Rs. 6,894 crores essentially catered to the requirements of its as many as 17 institutions (16 sectoral and only one GBPHIED, dedicated to the over-all mountain agenda), totaling Rs. 1006 crores; of direct benefit to the mountain states. From where their individual line departments could possibly benefit could be counted National Afforestation & Eco-development Board and National Afforestation project, all others being a factor of preparedness on the part of the sectoral line department of the mountain states. The 44 Environment sector schemes are purely sectoral, National River Conservation Plan (Rs. 1500 crores) nearly non-applicable. Considering a multi-sectoral nature of sustainable mountain development agenda, given an absence of any inter Ministerial co-ordinational effort, it is extremely difficult to estimate the budgetary support to the mountain states from the Central Ministries. The budget

mechanism now evolved for the North Eastern States (10% of earmarked Ministries, with non-lapsable arrangements) is the only certainty. Given the multi-faceted engagements of the Ministry of Environment & Forestry it is extremely unlikely that they can ever take over the task of effective co-ordination amongst several Ministries whose inputs of schemes and inflows of funds are a sine qua non for sustainable mountain development.

It will be quite instructive to compare the allocation of business to the Ministry of Environment & Forests and their budget allocation with that of the Ministry of Development of North Eastern Region (upgraded from Department status on 27th May, 2004); which is as below:

(i) Matters relating to planning, execution and monitoring of development schemes and projects of North Eastern Region, including those in the sector of Power, Irrigation, Roads and Communication.,
(ii) Hill Area Development Program and Border Development Area Program in the NER,
(iii) Non-lapsable Fund for the NER,
(iv) North Eastern Council,
(v) North East Development Finance Institutions (NEDFI),
(vi) North Eastern Regional Agricultural Marketing Corporation Ltd (NERAMC),
(vii) The Sikkim Mining Corporation Ltd,
(viii) North Eastern Handloom and Handicrafts Development Corporation, Shillong
(ix) Road works financed in whole or in part by the Central Government in the NER, and Planning of Road and Inland waterways Transport in the NER.

The annual budget of Ministry of Doner for 2005-06 was Rs.1088 crores, (i) Rs. 585 crores under Non-lapsable Central Pool of Resources (NLCPR), (ii) Rs. 461 crores for NEC and four other Central Plan Schemes of which Rs. 22 crores for the Development Finance Corporation was the maximum. The NER has essentially depended on central funding for development works. All the States in the NER are Special Category States, their Annual Plan are financed on 90% grant and 10% loan. Same is the case with Uttaranchal, Himachal Pradesh and J&K. For the NER the Centre has approved constitution of a Central Pool of Resources in December 1997 and the Pool was created from the unspent balance of the 10% earmarked in the budget by various Ministries/Departments. Ministry of Doner sanctions infrastructure development projects to the North Eastern States out of NLCPR. The broad objective of NLCPR scheme is to ensure speedy development of infrastructure in the NER by increasing the budgetary financing of infrastructure projects comprising economic as well as social infrastructure sectors. Funds from the Central Pool can be released for State sector as well as central sector projects but these are not meant to supplement the normal Plan program either of the State government or the Union Ministries.(Annual Report, Ministry of Doner, 2005-06). The budget of NLCPR may be further augmented by increasing the existing 10% to 15% as earmarked in the budget of the Ministries/ Departments, as well as outlays which may become available by scrapping of all CSS schemes in Ministries/Department with less than Rs. 35 crores during the Tenth Five Year Plan.

The above comparison of functions and schemes of Ministry of Environment & Forest with those of Ministry of Doner amply demonstrates that the latter Ministry's structure, functions and budgeting mechanism are more favorable and suited for pushing the agenda for sustainable mountain development. For Department of Development of North Eastern Region (Doner, September 2001) to graduate to Ministry of Doner (May 2204) and ultimately to the Ministry of Mountain Development, by incorporating the three states of North Western Himalaya viz. Uttaranchal, Himachal Pradesh and Jammu & Kashmir, would be the most logical step for an integrated planning of the Himalayas. There is simply no other alternative to integrating concerns relating to fragile mountain ecosystems into other sectors (ministries, departments), save pooling of all Central resources, creating a mechanism as has been done for the NER and drawing up of a Mountain Policy on the solid bed-rock of such a non-lapsable resource base and integrated planning. Any other attempt at 'co-ordinating' various schemes/programmes of related Ministries/Departments in the name of 'systems of integrating concerns relating to fragile mountain ecosystems' are bound to be non-productive and fail, as we all know so very well.

Further, all the mountain states have been categorized as Special Category States (SCS) owing to (i) their weak infrastructure,(ii) forest-dominant area,(iii) environmental fragility,(iv) weak economic base, and (v) being located on international borders. Internal and external security of the mountain -ecosystems/states has thus been made an integral part of flow of resources, both plan and non-plan. Recently, concerned with the accelerated build-up in regions across our national borders, the process of connecting our border-regions with all-weather -roads was accelerated, after Ministries dealing with Defence, internal security (Home) and environment (MoEF) were able to converge and compromise their respective interests. Such a delay would not have taken place had there been a Ministry of Mountain Development, with an agenda of over-all development and not merely a single sector or concern. Thus, even to guard our precious mountain ecosystems/states from external and internal threats such a Ministry seems an urgent necessity.

4.2.2 In Mountain States mainstream F.R.D.C. types of Administrative Structures

Forest and Wildlife departments are seen to function in comparative isolation and forest officials / functionaries are not exposed to the pressing livelihood concerns of mountain community / households. In States, to push agricultural production in 1960s Agriculture Production Commissioner / Development Commissioner branches were constituted. These brought together agriculture, co-operative, animal husbandry etc. under one umbrella, under the second highest administrative head called Forest and Rural Development Commissioner (F.R.D.C.) at the level of Additional Chief Secretary. Results are there to see in India achieving food – self sufficiency. Like the plains, there is need to bring Forest & Livelihoods in mountains together, under a similar umbrella. Uttaranchal since 2000 has constituted what is called the Forest & Rural Development Commissioner Branch, with very encouraging results. Many a boxes, which appear in this Report, are the best testimony of the experiment. This may be tried in all IHR states.

4.2.3 Back-stopping of Ministry of Mountain Development by R&D Institutions

Mountain Policy initiatives, which would be initiated and implemented through the Ministry of Mountain Development will need to be back-stopped by constituting a formal net-working arrangement amongst 40 plus R&D institutions belonging to ICAR, CSIR, DST and DRDO. A SWOT analysis of these institutions has been provided in Chapter 3 dealing with institutional and individual capacities. There is perceived tendency to enfeeble an existing R&D institution (e.g. Indian Veterinary Research Institute) and bring it down from the mountain region and locate them in the plains region (Bareilly), without vacating the space once occupied by it. Such tendencies should not only be strongly resisted but efforts should be made to strengthen the existing R&D institutions and set up new centres of R&D excellence based on mountain specific needs. There is a clear need to anchor Centers of excellence like IIMs, IITs for improving HRD component, and like IRMA, Anand for properly addressing the management needs of the rural development sector. The abysmal poverty and unemployment levels, which are aggravating further, are to be understood better and suitable anti-poverty programs designed specifically to address mountain poverty. Mountain ecosystems are to be salvaged from bio-socio-economic vulnerability to bio-socio-economic security, and this can happen only through a collective of integrated efforts, and not through sectoral interventions.

4.2.4 Follow the ICAR Regional Committee system

An important forum where interactive dialogue with all different functionaries is held on various problems and constraints in the region, should be followed. Till date ICAR Regional Committee system has held 17 rounds (2004) of such consultations. It would be advisable to hold such Regional Committee meetings, once every two years, one for NER states and another for North Western states, to which all ICAR, DST, CSIR and DRDO institutions located in the Himalayan States, or dealing with mountain issues although not stationed in the Himalayas, could be invited. This will go a long way towards integrating the R&D efforts which are being made in isolation by various agencies/institutions. One of these institutions could be declared as the Lead R&D institution for a particular mountain theme and made responsible for co-ordinating all R&D efforts on the theme. Fund-release by related Ministry/Department could be made conditional to recommendations made under this mechanism. This will save considerable amount of duplication which is prevalent today.

4.2.5 Legal and Institutional Mechanisms

There is a greater recognition of the need for new or reinforced legal mechanisms to protect fragile mountain ecosystems and promote sustainable and equitable development in mountain regions. (e.g., The Forest Conservation Act, The Environment Act, The Schedules Tribes (Recognition of Forest Rights) Bill etc.). There is, however, a strong case to have an inbuilt mechanism for a review of all such legal and institutional mechanisms as technological development, improved insights into various parameters of development and ever increasing population pressure force us to re-visit earlier

assumptions (e.g. Shifting Cultivation, plantation on wastelands, watershed development dialogue, exploration of NRM-based livelihood options).

4.2.6 Investment in mountain development and conservation

More mountain-specific investment programs and greater mobilization of financial resources for mountain development and conservation programs will be required. In some cases this may mean formulating and financing programs which are focused exclusively on mountain areas. There are signs of greater willingness on the part of government to increase investment levels in mountain areas, which historically have been neglected. (e.g. NER initiatives, construction of strategic border-roads, electronic connectivity etc.). Yet, newer investments opportunities through Private Public Partnerships (PPP) need to be explored for increased resource mobilization.(e.g. Bamboo Mission between GoUA and E-land of Thailand and Bio-fuel Mission, private investment both in plantation and setting up de-esterification plant and jatropha plantation by GoUA, MoRD, NOBORD GoI, both Uttaranchal).

4.2.7 Improve Resource flows

There remains the need for clearer understanding of resource flows to and from mountain areas. This will lead to increased income to mountain communities and a fairer distribution of earnings from natural resources exploitation and services provided. A number of innovative mechanisms, allowing a greater share of the proceeds from mountain-based economic activities to reach mountain people have to be continuously thought of and evolved (e.g. in all hydro-electric projects set up in the mountains, 100% deployment of resources generated out of 12% free electricity to development of upstream regions only; Recognition of Ecosystem-services provided by the NRM in the mountains, both by Planning Commission and Twelfth Finance Commission, for Forest Protection).

4.2.8 Effectively address Mountain Poverty and Improve status of women and children

Attention to the basic causes of poverty in mountain areas and women drudgery is of paramount urgency. This cannot be addressed by looking at everything from a conservationist glasses. An equipoise has to be struck between environment conservation and development. Population below poverty line (1999-2000) in the mountain regions are much higher than the rest of the country and its severest impact is felt by mountain women and children, as most of the able-bodied adult out-migrate in search of livelihood. Agriculture is already at subsistence levels.

Population below poverty line (1999-2000)

Sr No	States	%
1.	Arunachal Pradesh	33.47
2.	Assam	36.09
3.	Manipur	28.54
4.	Meghalaya	33.87
5.	Mizoram	19.47
6.	Nagaland	32.67
7.	Sikkim	36.56
8.	Tripura	34.44
9.	Uttaranchal	47.42
10.	Himachal Pradesh	N.A.
11.	Jammu & Kashmir	N.A.
	All India Average	**26.1**

Mountains, in India, relative to their surrounding lowlands, are necessarily regions of poverty as indicated in the table above. However, the approaches adopted for the entire country have also been made applicable for these regions. With relative lower density of population and larger geographic area per capita the resource made available for poverty alleviation and rural infrastructure development fall short of the norm. Many regions which witness extreme poverty and lack of resources also practice seasonal-migration, making it difficult to pull them above the poverty line with the help of schemes designed for the mainland. All the mountain regions in India are also land-locked, with international boundaries, closing any trading/ market avenues whatsoever. These situations demand out of the box solutions like the "Look East Policy" for the NER and opening of old Indo-Tibetan trade routes. Without effectively tackling mountain poverty it would be well neigh impossible to sustain and maintain the mountain ecosystems

Women's work in the mountainous regions can be separated into three categories. First, women produce for subsistence, this is essential work that forms the main economy. Second, women enable their men to live and work outside the village for long period at a time while they maintain the traditional way of living. Thirdly, women replace men in tasks that are traditionally performed by men, thereby increasing the burden of their own work load. Cumulatively, the total work load of mountain women has become what is popularly known as "drudgery". Ministries dealing with poverty, agriculture, animal husbandry and women and child issues have to converge their resources on mountain women to pull them out of their immense work-load.

4.2.9 Mainstream Food Security

Efforts to eradicate hunger and mal-nutrition to receive greater attention along with the overall objective of poverty alleviation in mountain regions. Translated into inter-state

transfers of cereals and developing states' own pool of food-grains has to be effectively targeted on to the mountain regions, as no change in agricultural productivity or diversification in production is possible without ensuring an effective public distribution system (PDS). Alternately, introduction of mountain cereals as PDS commodities, could simultaneously secure food-security with better opening for these cereals.(e.g. introduction of mandua into food-supplement for the ICDS programme in Uttaranchal).

4.2.10 Re-visit Mountain Forests

New interest and attention is being devoted to the forest policy debate; new opportunities have become available to discuss further the important role played by forests in mountain areas with respect to issues such as hazard prevention(e.g. Bamboo development for zone 5 earth-quake prone houses); biodiversity conservation (e.g. CDH Plan and Medicinal and Aromatic Plants, development and marketing); livelihood opportunities (e.g. community forestry, Van Silk, Bamboo and Fiber development)

4.2.11 Exchange of experience and information collection and dissemination

The networks which have been created over the past 15 years, especially through activities of the Mountain Forum (e.g. Mountain Forum); regional inter-governmental organizations like ICIMOD and NGO consultations (various NGO Networks) should be fully exploited to stimulate and enhance this type of direct exchange at all levels. Recent trends of mountain states joining hands in selected sectors need to be taken to their logical conclusions in joint ventures in a win-win mode (e.g. Uttaranchal - Himachal governments' MoUs on development of Tourism, Horticulture, Civil Aviation and Hydro-power development).

Overall, while the Mountain Agenda could be said to have made satisfactory progress during last 15 years, nevertheless there remain certain unfulfilled expectations which require a more concerted effort. The Eleventh Five Year Plan is one such occasion when "better institutional arrangements at the national level to adequately address the multi-dimensional aspect of many mountain issues", through establishment of a Ministry of Mountain Development" (by further upgrading the Ministry of Doner, by including the three left-over mountain states of North Western Himalaya and without adversely affecting fund-flows to the NER states), greater attention could be focused to the special concerns of mountainous states/regions" and also gain a more thorough understanding, as suggested in this chapter, of the knowledge base on mountain ecosystems.

4.3 Recommendations

Task Force, besides the above structural changes, for inclusive growth of mountain areas, would like to recommend a few specific integrated programs, and these are:

4.3.1 Rangeland Management and Wildlife Conservation

Alpine arid and semi-natural pastures, collectively known as 'Rangelands', occupy a considerably large geographical area. These marginal and seemingly low productive ecosystems harbour unique floral and faunal assemblages and represent important ecological and cultural landscapes. The Changthang plateau in the eastern Ladakh represents one such landscape. This area forms the western extension of Tibetan plateau and lies above 4500 msl. It supports diverse but low populations of several globally threatened mammals such as snow leopard (*Uncia uncial*), Tibetan argali (*Ovis ammon hogdsoni*), blue sheep (*Pseudois nayaur*) and Tibetan wild ass (*Equus kiang*), besides several species of migratory waterfowl including black-necked crane (*Grus nigricollis*) and Bar-headed Goose (*Anser indicus*). Less than 2 % of the geographical area on the plateau is cultivated and most of the vegetated zone is used as grazing ground by the *Changpa* herders, a migratory pastoral community. The *Changpas* keep goats, sheep, yaks, and horses. Despite a poor vegetation cover, relatively low standing biomass and high anthropogenic pressure, this area sustains a considerably high livestock population. Steady increase in the livestock population in the area is mainly attributed to influx of nomadic herders from Tibet during recent decades and promotion of *Pashmina* goat production by the Animal Husbandry Department (AHD) for fine quality under wool (*Pashmina*). The herders and AHD officials, in recent years have begun to raise concern over degradation of pastures, resultant shortage of forage, and mass mortality of livestock during severe winters.

In the absence of any alternative lifestyle available for the herders and under the rapidly changing socio-economic conditions it is imperative to manage the area for multiple use viz., biodiversity, watershed and traditional pastoral practices. This calls for formulation of an integrated and practical conservation plan for the area which would require building a strong institutional mechanism by adopting the principles of adaptive and co-management and integration of concerns raised by the departments of Wildlife, Animal Husbandry, Tourism and Tribal Development.

4.3.2 Watershed development, with Rural Livelihoods and Biodiversity Conservation

The Technical Committee on Watershed Programs (Parthasarathy Committee) has recommended factoring in livelihood issues while implementing watershed development. It

has analyzed the drawbacks of the current 'Hariyali Guidelines', a Panchayat centered watershed program and emphasized a major role for civil society. Importantly, it has been pointed out that the watershed development has been preoccupied with "the conventional soil conservation approach of safe disposal of run-off" and of late it has been equated to "rainwater harvesting and conservation". This soil conservation bias has come from the long-standing concern about silting of dams built at great cost and the more recent one about loss of top soil, leading to wastelands and desertification. Even the wider objectives set out in the Fifteen Year Perspective Plan (2005-2017) for Watershed Development for the state of Uttaranchal (2005), also suffers from the same biases. Parthsarathy Committee report has been credited to correct these biases.

All future watershed development projects must be dovetailed and compulsorily address rural livelihoods.

4.3.3 Mountain Eco-tourism and rural livelihood

Given the fragility of the landscape and relative disinclination of rural folk for enterprise based livelihoods, mass tourism in the IHR is likely to cause irreparable damage. Hence most of the tourism in IHR needs to take the form of Eco-tourism as has been successfully demonstrated in cold arid Ladakh region. Nature and local culture based tourism / eco-tourism can contribute significantly to local development. However, little efforts have been made to promote community based eco-tourism in the IHR (except Dzongri Trail in Kanchendzonga). Further efforts have been made to promote ecotourism only around PAs and a few Reserved Forests. A good example of joint management of tourism for the benefit of local communities comes from the Valley of Flowers National Park (see Box : 4.1) which can be replicated in many parts of IHR.

Much more efforts are needed by the Ministry of Environment & Forests, Ministry of Culture and Tourism and Ministry of Rural Development / Tribal Development to encourage and augment appropriate Eco-tourism Policy in IHR. This sector would also require active involvement and close coordination among the central and state governments, public sector undertakings, Panchayati Raj Institutions, local NGOs, rural unemployed youth and women.

The Valley of Flowers – Hemkund Shrine Initiative
(A community managed environmentally responsible mass tourism in India)

The Problem:

The buffer zone of the **Valley of Flowers (VoF)** National Park and adjacent Hemkund shrine (4200 m) in Chamoli District, Uttaranchal shared common conservation concern since early 1980s till 2002 due to want of a system for managing religious tourism in an environmentally responsible manner. Four to five lakh pilgrims converged in 19 kms of Bhyundar Valley**,** the common access to VoF and Hemkund shrine during May to September every year. The ecosystem of the whole Bhyundar Valley was under great duress due to accumulation of garbage and plastic waste. The problem had multiplied manifold due to the ever increasing pilgrims with environmentally irresponsible behaviour. The initiative to **redefine the conservation strategy started in the year 2002**.

Strategy adopted:

This process involved churning a multi-stakeholder partnership by the Uttaranchal Forest Department. Effort was to evolve a system of responsible tourism with active participation of locals, pilgrims and the Shrine Management Committee. The management systems evolved since 2002 led the local community mobilize funds to the tune of **Rs. 4.68 million in three years (2003, 2004 and 2005)** through sharing of the cess on pony business for catering pilgrims with the local Zilla Parishad. This win-win exercise initiated with primary stakeholder community by the Goverrnment resulted in removal of illegal encroachments by the locals from 400 to 76 in 2002 & 2003. Most importantly it relieved Bhyundar valley of **123 tons non-biodegradable waste accumulated over last 20 years with local community of two gateway villages** taking lead in the whole cleaning operation through their **Ecodevelopment Committees.** The garbage collected were sent to different destinations for recycling. In 2006, **98 local people were directly employed** in different activities involved in responsible tourism management for 5 months with the fund mobilized. This process has gone beyond in 2005 with local community managing most of the service sector for pilgrims including the **insurance cover** in collaboration with **financial institution.**

The Outcome:

This experiment is a telling example how a cost effective and productive management system for conservation can be evolved in difficult areas (14000 ft msl) by keeping **public at the center stage in resource building, resource sharing and resource handling** with well planned capacity building and accountability processes through institutional and government policy support. The economic analysis of VoF garbage collection catapulted to creating a **new business model** for handling plastic waste in high hills. As a result, the Uttaranchal Government made operational **first waste plastic densification (lumping) plant** of 10 tonnes capacity per month at **Srinagar (Garhwal) in Jan 2006** under **public private partnership**. More of such plants are offing in Uttaranchal thus realizing the relationship of economics in environment and equity. This experiment have been adapted by Zilla Parishad of adjacent district, Rudraprayag in ***Kedarnath Dham*** route from 2005 onwards.

This unique effort ultimately rewarded the VoF with the World Natural Heritage Site status in July 2005.

(Source : Jyotsna Sitling, UA Forest Department)

4.3.4 Mountaineering with purpose

Himalayan mountains have been attracting mountaineers from all over the world, but this activity (mountaineering) has not been perceived beyond just being a sport / a past time.

(see Box 4.3). It is imperative to consider this activity as a potential service – sector activity, with many ramifications, trekking guiding, adventure sports, search & rescue operations etc. Integration of various departments such as tourism and sports, defense personnel, departments of environment and mountain hazard mitigation need to consider this aspect and train the local youth, committing members, including their own persons and women in mountaineering and other adventure sports.

Box 4.3 : Mountaineering with Purpose

Mountaineering is emerging as one of the popular adventure sports the world over. In the Indian Himalayas, it , however, needs to be promoted in a regulated and a more purposeful manner, with adequate environmental safeguards so as to enable us to preserve the fragile Himalayan environment. It is necessary that the Indian and International mountaineering activity in the Indian Himalayas is conducted in an organized manner by adhering to appropriate, time tested systems evolved at the Indian Mountaineering Foundation over the last five decades. A balance needs to be maintained between the development of tourism and promoting mountaineering activity with a view to inculcate in the youth of the country a passion for mountaineering and related adventure sports as this contributes in character building and development of leadership qualities.

Mountaineering brings a sense of adventure in the youth and enables them to take required risks in real life and develop qualities of team spirit. Adventure sports should also enable the mountaineers make new friends, gain new knowledge and enhance their physical endurance. Given the natural hazards and emergency mitigations, often required in the mountains, it would be desirable to add the component of 'mountaineering with a purpose' to the courses on high altitude trekking and mountaineering. This would prepare the mountain youth for combating rescue operations during emergency and natural calamities. Likewise, all other adventure activities related with mountaineering such as skiing, river rafting, rock climbing, high altitude survival, expeditions could be viewed with more wider purpose rather than merely from the purpose of sports. Thus, mountaineering could also aim at enterprise based community development by linking with tourism industry, income generation, recreation and providing long term employment to talented local youth. The course curriculum on adventure sports also needs to include the aspects of mountain ecology and conservation.

(Source : Col Bhimwal, IMF)

4.3.5 Agro-forestry and Community Forestry in NEHS

Shifting agriculture (Jhum) is one of the major forms of agroforestry in the NEHR and is often viewed as a major cause of deforestation and loss of biodiversity. Recently at the initiation of ICIMOD and IFAD (see Annexure 8 - Shillong Declaration) there have been attempts to review policies and documenting this age old practice to arrive at a consensus. This called for viewing forestry and agriculture in a holistic manner in the region and implementing various schemes for achieving socio-economic development while minimizing the loss of BD, maintenance of life support system and ensuring the ecosystem services. In absence of cadastral surveys, there is often an overlap between agricultural and forested land. Hence it is extremely important to recognize the strong linkages between

agriculture and forest, need for greater integration between two sectors and improved policy synchronization. There is a need to tune the shifting agriculture towards cash/niche (organic) crops so as to increase cash income of farmers and to ensure favourable markets for shifting agriculture products. Introduction of shade loving cash crops like cardamom, beans (*Rajma*), ginger, turmeric, etc are fine examples of how shifting cultivators can maximize their incomes. The transition in shifting agriculture needs to be closely monitored and well - directed with practical and viable policies, for making it simultaneously more productive and ecologically sustainable.

4.3.6 Management of Common Property Resources

Management of common property resources (CPRs) require an integrated bottom up approach. For example, the Unclassed State Forests (USFs) in NEHR suffer from lack of management policies and guidelines. Therefore a policy review is needed to ensure that the state directly facilitates and supports the communities in the management of USFs, not just through proxy support like JFMs. A better example of managing CPR comes from the yak herders of Arunachal Pradesh (see Box). Task Force recommends documentation of an adoption of these local practices and assisting them with critical inputs by related agencies, rather than designing and imposing schemes from outside.

4.3.7 Organic Farming and Integrated Pest Management

Organic farming and conservation of local agri-biodiversity (indigenous crop varieties) are now being officially advocated for the mountain farmers who have small land holding, remained uncovered by the Green Revolution and have less fertile land. Yet pressure of producing more out of the same unit of land is ever mounting. Less land per person requires more high yielding agriculture. To increase yield from existing land requires healthy soil and effective crop protection against insect and pests. Therefore an ecologically acceptable integrated pest management (IPM) needs to be evolved for various sectors involving scientists from the Agricultural, Horticulture, and Plant Pathologists. The GB Pant University of Agriculture and Technology has suggested a case study from Uttaranchal (Box) which is an excellent example of coordination between scientists and rural development agencies that needs to be replicated in other parts of IHR.

Traditional knowledge : the *Brokpas* of Arunachal Pradesh

Yak production system among the *Brokpa* community of Arunachal Pradesh has evolved under high-risk conditions. *Brokpas* are competent in maintaining the traditional breeds of yak. They consider several important characters such as productivity and health while selecting the yak breed for breeding hence they have maintained about 20 indigenous yak breeds. The *Brokpa* community prefers local breed of yak for the meat and milk products due to compatibility of food habits and socio-environmental factors. Existence of informal rural social institutions plays a pivotal role during the breeding and conservation of yak breeds. For the sound healthcare management, this community considers some of the local attributes in grazing land and moving the yak to keep them healthy. Selection of grasses, shrubs and trees as supplementary feed during the lean season is found to be quite rational. Curing different diseases and disorders by using ethno-veterinary medicines are based on years of informal experimentation, location specific observations, locally available plants and practices. Local breeds have developed special traits to cope with the high fluctuations in climatic factors (temperature regime) and forage supply.. Development of pastoral economies is the key to poverty alleviation and improving food security, as well as to the wider goal of creating sustainable livelihoods. These can be well facilitated through utilization of local knowledge systems of breed management and healthcare practices for yak adopted by *Brokpa* people.

The participatory research on the traditional management system among the Brokpas of Arunachal Pradesh reveals a tremendous promise for maintaining culturally viable and sustainable livelihoods by drawing on their own rich store of knowledge and practices relating to forest, agriculture and land use. Hence mainstreaming gender-sensitive approaches in management and use of indigenous resources and other culturally important species will allow marginalized and subsistence groups to enhance their capacity to manage, conserve and use their natural resources sustainably and strengthen their local economies. Women's knowledge of bioresources used in preparation of ethnic foods and its dynamics with cultural aspects reminds us to acknowledge the context of diversities of social capital of northeastern region and their role in sustainable use of traditional foods and management of related natural resources.

These results may be of immense use in framing the appropriate policies for the effective designing and managing not only the natural resources and biodiversity of Arunachal Pradesh, but also the further eco-friendly development vision of the region so that matching government policies could be designed accordingly.

(Source : Ranjay K. Singh, Arunachal Pradesh)

Integrated Pest Management Programme for the Hill Farmers in Uttaranchal

Under crop diversification plan in the state, off-season vegetable cultivation is poised to play a unique role in the hill farming system in Uttaranchal state. Being low volume and high value crops they are rated to be potential cash earners. Unfortunately, however, all these cash crops suffer recurrent chronic losses due to a variety of diseases and pests. The per hectare agrochemical usage in the vegetable crops is very high as compared to cereal crops with a simultaneous increase in the pesticide consumption. This trend where on one hand threatens the highly fragile Himalayan ecosystem, on the other it does not fit with in the frame work of organic farming, which is the state policy. In view of this, a an integrated pest management programme was designed at GBPUAT so as to mitigate recurrent losses (nearly 80 %) due to seed and soil borne pathogens in vegetables each season in the region. The key components of this programme were a) plastic mulching (soil solarization) of nursery beds and fields, b) use of bioagents for seed treatment, seedling treatment, soil treatment and foliar application, c) Bio-composting including vermi composting and d) use of value-added vermin-compost and farm yard manure. Other location-specific problems could be addressed through supplementary intervention(s).

Through adoption of this programme losses through seed and soil borne diseases as well as insects could be severely minimized. This is achieved through maintaining microbial diversity in the soil, creating conditions suitable for their growth and development through providing habitats for their growth. This way the farmers can reduce cost of production, minimize losses due to pests and diseases, increase benefit-cost ratio and raise value-added crop. This programme is being adopted by over 3000 farmers from 55 villages in districts Tehri, Pauri, Almora, Champawat, Nainital and Udham Singh Nagar. Depending on the extent of damage to the soil ecology through indiscriminate use of chemicals, varying degree of success has been achieved. However, with continuous adoption of IPM success rate can be quite high. To the predominantly agrarian economy in the state, this programme can prove handy to the small farmers in the years to come. There, however, remains the necessity to enforce implementation of IPM through extension functionaries (Krishi Vigyan Kendra – KVKs) in the state for its widespread adoption and implementation. On similar lines, such plans that apply ecological principles in pest management need to be developed for other crops.

(Source : Dr. J. Kumar & U. S. Singh, GBPUAT)

There is an urgent need to promote a multidisciplinary and cross-sectoral approach in training and dissemination of knowledge to the local people on a wide range of issues, such as household production systems, conservation and utilization of arable and non-arable land, treatment of drainage lines and recharging of groundwater, livestock management, fisheries, agroforestry and horticulture. Similarly, in the field of transport and communication use of science and technology including inputs from Geosciences would be needed. Although road network forms the life-line of the local people in the region but faulty alignment, improper disposal of debris and inability to stabilize the slopes often cause great loss to the surface soil, change in hydrology and degradation of ecosystem. IITs and Eco-task Force of Indian Army could be of much assistance in constructing better roads in the region.

5.0 POLICY REVIEW AND CORRECTIVE MEASURES

5.1 Background

MoEF has notified a number of guidelines and rules pertaining to conservation of environment and forests, from time to time, which are duly backed by different Acts and Regulations passed by the Government of India. Conservation of critical environmental resources, livelihood security for the poor, inter-generational equity, integration of environmental concerns, economic and social development, efficiency in environmental resource use, environmental governance and enhancement of resources for environmental conservation are the **seven over – riding Objectives**. These seven objectives, to be realized through various strategic interventions, are premised on **fourteen Principles** and these are anthropocentric sustainability of all development initiatives, right to development, environmental protection, precautionary approach, economic efficiency, entities with incomparable values, equity, legal liability, public trust doctrine, decentralization, integration, environmental standard setting, preventive action and environmental offsetting.

The Task Force is more than conscious of the fact that a Task Force dedicated exclusively to review all aspects related to EIA, due to unavoidable circumstances could not complete the task and had to be merged with the one on Governance, which has rendered its own task more onerous. Members of the Task Force who specialized in EIA issues also pointed out issuance of latest Notification as recent as Sep 14, 2006, rendering any useful insight difficult.

5.2 Review of Current EIA Practices in the Mountains

Environmental Impact Assessment (EIA) is a planning tool that is now accepted as an integral component of environmentally and economically sound-decision making. The major objective of EIA is to foresee and address potential environmental problems at an early stage of project planning and design. The EIA and Environmental Mitigation Plans (EMPs) assist the planners and the Government authorities in the decision making process by identifying the key impacts and formulating mitigation measures. The principal legislation related to EIA in India, for over a decade has been the EIA Notification (1994), which has been superseded recently by EIA Notification (2006) issued on September 14, 2006.

The new EIA notification involves categorization of projects as A and B based on "spatial extent of potential impacts on human health and natural and man made resources". Category A projects are to get clearance from the central EIA Appraisal Committee of MoEF while Category B projects are to be cleared by the State Environment Impact Assessment Authority (SEIAA). Though none of the Himalayan states have notified SEIAAs so far, it gives adequate flexibility and power to the respective states to undertake the EIA and formulate EMPs. The EIA Notification (2006) makes EIA mandatory for 30 categories of developmental projects under Environment (Protection) Act, 1986. A Manual has been brought out by the MoEF to cover the whole

gamut of issues like regulatory requirements, the EIA methodology, baseline surveys, identification of key issues (screening and scoping) and consideration of alternatives and remedial measures.

In the 1994 Notification. EIA was mandatory for all tourism projects in the mountain areas (above 1000m) with investment of more than Rs. 5 crore. However, this clause has been withdrawn from the new EIA Guidelines. Considering the fragility and sensitivity of mountain ecosystems it is necessary to carry out EIA for such projects and it must be realized that the amount of money spent cannot be correlated with the magnitude of environmental impacts. For example, in an ecologically sensitive site, even small infrastructural projects costing a few lakhs, could have severe negative environmental impacts. Ecological fragile locations need to be taken out of this exemption. Uttaranchal High Court, on its own, has banned concrete constructions in Chopta bugyal region.

EIAs are usually conducted under serious limitations of time and resources. To overcome these constraints it is desirable to focus on a few manageable and relevant issues. There are two methods by which significant issues could be identified, viz., ecological and social scoping. Ecological scoping deals with the determination of significance of those changes which can be measured and predicted with a reasonable accuracy. These include changes in the physico-chemical and biological environment. The criteria for determining significance should include severity of impacts, human health and safety, potential loss of important commercial species/commercially available production or breeding spawning areas, environmental attributes of major recreational or aesthetic importance, areas of archaeological, historical, architectural, aesthetic, artistic cultural importance, rare endemic or endangered species, loss of habitat, loss of local culture and communities. Some recommendations pertaining to EIA procedures for the IHR, which this Task Force considers deserving of inclusion need to be in the EIA Manual are as follows :

5.2.1 Methodology used in EIA of the mountain area projects must include fragility and ecological sensitivity of the area for impact identification, evaluation, prediction and mitigation. Compensatory Afforestation Plans and Catchment Area Treatment (CAT) Plans in the Project areas need to be implemented strictly under the supervision of an appropriate high powered committee.

5.2.2 The mountains exhibit a strong seasonal variation in the occurrence of flora and fauna. Therefore, collection of baseline data for three seasons (summer, rainy and winter) should be made mandatory for assessing impacts on biological components.

5.2.3 Ecosystem integrity, uniqueness of the habitats, floral and faunal values along with wildlife corridors must be taken into account while calculating the cost of the project.

5.2.4 Often the cost of compensation is calculated for timber, fruit trees, fodder trees and agricultural crops submerged or destroyed due to the project activities. But the ecosystem goods such as NTFPs including MAPs, honey, lichen, mushrooms,

etc. are not taken into account, for calculation of lost goods and compensation to the stakeholders' community. These should be included as these have now become tangible incomes of households in some mountain regions.

5.2.5 Furthermore, the ecosystem services such as carbon sequestration, watershed protection, stream water regulation, etc. need to be internalized in the **cost : benefit** analysis of developmental projects. Likewise, the aesthetic and scenic beauty of project site(s) and their importance from the standpoint of ecotourism has also to be considered.

5.2.6 The "public hearing", although mandatory as per the MoEF, GOI guidelines, is a crucial aspect of any developmental project, in the remote mountain areas. People's aspirations need to be addressed right from the inception of surveying for a developmental project to avoid any confrontation with the stakeholders at the later stages of project. It should be transparent, organized within the project area inviting views and grievances of the stake holders and the community at large.

5.2.7 MoEF as well as SEIAAs need to publicly notify the agencies which have requisite scientific credentials to carry out EIAs in the IHR. SEIAAs should also monitor the environmental mitigation plans very closely.

5.2.8 The SEIAAs technical and scientific man – power need to be strengthened by including best contemporary environmental scientists and develop guidelines for categorizing B1 and B2 type of projects (B2 categories do not need public hearing) as per the new EIA notification (2006). SEIAAs also need to evolve Best Practices in HEPs, CAT Plan implementations, Mining and other developmental activities. Task Force feels that common sets of guidelines for the WH and NER as a region would be better suited than each state conducting a separate exercise on its own.

5.3. Review of other Environmental Laws and Policies Pertaining to the IHR

Following the formal commencement of forest laws and institutions in 1865 the recognition of traditional community entitlements were effectively extinguished in many parts of the country. Such disempowerment has led to the forests becoming open access in nature, leading to their gradual degradation. It has also led to perennial conflict between the forest dependent communities and the forest department, constituting a major denial of justice. The Panchayats (Extension to the Scheduled Areas) Act, 1996 and the relevant provisions of Part IX of the Constitution provide a framework for restoration of the key traditional entitlements. Yet another significant legislation has recently been tabled for providing access to the Scheduled Tribes living in forests.

It is essential that women in the mountains play a greater role in the management of natural resources. While they have to bear the brunt of natural resource degradation, they

have little control over the management of these resources. National Forest Policy, 1988, Indian Forest Act, 1927, as well as the regulations under it, provide a comprehensive basis for forest conservation. The National Forest Commission, set up in 2003, has reviewed the policy and other related matters and submitted its recommendations.

From June 1990 Joint Forest Management/community forestry has been officially promoted and state governments have taken measures to bring large areas hitherto unclassified or non-reserve forest under community forestry/joint forest management. In some states efforts are being made to provide a community forest for every revenue village for their fuel, fodder and livelihood enhancement opportunities, through constitution of new Village Forests/Community Forests and extending areas of the existing Village forests (see Box 3.1 on Van Panchayats).

The Task Force would like to conclude its review with brief remarks on a few other laws relevant to IHR as follows:

5.3.1 Declaration of Ecologically Sensitive Areas (ESAs)

The Environment (Protection) Act, 1986 under section 3 (2) (v) empowers the central government i.e., MoEF to take all measures that it feels is necessary to protect and improve quality of the environment and to prevent and control environmental pollution by declaring an area as ESA. Accordingly, the MoEF may restrict an area for any industry which is likely to have negative impact on the environment. Section 5 (1) of the Environment (Protection) Rules, 1986 (EPR), states that the central government can prohibit or restrict the location of industries and carrying on certain operations or processes on the basis of considerations like the biological diversity of an area (clause v) maximum allowable limits of concentration of pollutants for an area (clause ii) environmentally compatible land use (clause vi) proximity to protected areas (clause viii).

The declaration of an area as ESA helps regulate and plan for a more ecologically sensible land use management. Some of the measures that have been used in previously declared ESAs are categorization of industries as red, orange and green on the basis of their pollution loads, regulation of industrial units/ activities, setting up of industries on the basis of guidelines and plans, special approvals made necessary for certain activities/ operations, creating zonal / master plans for future development of the area, setting up of monitoring committees to oversee the planning and regulation of land use in the area. MoEF had set up a committee in 2000 to develop guidelines for identifying areas that can be declared ESAs. Although the report of the committee has been submitted, these guidelines are yet to be finalized by MoEF. So far only two areas have been declared as ESA in the IHR viz., Doon Valley in Uttaranchal and Numaligarh in Assam (see Box 5.1). There is a need to take a fresh look at the concept of ESAs throughout the IHR. All high altitude wetlands, lakes and glaciers the Task Force feels need to be declared as ESA

on a priority basis. The Government of Sikkim has notified its high altitude lakes as ESAs.

BOX 5.1: ESAs in the IHR

Restriction on mining in Doon Valley, Uttar Pradesh (No. J – 20012/38/86-1A dated February 1, 1989): In the early 1980s a number of petitions were filed in an effort to stop the limestone mining ravaging the Doon Valley in Uttaranchal. This went up to the Supreme Court, which directed the stoppage of further mining in this area. Thereafter the Central Government issued a notification under the EPA restricting location of industries, mining operations and other development activities in this area. This has had a most salutary effect on the environment of Doon Valley, which is again threatened as the new capital (provisional) of Uttaranchal.

Numaligarh 'No Development Zone' (issued on 5th July, 1996) : As a condition of environmental clearance granted to the Numaligarh refinery in Assam, MoEF declared an area of 15 km radius around Numaligarh refinery in the proximity of Kaziranga National Park as a 'No Development Zone' in 1996. This notification does not permit the expansion of industrial area, townships, infrastructure facilities and such other activities which could lead to pollution and congestion shall not be allowed within "No Development Zone" specified in the Appendix to this notification, except with the prior approval of the Central Government.

5.3.2. Applicability of National Laws across the Himalayan States

In the NEHS various Acts and Rules pertaining to Environment and Forest Conservation are not applicable automatically owing to status of land (VIth Schedule). Several issues of governance and local land use practices need to be streamlined, customary laws codified in order to strengthen the conservation of environment and forest in the region. A case in point here is the coal mining activities in the Jaintia hills (see Box 5.2).

BOX 5.2: Environmental Implications of Coal Mining in Jaintia Hills, Meghalaya

The state of Meghalaya has rich biological diversity as well as mineral resources. It is estimated that the state has a coal reserve of 560 Million Tonnes which is spread over an area of 213.9 sq kms (1% of the total geographical area). During the year 1999-2000, about 4060 tonnes of coal was produced in Meghalaya. Out of which 2936 tonnes was produced in Jaintia Hills District alone. Mining is performed by individual tribals using traditional method commonly known as "Rat-Hole Method" generally on small plots of lands. Recently, underground mining method is also introduced in which a well type structure is dug. Thousands of such mines covering substantial area of the state are either in operation or abandoned without adopting any mitigation/reclamation measures. These coalmines usually exist in clusters and, as such, the area covered by these mines is quite large and their cumulative impact is highly devastating on extremely fragile environment of this region. So far, provisions of Mines and Minerals Regulation and Development Act, 1957, Water (PCP) Act, 1974, Air (PCP) Act, 1981 and EIA notification, 1994 could not be applied in the area owing to Provisions of 6th Schedule. The state does not have any State Mineral Policy in spite of abundance of several major and minor minerals which could have helped in protecting the environment from such activities.

Uncontrolled coal mining in these fragile hills have resulted in deforestation, surface and ground water pollution, change in drainage pattern, drop in groundwater tables, air pollution, soil pollution, disposal of over burdens, land slides, soil erosion and impact on flora and fauna. These impacts are likely to cause health hazard in the region and other socio-economic maladies.

It is therefore recommended to carry out Regional Environmental Impact Assessment (REIA) and evolve Regional Mitigation Plan (REMP) for achieving the sustainable mining practices. Initiative for REIA and REMP should be taken by Mineral Resource Department of State in a time bound manner who is currently entrusted with collection of revenue from such coal mining. Expert institutions like Indian Institute of Mines, Dhanbad, I.T., BHU, NEERI or any other competent agency may be engaged for the purpose. Mineral Resource Department should also be entrusted to implement the REIA and REMP. Coal miners should be charged with Environmental Cess for undertaking above activities which is in line with "Polluter Pays" principle envisaged in NEP, 2006. If required, suitable legislative amendments be made for the purpose as envisaged in NEP, 2006.

(Source : Dr. S.C. Katiyar, MoEF Regional Office, Shillong)

Similarly, the state of J&K has separate laws and policies pertaining to forest and wildlife (see Box 5.3). Though most of these have been derived from the National Policies and Acts, there is a justifiable case to reassess the central and state laws so that the environmental concerns are suitably taken care of.

BOX 5.3: Environmental Policies and Acts in Jammu & Kashmir

Jammu & Kashmir has been given the special constitutional provision to formulate its own Laws and Policies for the conservation of natural resources. Some of the relevant Acts include The J&K Fisheries Regulation Act (1903), The Jammu and Kashmir cattle tresspass Act (1920), The Jammu & Kashmir Kuth Act (1921), The Jammu & Kashmir Forest Act (1930), The Jammu & Kashmir Game Preservation Act (1942), The Jammu & Kashmir Preservation of specified Tree Rules (1969), The Jammu & Kasmir Wildlife Protection Act (1978), The Jammu & Kashmir Order on Joint Forest Management Notification (1992). The J&K Forest Act of 1930 is mainly based on the Indian Forest Act of 1927. However there are some differences. Forests under the J&K Forests Act are classified as "Demarcated", "Un-demarcated" and "Village" forests. The government can regulate the forest land under the first two categories. In the case of the village forests, any revenue land may be handed over to a village community and the management of this land may be done in accordance with the rules made under the provision. This Act has further been strengthened by virtue of the J&K Forest (Amendment) Act of 1997.

5.3.3 Biological Diversity Act, 2002

Section 36 (3) states that the Central Government shall take measures "wherever necessary, for assessment of environmental impact of that project which is likely to have adverse effect on biological diversity, with a view to avoid or minimize such effects and where appropriate provide for public participation in such assessment." This could be used for projects adversely affecting areas rich in biodiversity but not covered by the EIA notification. But the operational aspects of this provision are unclear as of now. It is not clear how the Central Government hopes to operationalize this and how it interfaces with other EIA related procedures.

Under the provisions of Convention on Biological Diversity (CBD), the Conference of Parties (COP) selected mountain biodiversity as one of the major themes for in-depth consideration at its seventh meeting. In order to provide advice to COP, the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) considered Mountain Biodiversity as one of the three themes in its eighth meeting (10-14 March, 2003, Montreal). Further, in response to SBSTTA proposals, an Ad-hoc Technical Expert Group (AHTEG) on Mountain Biodiversity was constituted which proposed various conservation programmes for Mountains. These programmes were adopted by SBSTTA at its IX Meeting (10-14 November 2003, Montreal). As the programme elements are framed to cover general and specific issues of Mountain Biodiversity across the globe, the Government of India needs to initiate action on the suggested programmes for IHR.

5.3.4 Policy Gaps

The National Forest Policy (1988) aims at achieving 60 % forest cover in the Himalayan Area by 2020. While this seems achievable in the NEHS given the geographical location (proximity to the equator) and physical environment (high rainfall), same target appears unrealistic for the Western and North Western Himalaya as nearly 40 % of the geographical area in the region falls in the alpine and aeolian zone i.e., above natural treeline. There is a moratorium on the commercial felling of trees above 1000 m but rules & regulations alone are inadequate to promote regeneration of forests in the Himalayan region because in the absence of any policies on land use or livestock grazing on steep hill slopes the seedlings and saplings are vulnerable to browsing and the forested habitats are amenable to growing populations' need of fuel and fodder, soil erosion and invasion by alien invasive species.

The National Wildlife Action Plan (NWAP) 2002 - 2016 was released by the Prime Minister during the XXI meeting of the Indian Board for Wildlife (IBWL) held on January 21, 2002. At this meeting the IBWL adopted the "Wildlife Conservation Strategy 2002". One of the points in this document was "Lands falling within 10 km. of the boundaries of National Parks and Sanctuaries should be notified as eco-fragile zones under section 3(v) of the Environment (Protection) Act and Rule 5 Sub-rule 5(viii) & (x) of the Environment (Protection) Rules." In case of IHR, often the altitudinal gradients are sharp and most of the National Parks and Sanctuaries were proposed or notified much later consequently a number of human habitations have come within 10 km of PAs. This limit needs to be immediately reconsidered and rationalized in case of mountain PAs.

IHR has 3 Biosphere Reserves (BRs), 18 National Parks (NPs) and 71 Wildlife Sanctuaries (WS) encompassing 9.2% of the geographical area (much higher than the country average viz. 4.5 %). However, a large number of PAs exist merely on paper and the local communities continue to exercise the rights of livestock grazing and NTFP collection. Delay in realignment of boundaries and settlement of rights in case of many mountain PAs is likely to further increase already exacerbated PA – people conflicts. Similarly, straying out of threatened species such as elephants (e.g., in Garo and Khasi hills) has been a major issue both for wildlife managers as well as local people. There is no policy as of today to deal with such popuations. Though the BRs and Community Conservation Reserves have provision for continued use of natural resources by the local people, these categories lack clear management guidelines and legal backing. Hence, there exists an air of uncertainty and confusion both among the management authorities as well as local communities. This works against the policy of gaining support of local communities in conservation of wildlife and management of PA.

In addition, several issues in the IHR deserve policy formulations, procedures and clear guidelines. Some of these include:

- Rules for use of timber species planted under Agroforestry (in revenue land),
- Policies on NTFP and MAPs collection including transit rules
- Policy on Livestock Grazing in IHR
- Customary Laws and Codification
- Cadastral surveys for rehabilitation of people and reducing conflicts in NER
- Policy on traditional hunting in NEHR and wild pigs in NW parts of IHR
- Policy on collection of lichens and mosses from the mountain forests

5.4 Recommendations

Task Force would also like to make a few recommendations which it feels deserve serious consideration of the related Ministries.

5.4.1 Revisit Hanumanta Rao Committee Report on Cold Deserts

The Hanumant Rao Committee report has identified cold deserts only in HP and J&K. It is pointed out that a considerable area within the state of Uttarancal, especially along the international border with China (Tibet) falls in cold arid region e.g., upper catchments of Bhagirathi (Jad Ganga), Alaknanda (e.g., Badrinath and Mana areas), Western Dhauli (Niti, Gamsali and Malari), Gori valley (Upper Johar), Eastern Dhauli (Upper Darma) and Kali (Byans) also falls under cold deserts classification. Hence, the report on the Hanumant Rao Committee needs to be revisited for the definition and extending it to regions which have been left out. Desert Development Programme should also include these additional areas for assistance.

5.4.2 Provision for non-lapsable budget for entire IHR

It is recommended that the provision of non-lapsable budget as in case of NEC must be made applicable uniformly across the entire IHR, given the comparable environmental conditions and limited working seasons at the high altitudes and remote localities.

5.4.3 Include Mountain Specificities in the Curricula at at all levels

There is a need to review the current course curricula at school and college level in order to bring mountain specificities in education. Courses on biodiversity conservation, natural resource management and vocational courses such as mountain farming and livestock management need to be initiated.

5.4.4 Policies on plantation of non-native species

Plantation of exotic tree species under afforestation programmes can have severe negative impact on the mountain environment. Clear guidelines are required for the assessment of land as well as species before planting any species. Similarly, the rain shadow zones in the mountain region that support low forest cover need to be separated from the degraded secondary scrub before any forestry operations are initiated. Implementation of *Jhum* Projects initiated by MOEF in the NER under National Afforestation Board (the project recommends to retain at least one third of the jhum fields to be under tree cover at any point of time) also need to be revisited in terms of species selection and acceptance by the local communities.

5.4.5 Policies on mountain farming

Appropriate policies on mountain farming especially integrated pest management, mixed farming, conservation of native crop varieties and promotion of cooperative institutions for organic products, certification etc. need to be evolved. In this context Organic Farming Act (as passed by Mizoram) needs to be replicated in other states of IHR.

5.4.6 Policy on the Disaster Management for IHR

Much of the IHR is prone to a range of natural disasters. Adequate measures are required at the national and state level to mitigate the natural disasters in the mountain regions in view of climate change and related impacts. Initiatives taken by some mountain states, moving from relief to preparedness, need to be studied and replicated in all mountain states. (see Box 5.4).

BOX 5.4: Disaster Management:
Initiatives of Uttaranchal Government

Policy:

- Uttaranchal Disaster Mitigation, Management and Prevention Act 2005 shows the State's resolve for disaster risk management.

Institution:

- Uttaranchal is the first State in the Union of India to have a dedicated Department of Disaster Management.
- A Centre of Excellence for disaster related issues, Disaster Mitigation and Management Centre (DMMC) has been set up with budgetary allocation.

Process:

- Departmental Standard Operating Procedures as also State, District and Block Disaster Management Plans have been prepared. State and District Emergency Operations Centres have been operationalised on 24X7 mode.
- Hazard Safety Cell and Hazard safety Units have been constituted at State and District level for assessing seismic safety of the lifeline buildings.
- More than 500 police and revenue personnel have been trained in Search and Rescue while 450 engineers have been trained in earthquake resistant construction technology apart from 800 masons.
- Two well equipped Search and Rescue teams are being raised for every Tehsil.
- Masses are being trained and Village Disaster Intervention Teams have been constituted in 400 most vulnerable villages.
- Satellite phones and Police wireless network are being used for effective management of disasters.
- GIS based inventory of resources is being prepared and landslide risk assessment is being done using GIS and RS techniques.
- School children as also NCC cadets and NSS volunteers are being trained and massive awareness drives are being undertake. Audio visual tools are being freely used for propagating this message.

(Source : Dr. Piyoosh Rautela, Department of Disaster Management, UA)

5.4.7 Policies on benefits from Hydro-electric Projects for Catchment Area Development

Host mountain states receive 12% free power from hydro – electric power projects. For sustainable development of the area affected by impounding of water or drilling of channel / tunnel, the proceeds received must be deployed back in development of the Catchment Area.

5.4.8 Policies on Urban Environmental Restoration in IHR

Most of the hill stations and capitals of Himalayan states suffer from mismanagement of water, garbage and other resources. Policies for the development of green cities and clean urban environment need to be evolved (see Box 5.5).

BOX: 5.5: CONSTITUTIONAL PROVISION URBAN AND RURAL NATURAL RESOURCE GOVERNANCE

Certain provisions of the 74th Constitutional Amendment (Nagarpalika Act) are of great relevance to decentralized governance of biodiversity and natural resources. Article 243-ZD 2(b) provides for a representative District Planning Committee, and Metropolitan Planning Committee in case of metros (with population exceeding 10 lakhs).These Planning Bodies are constituted with due representation of elected representatives. The article states that 'District Planning Committee' shall, in preparing the draft development plan have to regard matters of common interest between the Panchayats and the Municipalities including spatial planning, sharing of water and other physical and natural resources, the integrated development of infrastructure and environmental conservation. It has been recommended that in the case of Metros, the Metropolitan Planning Committee will 'prepare a draft development plan for the Metropolitan area as a whole' [Art. 243-ZE (i)].The composition does not explicitly include village-level institutions where the metropolitan area includes rural settlements. In constituting this Committee (the same applies to the DPC) there should be representation not from only higher levels, say *Taluka Panchayats*, but also from *Gram Sabhas* and Ward Committees, as the case may be. This can be on a rotational basis, as proposed, provided the composition includes representatives that are closest to the people, at smaller units of governance. Even 10 years after the enactment, most States have ignored their responsibility in implementing this provision, as also the need for constituting Ward Committees. Communities and people's movements need to step up their advocacy on these issues. Art 243-ZE 3 (i) as quoted above, re-emphasizes the need for coordination between Municipalities and Panchayats, including 'coordinated spatial planning' and 'environmental conservation'. On due consultation with 'institutions and organizations', it advocates the formulation of a 'development plan' to be forwarded for the overall planning within the State. This could be a powerful vehicle for the proposed land and water use planning process proposed in *Section 7.0.1*. The Twelfth Schedule, which provides a list of issues within the mandate of local governance, explicitly recognizes various features of biodiversity conservation and environmentally compatible planning. These include regulation of land-use; water supply for domestic, industrial and commercial purposes; urban forestry; protection of the environment and promotion of ecological aspects; and provision of urban amenities and facilities such as parks, gardens, and playgrounds. Accordingly, all the hill stations and urban centres in the IHR need to take up these plans on priority basis and seek appropriate funding support from the national and international funding agencies.

(Source : Adapted from Contribution by Leo Saldanha (NBSAP))

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Annexure : 1

Constitution of the Task Force on Mountain Ecosystems

M-13033/1/2006-E&F
Planning Commission
(Environment & Forests Unit)

Yojana Bhavan, Sansad Marg,
New Delhi, Dated 21st August, 2006

Subject: Constitution of the Task Force on Mountain Ecosystems for the Environment & Forests Sector for the Eleventh Five-Year Plan (2007-2012).

It has been decided to set up a Task Force on Mountain ecosystems for the Environment & Forests Sector for the Eleventh Five-Year Plan. The composition of the Task Force will be as under:

1.	Shri R.S. Tolia, Chief Information Commissioner, Uttaranchal	Chairman
2.	Shri Upendra Dhar, Director, GBPIHED, Almora	Member
3.	Director, Wadia Institute of Himalayan Geology, Dehradun	Member
4.	Director, High Altitude Plant Physiology Res. Centre, Srinagar	Member
5.	Prof. Jayanta Bandopadhyaya - IIM, Kolkata	Member
6.	Dr. G.S. Rawat, WII, Dehra Dun	Member
7.	Dr. P.S. Ahuja, Dir., Himalayan Bioresource Instt., Palampur, H.P.	Member
8.	Major H.P.S. Ahluwalia, Director, IMF, New Delhi	Member
9.	Shri Amba Jamir Director, The Missing Link (TML), Assam	Member

Terms of Reference of the Task Force will be as follows :

1. Review the current status of knowledge on various environmental aspects of conservation and sustainable use of mountain ecosystems and recommend correctives.
2. Assess the potential impacts of climate change on mountain ecosystems and recommend required new or remedial measures of dealing with these impacts.
3. Review the institutional and individual capacities available to address issues related to conservation and sustainable use of mountain ecosystems and recommend how they may be adequately strengthened.

4. Assess the current issues and systems of integrating concerns relating to fragile mountain ecosystems into other sectors (ministries, departments) and to recommend required new or remedial measures.

5. Review the current EIA laws, policies, procedures and practices as being applied in the mountain ecosystems context and recommend corrective measure to address significant issues that specifically arise in the context of these fragile ecosystems.

6. Ministry of Environment & Forests will provide basic information and data input to the Task Force as the when required.

7. The Chairperson of the Task Force will be free to co-opt any official/ non-official as special invitee for its meeting.

8. The non-official members will be paid TA/DA by the Planning Commission as per SR 190 (a) for attending meetings of the Task Force.

9. The Task Force will submit its report to the Chairman, Working Group on Forests by 31.10.2006.

10. Sri M. Ravindranath, Joint Adviser (E&F), Room No. 301, Yojana Bhavan (Tel No. 23096725) will be the Nodal Officer for the Task Force for all further communications.

sd/-
Dr. S.K. Khanduri
Director (Forestry)

Copy forwarded to: All Members of the Working Group.

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13. Dr. Pushkin Phartyal, CHEA, Naini Tal
14. Col N.K. Bhimwal, IMF New Delhi
15. Dr. Suneel Pandey, TERI, New Delhi
16. Dr. Piyoosh Rautela, Centre of Disaster Management, Dehra Dun
17. Dr. P. S. Ahuja, Director, IHBT, Palampur
18. Dr. Uma Melkania, GBPUAT, Pantnagar
19. Mr. S. Madhawan, CHIRAG, Bhimtal
20. Shri Jagdish Kishwan, Director General, ICFRE, Dehra Dun
21. Shri P.P. Srivastava, Member, NEC, Shillong
22. Dr. (Mrs.) I.K. Barthakur, Member NEC, Shillong
23. Shri H.V. Lalringa, Secretary, NEC, Shillong
24. Shri N.S. Barfal, Conservator of Forests, Tura Meghalaya
25. Dr. S.C. Katiyar, MoEF, NE Regional Office Shillong
26. Mr. Toki Blah, Consultant, IFAD, Shillong
27. Prof. B.K. Tiwari, NEHU, Shillong
28. Prof. S.K. Barik, Botany Department, NEHU, Shillong
29. Dr. Uma Shankar, Department of Botany, NEHU, Shillong

30. Mr. B.K. Lyngwa, Conservator of Forests, Meghalaya
31. Mr. K.R. Lyngdoh, Chief Conservator of Forests, Nagaland
32. Mr. R.L. Sanga, DCF, MoEF, NE Regional Office, Shillong
33. Dr. R. K. Pachauri, TERI, New Delhi
34. Dr. A. Arunachalam, NERIST, Nirjuli, Arunachal Pradesh
35. Dr. Karuna Shrivastava, NERIST, Nirjuli, Arunachal Pradesh
36. Dr. R.K. Maikhuri , GBPIHED, Garhwal Unit, Srinagar Garhwal
37. Dr. Nehal Farooquee, GBPIHED, Garhwal Unit, Srinagar Garhwal
38. Shri Lalit Pande, Uttarakhand Seva Nidhi, Almora
39. Dr. Jeet Ram, Deaprtment of Forestry, KU Nainital
40. Dr. V.P. Upadhyay, MoEF, GOI, Bhubaneshwar
41. S.S. Samant, GBPIHED, HP Unit, Mohal, Kullu
42. Dr. Ranjay K. Singh, Central Agricultural Univ. Pasighat, Arunachal Pradesh
43. Dr. Vir Singh, GBPUAT, Pantnagar
44. Dr. R.J. Sharma, GBPUAT, Pantnagar
45. Dr. Sachi Shah, GBPUAT, Pantnagar
46. Dr. P.K. Singh, GBPUAT, Pantnagar
47. Dr. J.P.N. Rai, GBPUAT, Pantnagar
48. Dr. Salil Tiwari, GBPUAT, Pantnagar
49. Dr. Rajesh Kaushal, GBPUAT, Pantnagar
50. Prof. P.S. Ramakrishnan, JNU, New Delhi
51. Dr. Reeta Raghuvanshi, GBPUAT, Pantnagar
52. Dr. N.P. Melkania, Ex- Professor, IIFM Bhopal
53. Dr. H.S. Kushwaha, GBPUAT, Pantnagar
54. Dr. R..K. Srivastava, GBPUAT, Pantnagar
55. Dr. V. Bhardwaj, GBPUAT, Pantnagar
56. Dr. Anita Pandey, GBPIHED, Almora
57. Dr. N.P. Todaria, HNB Garhwal University, Srinagar Garhwal
58. Dr. S.P. Shukla, Rajiv Gandhi University, Arunachal Pradesh
59. Dr. M.L. Deewan, HIMCON, New Delhi
60. Prof. Y.P.S. Pangtey, Uttaranchal Biotechnology Park, Haldi, Pantnagar
61. Dr. L.M.S. Palni, Uttaranchal Biotechnology Park, Haldi, Pantnagar
62. Dr. Eklabya Sharma, ICIMOD, Kathmandu
63. Dr. Madhav Karki, ICIMOD, Kathmandu
64. Dr. Dhrubad Chowdhury, ICIMOD, Kathmandu
65. 54. Dr. M.L. Diwan, HIMCON, New Delhi
55. Mr. Sanjay Upadhyay, Enviro Legal Defence Firm, NOIDA
56. Dr. R.C. Sundriyal, GBPIHED, Almora

Annexure : 2

Earlier Recommendations on Mountain Environment & Development : A Review

1. Till the beginning of the Fourth Plan there was no specific reference of any regional development plans for the Himalayan region. Only in the year 1974 the Government of India initiated a Hill Area Development Programme (HADP) in for Eco-preservation and eco-restoration in hilly regions of the country.

2. As time elapsed, very detailed and specific strategies were contemplated for the integrated development of hilly regions and particularly the Himalaya. By 1980 it was realized that existing administrative measures and institutions were less than successful in addressing the fragility of mountain environment and socio-economic marginality of the people. As a fall out of various seminars and regional consultations, an authority on Himalayan Development was conceptualized in 1981.

3. The PC constituted a TF in 1981 under the chairmanship of Dr. M. S. Swaminathan, the then Member of the Planning Commission, to look into the various issues connected with the development and preservation of the ecology of the Himalayan region. The TF, after a detailed examination of several aspects, recommended that there was a need for coordinated and action-oriented research on various aspects including post-harvest operations of agricultural commodities, transport, planning etc. The TF felt the absence of a high-level institutional infrastructure to oversee the problems of the Himalayan region. The TF, therefore, recommended the constitution of a high level Himalayan Eco-Development Commission. Though, such a commission was not set up but the MoEF established an autonomous Institute Govind Ballabh Pant Institute of Himalayan Environment and Development (GBPIHED) in the year 1988 which was asked to prepare an Action Plan for the Himalaya. The plan was subsequently approved by the Parliament.

5. The PC constituted an Expert Group in 1992 to formulate a policy for the integrated development of the Himalaya. The Expert Group was led by Dr. S.Z. Qasim, the then member, PC. The Expert Group noted that despite a large number of organizations working in the IHR, there is a lack of integration and administrative mechanism to implement development plans. The group had recommended setting up of a High Power Himalayan Development Authority and creation of a Himalayan Environment & Development Fund to support the innovative actions, programmes and studies emerging from the recommendations.

6. During 9th and 10th Five Year Plan periods the State Governments were asked to prepare a separate Sub-Plan for the hill areas indicating the flow of funds from State Plan outlay and Special Central Assistance (SCA). This scheme focused on eco-preservation and eco-restoration on the watershed basis. However, the development needs of people of the mountain areas in consonance with the fragility of the environment demands an approach which is more than just watershed development. Therefore, it is felt that more attention should be paid to economic activities which are sustainable, use of technologies which will help lighten the burden of the people both in economic and household situations and ensuring means of livelihood for the inhabitants with as little disturbance to the ecology.

Annexure : 3

Major Landslide and Flash Floods in the North West Himalaya during recent decades

S.No,	Area / Place	Date	Consequences of heavy rainfall
1	Uttaranchal, Belakuchi	July 1970	Landslide and flush floods in Alaknanda valley caused considerable loss of life and property and an entire village was washed away.
2	Uttaranchal	September 1970	Landslide and house collapse killed 223 people.
3	Himachal Pradesh	July 1973	Landslide cut off Shimla from the rest of the country.
4	Uttaranchal, Bhagarathi Valley	6 August 1978	Flush flood in Bhagarathi due to breaching of lake in Kanldiya Gad, Debrani village washed away, Manari-Bhali hydroelectric project damaged.
5	Uttaranchal, Tawagath	15 August 1977	Tawaghat landslide in Kali valley killed 44 people, damaged 100 houses and 2 km road damaged at many places, life was disrupted in an area of 50^2km.
6	Uttaranchal, Mandakini Valley	August 1979	Kauntha landslide along Kyoinja Gad in Mandakani valley killed 39 people 100 cattle, destroyed 150 houses and effected an area of 10^2km.
7	Himachal Pradesh, Satluj Valley	29 September 1988	Cloud burst and flash flood along Soldan Khad in Satluj valley killed 32 people, 15 houses, 35 bigha agricultural land, 600 apple trees, 2 km road of NH 22 and 20 m bridge on Soldan Khad washed away.
8	Himachal Pradesh, Lower Speti Valley	31 July and 2 August 1991	Flush flood and landslide along Malling Nala in lower Spiti valley damaged 1500 m road section of NH-22 and washed away agricultural land of Leo village situated down stream.
9	Himachal Pradesh, Satluj Valley	February 1993	500m road section of NH-22 washed away by Jakhari slide. Rs. 10 million loss to road and forest land, a village upper slope was in danger.
10	Himachal Pradesh, Satluj Valley	8 July 1993	Lake formed by the blocked of the Satluj river due to Nathpa rockfall damaged Sanjai power house, loss of about Rs. 45 million.
11	Uttaranchal, Haridwar	23 August 1994	Landslide at Bhimgora in Haridwar killed 1 child, destroyed 2 houses and 50m rail track and 100m, rail traffic was held for 21 days. Total estimated loss to railway, P.W.D. and private property of Rs. 210 million.
12	Uttaranchal, Bhagarathi Valley	20 August 1995	Cloud burst associated debris flow along Tiloth Nala at Uttarkashi in Bhagarathi valley damaged 200m road section and 18 buildings.

13	Himachal Pradesh, Beas Valley	4-5 and 12 September 1995	Flood and landslide along Beas river in Kulu valley killed 65 people, NH-21 damaged at numerous places, loss to government and private property, road and bridges estimated US$ 182 million.
14	Himachal Pradesh, Satluj Valley	4-5 September 1995	Flash flood along Panwai Khad in Satluj valley washed away 19 houses, 3 bushes, HPRTC workshop and damaged HP P.W.D. RH at Tapri.
15	Himachal Pradesh, Pabbar Valley	11 August 1997	Flush flood and landslide along Andra Khad in Pabber valley killed 124 people, 456 cattle, washed away government and private buildings, 200m road section and damaged 500m road and Andra power house at Chirgaon. Loss to property was estimated Rs. 10.63 million.
16	Himachal Pradesh, Satluj Valley	August 1997	Cloud burst and flush flood along Satluj river killed 19 people, 464 cattle damaged 105 houses, 10 cattle sheds and 39 hector agricultural land. Total loss to property and hydel projects was estimated Rs. 672.9 million.
17	Uttaranchal, Mandakani Valley	11-12 and 18-19 August 1998	Devastating landslide and flush floods in Madhmaheshwar and Kaliganga valley around Okhimath killed 101 people 422 cattle, washed away 820 houses and 411 hector agricultural land, 9752 person in 29 villages effected. Loss to immovable property was estimated Rs. 41 million.
18	Uttaranchal, Kali Valley	August 1997	Cloud burst, flush flood, rockfall and debris flow along Malpa Gad in Kali valley killed 211 people, washed away road section at numerous places in upper part of Pithoragarh district.
19	Uttaranchal, Mandakani Valley	16 July 2001	Cloud burst, landslide and debris flow in Phata and Bung-gad, around 14 village are affected in Kedar valley, Okhimath tehsil, Rudraprayag district, killed 27 people and 53 livestock, more than 24 people injured, 154 houses damage, more than 43 hector agricultural land washed away. 11 km stretch of Rudraprayag-Kedarnath road between Guptakashi-Barasu severely damaged.
20	Uttaranchal, Yamuna Valley	30 August 2001	Khanara slide 14 km north of Barkot in Yamuna valley blocked the Yamuna, created lake and damaged 100m road section and interrupted pilgrimage flow to Yumnotri.
21	Uttaranchal, Alaknanda Valley	30 August 2001	Cloud burst in late hours in Guna village of Ghanshyali tehsil killed 7 people, 6 houses completely and 40 houses partially damaged, damage to agricultural land.

22	Uttaranchal, Balganga Valley	10 August 2002	Cloud burst and debris flow in late hours in Medh and Dharm Ganga valleys, Budha Kedar area, Ghanshyali tehsil, Tehri district. 29 people died and 31 people injured in Marwari, Medh, Agunda and Kot villages, 16 houses completely damaged, loss to live-stock agricultural land and bridges. Micro hydel plant damaged at Budha Kedar.
23	Himachal Pradesh, Kullu Valley	16 July 2003	Cloud burst and debris flow in late hours in Pulia Nal in Hurla valley washed away three labour camp site of Parbati Hydroelectric Project. 38 people died and around Rs. 10 million loss occurred to property beside damaging the road section of project area.
24	Himachal Pradesh, Kullu Valley	7 August 2003	Cloud burst and flash flood in late hours along Kangli Nala in Kullu valley washed away 40 labours and injured 17 due to channels shift at labour camp site of proposed Rhotang Tunnel Project of BRO.
25	Uttaranchal, Bhagarathi Valley	24 September 2003	Heavy rain activated the Tambakhani slide in Varnavatparvat along the right bank of Bhagarathi river at Uttarkashi. The slide continued for more than a week. The ingress of rain water through cracks and trenching above the crown on highly weathered phyllites and thick soil cover initiated the slide. Two new slide are created right from 600m high hill slope. Nine hundred houses are damaged and some of the four story buildings at the toe portion of slide are completely buried under sliding mass. About 5000 population was effected.

(Compiled by Dr. R.K. Mazari, WIHG)

Annexure : 4

Recommendations of the Expert Committee (MoEF) for the Conservation and Management of the Forests in the Northeast India

An Expert Committee was set up by the MoEF, Govt. of India (1997) chaired by Shri R. Rajamani, Ex-secretary, MoEF. This committee gave various recommendations for the conservation and management of forests in the NEI. Based on the discussions held with the officials at Shillong it was learned that following actions have been taken on the recommendations of this committee so far:

1. Creation of N.E. Cell under the Inspector General of Forests in the MoEF, New Delhi assisted by one Assistant Inspector General to look after the issues pertaining to NEHS.

2. Allocation of 10 % of budget of each of Central Ministries to the Ministry of Development of N.E. Region (DONER). [Further allocation to Forestry Sector of the state is not known]

3. Initiatives made by North-Eastern Council (NEC), Shillong through funding of Community Biodiversity Conservation Project (CBCP) in 8 N.E. states and funding of North-East Biodiversity Research Cell (NEBRC) under North-Eastern Hill University (NEHU), Shillong. A total amount of 214.28 lakhs under CBCP and Rs. 85 lakhs under NEBRC has been released by NEC till 2005-06.

4. *Jhum* project (Control of shifting cultivation) has been implemented in some states by MoEF, New Delhi under National Afforestation Project.

5. Enforcement of Forests (Conservation) Act, 1980, in all N.E. States, except Nagaland, where FC Act is made applicable only to the forests declared as “Reserved”.

Taking cognizance of the Expert committee, the Hon’ble Supreme Court of India has issued several directives to the NES for the conservation of environment and forests in NEHR. As a result (i) Several wood based units which are not following the norms of High Power Committee (HPC) have been closed down and those approved / cleared by HPC are shifted to the approved and designated industrial estates, (ii) Working Plan and Working Schemes are being prepared by the State Forest Departments. So far 33 Working Plans and 50 Working Schemes have been approved by the Regional Office, MoEF, Shillong and a total 15 Working Plans and 29 Working Schemes are pending for approval, (iii) Felling rules have been prepared by the State Governments in respect of

trees from non-forest / private areas, (iv) Rates of Royalty for Forest Produce and Minor Forest Produce are being revised by the State Governments, (v). Transportation of timber outside NES are allowed only from the designated railway stations as per the guidelines of Special Investigation Team, constituted by the Supreme Court of India, (vi) Bi-Annual review meeting on Forest Protection and development of each N.E. State are being held under the Chairmanship of the concerned State Chief Secretary (Except Sikkim), where the state Forest officials and Police officials are associated besides Regional Chief Conservator of Forests, Shillong.

Annexure : 5

List of Institutions with capabilities available to address issues related to Biodiversity, Conservation and Sustainable Use of Mountain Ecosystems

S N	Institution *	Focus	Geogr. Coverage	Remarks
1	Forest Research Institute (FRI) Dehra Dun	Forest Resources	NW India	ICFRE (MoEF)
2	Himalayan Forest Research Institute (HFRI) Shimla	Forest Resources	NW Himalaya	ICFRE (MoEF)
3	Rain Forest Research Institute (RFRI) Jorhat, Assam	Forest Resources	NEI	ICFRE (MoEF)
4	Central Soil & Water Conservation Research & Training Institute (CSWCRTI) Uttaranchal	Soil & Water Conservation	IHR	ICAR
5	Botanical Survey of India, (BSI)	Plant resources	All India Regional offices in IHR	MoEF
6	Forest Survey of India, (FSI) Dehradun	Forest resources	All India	MoEF
7	G B Pant Institute of Himalayan Environment & Development, (GBPIHED) Almora	Himalayan Environment and Development	IHR - 5 Units in IHR	MoEF
8	Wildlife Institute of India (WII), Dehradun	Wildlife management, PA management, Conservation	All India Significant work in IHR	MoEF
9	Zoological Survey of India, (ZSI)	Animal resources	All India Regional offices for mountain areas	MoEF
10	State Forest Research Institute, Itanagar, Arunachal Pradesh	Forest Resources	Arunachal Pradesh	Arunachal Pradesh
11	Central Institute of Temperate Horticulture (CITH, Srinagar)	Horticulture	IHR	ICAR
12	Central Potato Research Institute (CPRI), Shimla, Shillong	Agriculture	IHR	ICAR
13	Vivekanand Parvatiya Krishi Anusandhan Shala (VPKAS), Almora	Agriculture	IHR	ICAR
14	National Research Centre for Mithun (NRCM, Nagaland)	Mithun	NEI	ICAR
15	National Research Centre for Yak (NRCY, Arunachal Pradesh)	Yaks	EH	ICAR
16	National Research Centre for Orchids (NRCO), Sikkim	Orchids	EH	ICAR
11	National Research Centre for Mushroom (NRCM), Solan, HP	Mushroom	All India	ICAR
17	National Research Centre on Coldwater Fisheries (NRCCWF, Bhimtal)	Coldwater fisheries	IHR	ICAR

18	National Bureau of Plant & Genetic Resources (NBPGR)	Plant resources	All India, Centres in IHR	ICAR
19	Regional Research Laboratory, Jammu, Jorhat, Itanagar	Bioresources Utilization, Development	J & K Himalayas	CSIR
20	National Botanical research Institute (NBRI), Lucknow	Plant resources	All India	CSIR
21	Institute of Bioresources, Imphal	Biological resources	NEI	CSIR
22	Institute of Himalayan Bioresources and Technology (IHBT), Palampur	Biotechnological applications of bioresources of Himalayas	Indian Himalayan region	CSIR
23	Wadia Institute of Himalayan Geology (WIHG), Dehra Dun	Himalayan Geology	IHR Unit in AP	CSIR
24	Indian Institute of Remote Sensing (IIRS), Dehradun	Remote Sensing (all resources)	All India Significant work in IHR	NRSA
25	Geological Survey of India, (GSI)	Geological resources, hazards	All India, coverage in IHR	
26	High Altitude Plant Physiology Research Centre, (HAPPRC) Srinagar (Garhwal)	Plant resources, particularly high altitude MAPs and NTFPs	Indian Himalayan Region	Garhwal University
27	Indian Institute of Technology, Roorkee	Hydropower, Seismic-proof Housing, Mountain Hazards	All India, Focus on Mountains	Autonomous
28	Defence Research Development Organisation (DRDO)	High Altitude crops and vegetables	IHR	MoD
29	Snow and Avalanche Study Establishment (SASE, HP)	Avalanche control measures	WH	MoD
30	North East Region Institute for Water & Land Management (NERIWALM)	Land and Water resources	NEI	
31	The Energy Research Institute (TERI), New Delhi	Energy Resource Management	All India, covering IHR	NGO
32	World Wide Fund for Nature	Nature Conservation, Threatened Species, Wetlands	All India Centres in IHR	NGO
33	Ashoka Trust for Research on Environment & Ecology (ATREE)	Ecology & Conservation	All India, NEI	NGO

34	North Eastern Region Community Resource Management Society (NERCRMS)	Resource management & Poverty alleviation in uplands	NEI; 6 districts, 800 villages	NGO
35	The Missing Link		Assam	NGO
36	Chirag		UA	NGO
37	MRDS		Meghalaya	NGO

Universities in IHR Engaged in Research on Environment & Forest Sector

North-Eastern Hill University, Shillong

Nagaland University, Kohima

Mizoram University, Aizawl

Arunachal University, Itanagar

Tripura University, Agartala

Assam University, Silchar

Tezpur University, Tezpur

Gauhati University, Guwahati

Assam Agricultural University, Jorhat

Regional Research Laboratory, Jorhat

Dibrugarh University, Dibrugarh

GB Pant University of Agriculture & Technology, Pantnagar

Garhwal University, Srinagar

Kumaun University, Naini Tal

Y.S. Parmar University of Horticulture, Solan

Himachal Pradesh University, Shimla

Sher –e- Kashmir Agricultural University, Srinagar

Kashmir University, Srinagar

Jammu University, Jammu

Annexure : 6

An Analysis if Strengths and Weaknesses of Various Institutions Working in the IHR and Proposals for Strengthening

Type of Organization*	Strengths	Weaknesses	Proposed areas for strengthening
Type I: Integrated Research & Development : E.g., GBPIHED Coordinating (nodal) organization (s) for information and dissemination, and strategy development	• Entire IHR as area of operation • Multidisciplinary skills/ approach • Integrated of Research & Development • *Expected lateral support from in-depth sectoral research & development* • *Potential of becoming coordinating organization (s)*	• In-depth information on selected disciplines lacking • Limitation in manpower/ skill to address multidisciplinary issues • Varied target groups (aspirations) and imbalance in addressing issues of multiple stakeholders • Weak attention to some geographic areas • Poor network • Weak information dissemination • *Presently there is no lateral support from in-depth sectoral R&D* • *Potential has not been realized and harnessed in right perspectives*	***Designate and Strengthen as Nodal Institution(s) for mountain areas (e.g. Indian Himalayan Region)*** • Desired focused and minimum manpower to address issues of gaps in multidisciplinary skills • Establish a structured mechanism of information flow to other organizations (to and fro) • May facilitate multi-Institutional memorandum of understanding • Desired infrastructure (including manpower/ skills) to establish a coordination cell that is equipped with tools/skills for information generation, storage and retrieval. [**Nodal Network Facility**] • Strengthen dissemination network of partners • Nodal institutions be made part of major decision making/ policy planning committees/bodies • Strengthen outreach through appropriate skills and infrastructure development for capacity building of multiple stakeholders
Type –II Purely Research: E.g., WIHG (IHR Centers of advance learning)	• IHR focused mandate • Multidisciplinary as well as sectoral skills/ approach • Focused attention (either research or development) • *Potential of becoming centers of excellence in identified sectors(s)*	• In-depth information on specific discipline often lacking • Gaps in manpower/ skill to address multidisciplinary issues • Lack of integrative approach of functioning • Varied target groups (aspirations) and imbalance in addressing issues of multiple stakeholders • *Potential has yet to be realized*	***Strengthen selected agencies as lead organizations in research or development*** • Develop structured mechanism of information flow from lead (Category II) to the nodal organization (Category I) • Strengthen infrastructure to network with nodal organization and with partners • Develop skills to establish a dedicated coordination cell to facilitate integration with counterpart organization (i.e. research to development or vice versa)
Type –III State Govt Funded Centres of Excellence & NGOs ***(area/subject leads)***	• IHR focused mandate • Multidisciplinary as well as strong focus on specific disciplines • Mandate	• Lack of linkages/integration among disciplines • Low concern for other parts of region • Stagnation of skills • Area/state specific focus	***Strengthen selected ones as lead organizations in specified subject/geographic areas*** • Establish linkages with other disciplines through category II /category I organizations • Strengthen infrastructure for network with lead/nodal organization • Built capacity of existing manpower to

	focused to specific region (state/ zone)
	• Multidisciplinary as well as strong focus on specific discipline and geographic area
		• Wide gaps in manpower/ skill to address multidisciplinary mountain specific issues
		• Low concern for other parts of region
		Stagnation of skills
			make their skills comparable to any world class organization in the area of expertise
			• strengthen outreach among stakeholders
			  • Strengthen network (infrastructure & skills) with nodal organization (category I)
			  • Strengthen skills to address multidisciplinary issues

Type V Central Govt and International NGOs with All India Focus and few projects in IHR (Lateral feeders)	• Part of a strong (larger) institutional network (nationwide) that also covers IHR • Multidisciplinary skills/approach and support from strong sectoral skills • Integration of R&D • Country wide mandate • Specific focus of discipline • Multidisciplinary approach and support from strong sectoral skills • Strong hold on R&D • IHR specific programmes supported through a larger institutional set-up (national) • Skilled manpower back-up	• Most often the mountain focus remains suppressed under country focus • Disinterest of skilled manpower for serving in remote IHR sites • Wide gaps in manpower/ skill to address mountain specific issues • Imbalance in emphasis for different geographic areas. • Often the IHR focus remains neglected under country focus • Lack of linkages/ integration with other disciplines • Low concern for areas away from the center • Stagnation of skills • Disinterest in serving in remote areas • No dedicated establishment for mountains • Lesser commitment of skilled manpower for the mountains	• Strengthen centers (infrastructure/manpower) dedicated for mountain areas and identify focused activities in consultation with category I &II • Address issues of manpower gaps and provide stronger incentives to serve in remote mountain areas • Strengthen infrastructure and build-up capacity to make them a strong network partner of category I & II organizations • Strengthen centers (infrastructure/ manpower) dedicated for mountain areas and identify focused activities in consultation with lead centres • Built capacity of existing manpower in mountain centers to make their skills comparable to any national/ world level organization in the area of expertise • Strengthen outreach among multiple stakeholders • Develop mechanism for information transfer to nodal and lead centres • Strengthen IHR specific programmes (long term and multi location). • Establish functional collaborations with category I-VI organizations for execution of programmes

Source: Dhar, U. 2006. Strengthening Institutional Capacities for Conservation and Sustainable Use of Mountain Ecosystems. Paper submitted to the Planning Commission (Environment Forests Unit) for the Task Force on Mountain Ecosystems for the Environment & Forests sector for Eleventh Five-Year Plan (2007-2012)

Annexure : 7

THE DOON CHARTER, 2004

The delegates from the Himalayan States viz., Himachal Pradesh, Jammu & Kashmir, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, West Bengal and Uttaranchal, met at Dehra Dun during the Conference of Forest and Environment Ministers of Himalayan States (11^{th}-12^{th} October 2004), along with the representatives from various Research and Training institutions and discussed the issues of mutual concern related to forest, environment and biodiversity conservation for the Himalayan region and its people. The proceedings of the conference "**The Doon Charter 2004**" has been sent to the Government of India. The recommendations of the charter are as follows:

1. That the ecosystem services provided by the Himalayan states should be amply appreciated and taken into consideration while deciding upon devolution of funds.

2. That national policies and legislation should address the special needs and aspirations of the Himalaya and its people.

3. That the Government of India set up a Himalayan Development Authority to consider the issues and concerns of the Himalayan region and its people.

4. That the Govt. of India also set up a Fund for Himalayan Forest and Environment Protection to mobilise additional resources for this region.

5. In order to reduce pressure on existing natural resources, subsidy towards cost of L.P.G. and for development of alternate construction technologies should be increased.

6. The scope of the Natural Calamity Fund should be expanded to address special phenomenon like forest fires, land slides, loss of agricultural land by flash floods and cloudbursts etc.

7. Institutions engaged in study of aspects of Himalayan environment and ecology be strengthened and their priorities be clearly realigned to meet the needs of the Himalayan region. New institutions may also be established to meet emerging needs.
8. A special programme for conservation of Himalayan Glaciers and wetlands should be initiated.
9. That all the villages in the Himalaya should be considered as forest fringe villages and adequate additional resources should be mobilised for their development.
10. The concerns of the Trans Himalayan region should be addressed expeditiously.

Annexure : 8

THE SHILLONG DECLARATION

We, the participants from the eastern Himalayan countries, representing government agencies, farmers, international bodies, non-government organizations, academia, science and research institutions, local institutions, international donors and development assistance agencies, the private sector, and other professionals, concerned about Shifting Cultivation and shifting cultivators, regionally and worldwide, assembled in Shillong in Meghalaya, India from 6 to 8 October 2004 declare as hereunder:

a) That Shifting Cultivation must be recognized as an agricultural and an adaptive forest management practice which is based on scientific and sound ecological principles.

b) That it is imperative to provide an enabling environment in order to address the urgent livelihood and ecological concerns arising out of rapid transformations driven by development and other externalities including market forces.

c) That it is imperative to empower shifting cultivators as practitioners of rotational agro-forestry to become active participants in decision making and policy processes that impact them most.

d) That it is essential to make existing research and extension services sensitive and relevant to the needs and challenges of Shifting Cultivation and shifting cultivators and simultaneously assimilate the traditional ecological knowledge of Shifting Cultivation into future research, development and extension processes.

e) That it is necessary to recognize the traditional institutions and intellectual capital generated from traditional practices relating to Shifting, Cultivation and ensure its protection in the legal and policy regime.

f) That it is essential to provide interactive forums and environment for information access and sharing between multiple stakeholders at local, national, regional and global levels.

g) That it is imperative to acknowledge that women usually play the most critical role in Shifting Cultivation both at the activity and the impact level and therefore any development intervention must be sensitive to this fact.

Annexure : 9

Xth Plan Budget of Ministry of Environment and Forests (Rs crore) *

S No	Name of Scheme	Tenth Plan (outlay revised)	2006-07
	ENVIRONMENT		
	1.Environmental Management in Heritage Pilgrimage and Tourism Centres including Taj protection	85.00	0.01
	2. Clean Technologies	10.00	1.50
	3. Environmental Impact Assessment	13.00	2.50
	4.Industrial Pollution Prevention Project	**13.55**	**0.00**
	5.Hazardous Substance Management	35.00	6.00
	6.GBP Institute of Himalayan Environment and Development	35.00	7.50
	7. Conservation and Management of Mangroves, Wetlands	54.00	12.00
	8. Biodiversity Conservation	17.50	3.50
	9. Taxonomy Capacity Building Project	10.00	2.00
	10. Research and Development	24.00	4.00
	11. Environment, Education, Training and Awareness	150.00	35.00
	12.Environment Management Capacity Building Project	**49.15**	**0.00**
	13.Information Technology	80.00	4.60
	14. Adaptation and Capacity Building Project on Climate Change	30.00	1.67
	15. Civil Construction Unit	12.00	1.50
	16. Lump Sum provision for projects/scheme of North Eastern Areas scientific environment research	00.00	0.41
	New Schemes		
	17.Organizational Strengthening and repositioning of Environmental planning and Coordination Organization (EPCO) Madhya Pradesh and strengthening NRM & Farmers Livelihood in Nagaland		2.97
	18. Strengthening of Environment Information Centre	00.0	1.10
	19. Capacity Building EIA and Revised Env Clearance Process		0.02
	20. National Coastal Management Programme		1.00
	Total Environment	**1120.24**	**196.80**

* (There are 44 schemes, including the new schemes, in the Environment sector, and here only schemes with an outlay of more than Rs. 10 crores have been included; schemes in bold letters are Externally Assisted Project, EAP)

NRCD

45. National River Conservation Directorate (NRCD)	33.00	6.00
46. National River Conservation Plan	1500.00	300.00
47. NRCP	**325.00**	**80.00**
48. National Lake Conservation Plan	265.00	87.56
Total NCRD	**2123.00**	**473.56**

Forestry and Wildlife

49. Indian Council for Forestry Research & Education	210.00	50.00
50.Grant in Aid to Indian Plywood Industries Research and Institute	10.00	3.00
51. Indian Institute of Forest Management	20.00	5.00
52. Indira Gandhi National Forest Academy	30.00	4.75
53.Directorate of Forestry Education	15.00	4.00
54. Gregarious Flowering of Muli (Melocanna baccifera) bamboos	85.00	25.00
55. Forest Survey of India	35.00	5.00
56. Integrated Forest Protection Scheme	445.00	68.00
57. Strengthening of Forestry Division	34.00	5.50
58. Afforestation through PRI (NCMP related schemes)	500.00	0.01
59. Strengthening of Wildlife Divisions outside Protected Areas	10.00	4.00
60. Development of National Parks and Santuaries	350.00	60.41
61. Wildlife Institute of India	50.00	9.00
62.Project Tiger	150.00	31.11
63.Eco Development around Protected Areas	54.48	0.00
64. Project Elephant	71.00	15.00
65. Central Zoo Aithority	75.00	17.20
66. Protection of Wildlife outside Protected Areas	0.00	5.00
Total Forests and Wildlife	**2150.48**	**317.57**
70. Animal Welfare	100.00	13.00
NAEB		
71. National Afforestation & Eco-development Board (NAEB)	145.00	30.00
72. National Afforestation Project (NAP)	1205.00	300.00
74. Eco Development Forces	50.00	8.00
Total NAEB	**1400.00**	**338.00**
Grand Total	**6893.72**	**1338.93**