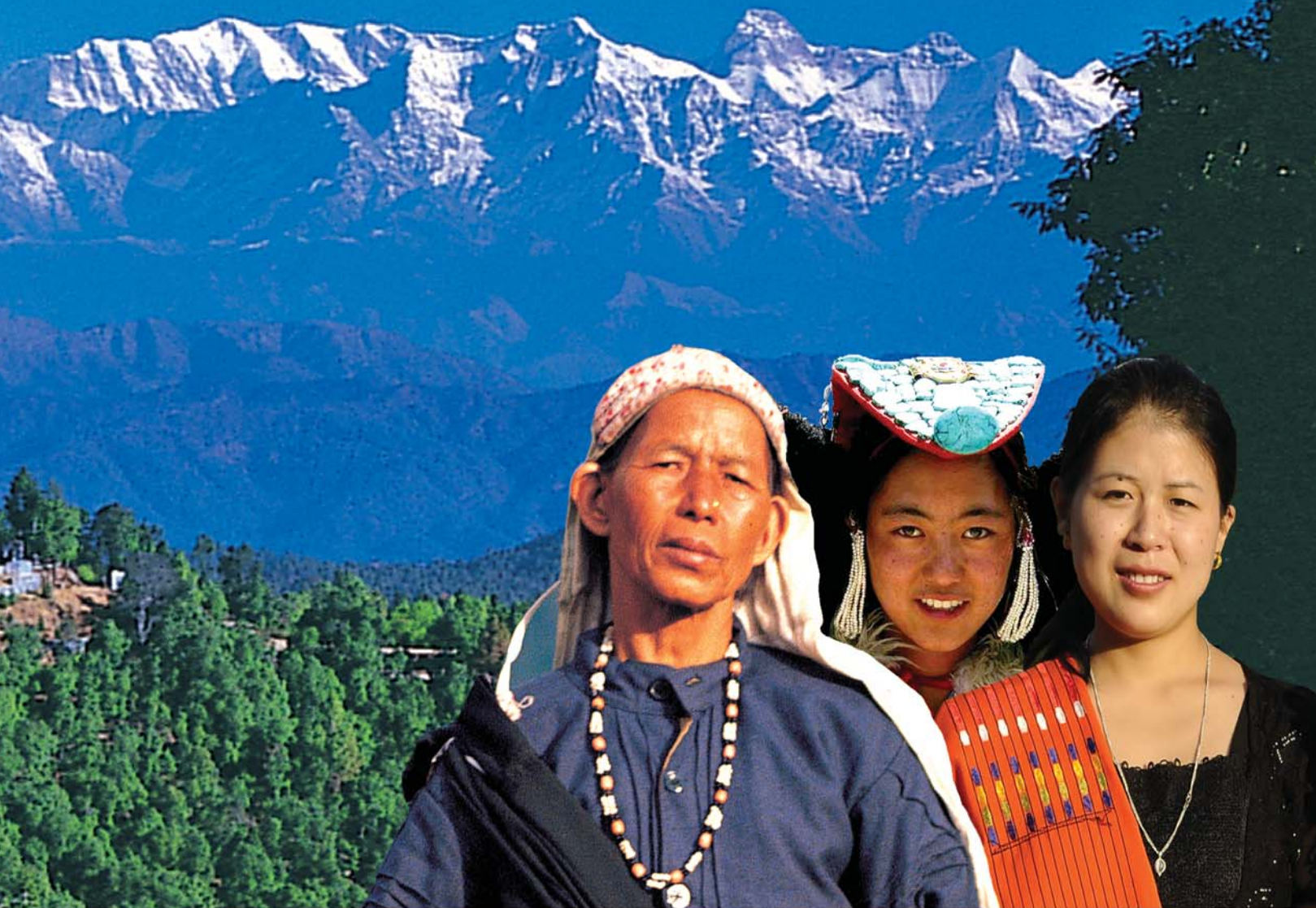


Governance for Sustaining Himalayan Ecosystem

G-SHE

GUIDELINES & BEST PRACTICES



Ministry of Environment & Forests
Government of India



G.B. Pant Institute of Himalayan Environment & Development



The present document is an outcome of a series of discussions with diverse stakeholders. However, this is an evolving document wherein inputs and suggestions from various State Governments of the Indian Himalayan Region, Institutions and individuals are invited, and will be accommodated suitably. For wider consultation, a copy of the document has been uploaded on the website of the Ministry of Environment and Forests, GOI (www.envfor.nic.in) and that of the G.B. Pant Institute of Himalayan Environment & Development (<http://gbpihed.gov.in>).



Abbreviations used

AP	Arunachal Pradesh
ARWSP	Accelerated Rural Water Supply Programme
asl	Above Sea Level
BARC	Bhabha Atomic Research Centre
BR	Biosphere Reserve
CAP	Catchment Area Protection
CEE	Center for Environmental Education
C-MMACS	Centre for Mathematical Modeling and Computer Simulation
EE	Environmental Education
EIA	Environmental Impact Assessment
GA	Geographical Area
GBPIHED	G. B. Pant Institute of Himalayan Environment & Development
GOI	Government of India
GPS	Global Positioning System
GSI	Geological Survey of India
HP	Himachal Pradesh
ICIMOD	International Centre for Integrated Mountain Development
IHR	Indian Himalayan Region
IPCC	Intergovernmental Panel on Climate Change
J&K	Jammu and Kashmir
JNNURUM	Jawaharlal Nehru National Urban Renewal Mission
Km	Kilometre
LAWDA	Lake and Water-ways Development Authority
LPG	Liquefied Petroleum Gas
M	Metre
Mn	Million
MoEF	Ministry of Environment & Forests
NAPCC	National Action Plan on Climate Change
NEP	National Environment Policy
NER	North East Region
NGOs	Non-governmental Organizations
PES	Payments for Ecosystem Services
PMGSY	Pradhan Mantri Gramin Sarak Yojana
RBH	Rural Business Hubs
REDD	Reducing Emissions from Deforestation and Forest Degradation
SAC	Space Application Centre
SWEET	Sloping Watershed Environmental Engineering Technology
TEK	Traditional Ecological Knowledge
UKSN	Uttarakhand Seva Nidhi
ULBs	Urban Local Bodies
UNFCCC	United Nations Framework Convention on Climate Change
VEAP	Village Environment Action Plan
WII	Wildlife Institute of India



Contents

From the Minister's Desk

Preface

List of Boxes, Annexure & Appendix

A.	Background	09
B.	Guidelines and Best Practices	15
1.	Sustainable Urbanization in the Himalaya	16
	1.1 Solid Waste Management	
	1.2 Town Planning & Architectural Norms	
2.	Regulated Tourism	20
	2.1 Pilgrimage in Sensitive Areas	
	2.2 Ecotourism & Regulation of Commercial Tourism	
3.	Water Security through Rejuvenation of Springs and Catchments	24
4.	Building Environmental Awareness	26
5.	Energy Options	28
6.	Conservation Areas & Forest Zone Management for Community Development	30
	6.1 Conservation Area Management through Community Involvement	
	6.2 Acknowledging the Community Contribution through PES	
	6.3 Conservation through Integration of Traditional & Cultural Values	
	6.4 Improving Indigenous Stewardship through Gender Empowerment	
7.	Monitoring Networks	36
8.	Infrastructure Development- Integration of New Approaches	40
	8.1 Ideal Himalayan Habitats	
	8.2 Ecologically Safer Roads – Green Roads	
	8.3 Comprehensive EIA of Developmental Projects	
C.	Conclusion & Overarching Issues	42
	Bibliography	
	Annexure I-VI	
	Appendix 1	



From the Minister's Desk



I am pleased to introduce the Report: **Governance for Sustaining Himalayan Ecosystem (G-SHE): Guidelines and Best Practices**¹. This publication, which forms part of our broader climate change adaptation strategy, puts together key guidelines related to the

governance and management of the Himalayan ecosystem, along with case studies.

The Indian Himalayan Region (IHR), which accounts for around 70% of the Himalayan biodiversity hotspot, spreads across a land area of 5.3 lakh km² (0.53 mn km²), comprising 16.2% of India's geographical area. We consider the IHR a unique national treasure, one to which we accord the highest priority. The IHR has rich forest cover, feeds the sub continent's perennial rivers that are a source of drinking water, irrigation and hydropower, and conserves important elements of our rich biodiversity. Managing the Himalayan ecosystem sustainably is critical not only for preserving its pristine beauty and spectacular landscapes, but also for ensuring the ecological security of the entire Indian sub-continent.

Ensuring the sustainable development of this region is a challenging endeavour, and there are no easy straitjacket solutions. We have to innovate, and we have to ensure that good practices are adopted after suitable adaptation to local conditions.

We are finalizing a "National Mission for Sustaining the Himalayan Ecosystem" under our National Action Plan for Climate Change (NAPCC), with the aim of scientifically

studying the impact of climate change on our Himalaya, and putting in place adaptation measures to meet the challenge. In parallel, there is a need for clear guidelines for sustainable management and governance of the Himalayan ecosystem. It is with this in mind that we have put together this document. While substantial literature on the subject of sustainable management of the Himalaya already exists, this is often dispersed across institutions and publications. This document attempts to collate key learnings from this literature at one place, embodied in a set of guidelines and best practices for various aspects of the governance and management of the Himalayan ecosystem.

The guidelines in this document cover a wide variety of issues – including urbanization, tourism, water security, energy, forest management and infrastructure – all of which are highly pertinent as the Himalayan region faces new and increased challenges and pressures.

We believe that there are valuable lessons contained in this document that need to be mainstreamed. This is a working document, which is meant to provide the basis on which new approaches and practices can be adopted. We welcome the inputs and suggestions on this document from State governments, domestic and international institutions, civil society, local communities and other stakeholders.

Jairam Ramesh

Minister of State for Environment & Forests (Independent Charge), Government of India & President, G.B. Pant Society of Himalayan Environment & Development

¹ 'G-SHE' is an appropriate acronym, given the pivotal role played by women in managing the Himalayan ecosystem on a day-to-day basis.





Preface



The Himalaya constitutes a unique geographical and geological system comprising a diverse social, cultural and environmental entity. Being the youngest mountain chain on earth, the Himalayan range is still evolving, and is yet to fully stabilize from a geomorphological and geological point of view. Any alteration in the environment, therefore, is likely to have cascading effects not only for the region but also for the other areas downstream. The special vulnerabilities of this ecologically fragile region have been widely recognized, as have its rich and unique natural resources in terms of forests, biodiversity and tourism potential. The states which share the Himalayan Ecology are also its principal sentinels. The region, often described as the “Abode of Gods”, is facing environmental degradation on account of various factors including anthropogenic activities. It is widely believed that climate change will affect the Himalayan ecosystem. Therefore, adaptation to the changing climate should be an integral part of the developmental path of the Himalayan region. To address this issue, a number of long-term measures are under consideration. This document attempts to highlight certain interventions, which, if put into practice, could go a long way not only in preventing the further degradation of this unique region but also in enhancing its ecology and life-sustaining role for millions of people residing within and beyond the Himalayan region.

Vijai Sharma

Secretary, Government of India
Ministry of Environment and Forests &
Chairman, Board of Governors, GBPIHED

List of Boxes, Annexure and Appendix

BOXES

- Box 1: NEP – Measures for the Conservation of Mountains
- Box 2: The NAPCC & The National Mission for Sustaining the Himalayan Ecosystem
- Box 3: Ban on Plastic in HP
- Box 4: Participatory Conservation of Lakes in the Region
- Box 5: Assam Hill Land and Ecological Sites Bill, 2006
- Box 6: Urban Development through JNNURM
- Box 7: Harnessing Religious Sentiments for Conservation
- Box 8: Ladakh Himalayan Homestays- Transforming Local Mindsets towards Snow Leopards
- Box 9: Highlights of Sikkim's Ecotourism Policy
- Box 10: Watershed Management in States of IHR
- Box 11: Snow Water Harvesting in Cold Deserts of J&K and HP
- Box 12: Promoting Environmental Awareness
- Box 13: Supportive Policy and Measures by States for Energy Generation and Conservation
- Box 14: Suggested Provisions for Income Generation from Conservation Areas
- Box 15: Some Initiatives to Reward the Conservation Efforts
- Box 16: Forests and Tree Cover as Carbon Sink
- Box 17: Mizoram Moves towards Organic Farming
- Box 18a: Community Efforts – Sustaining Soil Fertility by Protecting the Forests
- Box 18b: Traditional Wisdom – Maintaining Soil Fertility
- Box 19: Ensuring Equitable Access to Shifting Cultivation Patches – Strong Traditional Institution in Ukhrul, Manipur
- Box 20: Empowering Women to Manage Community Forests – Jamatia, Tripura
- Box 21: Key Areas for Monitoring Himalayan Ecosystems
- Box 22: Glacier Studies – Need of the Day
- Box 23: Monitoring Snow and Glaciers of the Himalaya
- Box 24: Long Term Weather Monitoring Programme
- Box 25: WII Initiatives for Studies on Sensitive Himalayan Wildlife
- Box 26: Ideal Himalayan Habitats
- Box 27: Impact of Road Construction in IHR: Some Examples
- Box 28: Carrying Capacity Assessment at Basin Level

ANNEXURE

- Annexure I: Solid Waste Management
- Annexure II: Hill Town Planning and Architectural Norms
- Annexure III: Regulating Tourists and Pilgrimage to Sensitive Areas
- Annexure IV: Promoting Ecotourism and Regulation of Commercial Tourism
- Annexure Va: Rejuvenation of Springs and Degraded Sites
- Annexure Vb: Rain Water Harvesting
- Annexure VI: Ecologically Safer Roads

APPENDIX

- Appendix I: List of Selected Institutions in the IHR

BACKGROUND



The majestic Himalaya represents one of the youngest but most complex mountain systems of the world. The region, being a discrete geographical and ecological entity, figures prominently among major bio-physical settings of the planet earth. This mountain system includes the area under Himalayan biodiversity hotspot, which covers an area of nearly 7.5 lakh km² (0.75 million km²) spanning over 3,000 km in length, and rising from low lying valleys to > 8,000m asl; it stretches from northern Pakistan on the west to the north-eastern region of India through Nepal and Bhutan.

The Himalaya produces a distinctive climate of its own and influences the climate of much of Asia¹. However, the variations in topographical features along three dimensional frameworks (i.e. latitudinal: South-North; longitudinal: East-West; altitudinal: Low-High) cause diversity in climate and habitat conditions within the region, resulting in richness, representativeness and uniqueness of its biodiversity elements ranging from genes to ecosystems². All this has contributed to a whole range of diversity in its indigenous human habitations, cultures and knowledge systems. Recognition of the Himalaya as one of 34 global biodiversity hotspots aptly reflects its wide ranging

ecological significance³.

The Indian Himalayan Region (IHR)⁴ with a geographical coverage of over 5.37 lakh km² (0.537 million km²) constitutes a significantly large proportion of the Himalayan biodiversity hotspot. IHR, located between 21°57' – 37°5' N lat. and 72°40' – 97°25' E long, and covers 16.2% of the total geographical area of the country (Figure 1). Administratively it covers 10 states entirely (i.e., Jammu & Kashmir – J&K; Himachal Pradesh – HP; Uttarakhand – UK; Sikkim, Arunachal Pradesh – AP, Nagaland, Manipur, Mizoram, Tripura, Meghalaya), and two states partially [i.e., hill districts of Assam and West Bengal]. Major features of IHR are depicted in Table 1.

Temporal and spatial variations caused by diverse geological orogeny have resulted in marked difference in its climate and physiography, thus contributing greatly to the richness and representativeness of its biodiversity components at all levels⁵. The spatial position and heterogeneous dispersion of biodiversity elements have led to complexity in the biogeographic patterns of the region. The eastern Himalaya (including north east India) that

States/Regions	Geographical area- GA(km ²)	Per-cent contribution to the total population of IHR & (India)	Sex ratio	Literacy rate (+7yr) (%)	Forest cover km ² (% of GA)#
Jammu & Kashmir	222,236*	25.41 (0.98)	900	54.46	21,273 (9.57)
Himachal Pradesh	55,673	15.34 (0.59)	970	75.91	14,369 (25.81)
Uttarakhand	53,483	21.40 (0.83)	964	72.28	24,442 (45.70)
Sikkim	7,096	1.36 (0.05)	875	69.68	3,262 (45.97)
W.Bengal hills	3,149	4.05 (0.16)	943	72.87	2,221 (70.53)
Meghalaya	22,429	5.82 (0.22)	975	63.31	16,988 (75.74)
Assam hills	19,153	2.52 (0.10)	915	60.68	13,051 (68.14)
Tripura	10,486	8.05 (0.31)	950	73.66	8,155 (77.77)
Mizoram	21,081	2.25 (0.09)	938	88.49	18,684 (88.63)
Manipur	22,327	6.03 (0.23)	978	68.87	17,086 (76.53)
Nagaland	16,579	5.02 (0.19)	909	67.11	13,719 (82.75)
Arunachal Pradesh	83,743	2.75 (0.11)	901	54.74	67,777 (80.93)
India	3,287,263	-----	933	65.38	677,088 (20.60)

* includes 78,114 and 37,555 km² area occupied by Pakistan and China, respectively and 5180 km² handed over by Pakistan to China (Source: Wasteland Atlas of India, 2000; FSI 2005#)

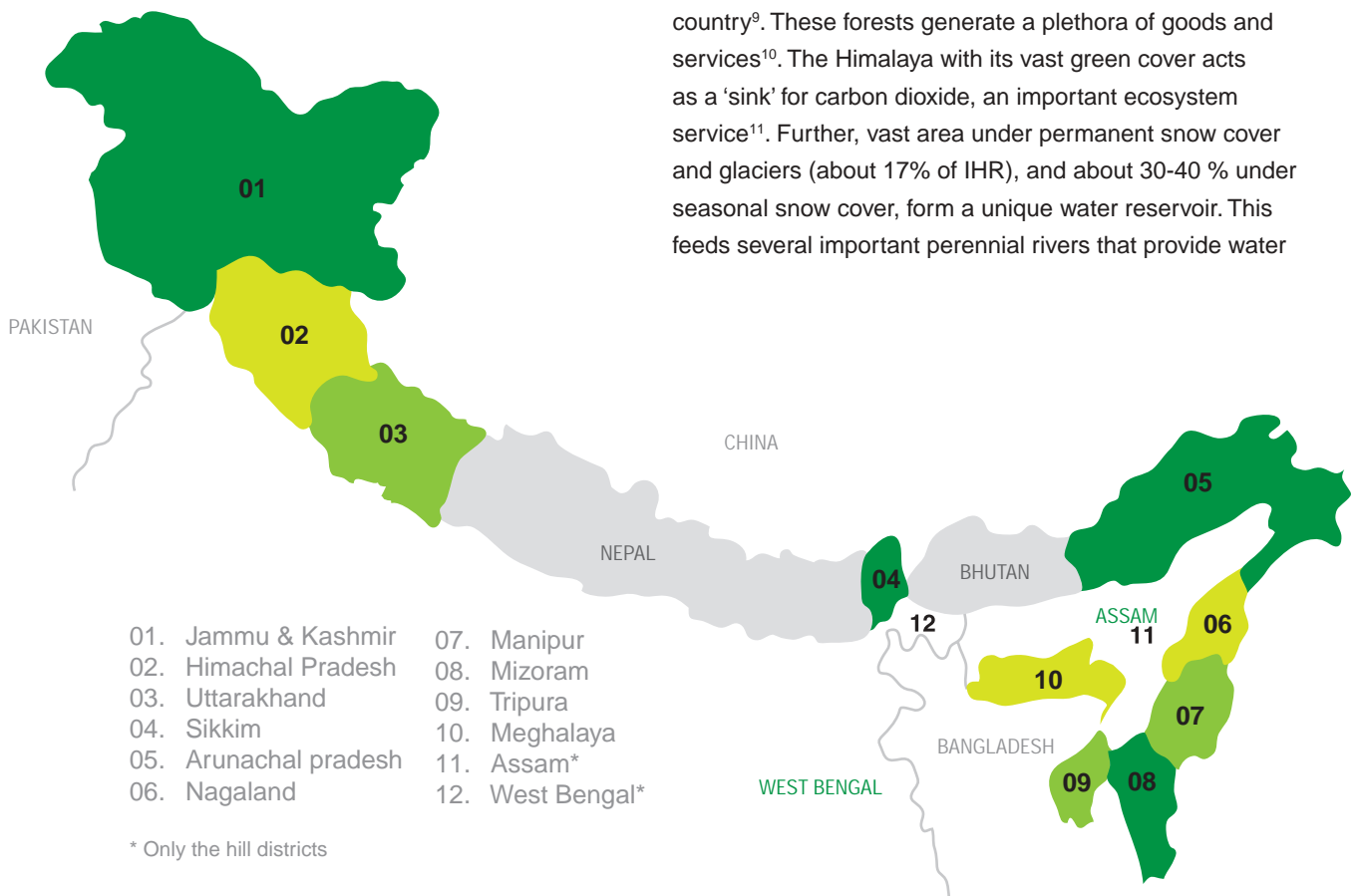
¹ *Bioscience*, 47: 735–745 (1997).

² 2nd Pandit Govind Ballabh Pant Memorial Lecture, GBPIHED (1992)

³ *Conservation International* (2007). <http://www.biodiversityhotspots.org>

⁴ *Resource Information Database of the Indian Himalaya*, GBPIHED, ENVIS Monograph 3 (2006).

⁵ *Current Science*, 90(6) 784-788 (2006)



country⁹. These forests generate a plethora of goods and services¹⁰. The Himalaya with its vast green cover acts as a 'sink' for carbon dioxide, an important ecosystem service¹¹. Further, vast area under permanent snow cover and glaciers (about 17% of IHR), and about 30-40 % under seasonal snow cover, form a unique water reservoir. This feeds several important perennial rivers that provide water

Figure1 - Indian Himalayan Region (IHR)

harbours about 8,000 species of plants is considered a cradle of flowering plants, whereas the western Himalaya supports over 5,000 plant species⁶. The region as a whole supports nearly 50% of the total flowering plants in India of which 30% are endemic to the region⁵. There are over 816 tree species, 675 wild edibles and over 1,740 species of medicinal value in IHR⁷. Likewise, nearly 300 mammal species (12 endemic) and 979 birds (15 endemic) are recorded from the region. The region also exhibits great diversity of ethnic groups (171 out of a total 573 scheduled tribes in India) which generally inhabit remote inhospitable terrains⁸.

The IHR occupies a strategic position along the entire northern boundary (North-West to North-East) of the nation. Apart from a national security standpoint, IHR is also important for its high forest cover. More than 41.5 % of its geographical area is under forest cover representing one-third of the total forest cover in India and nearly half (47%) of the "very good" forest cover category of the

for drinking, irrigation, and hydropower. Every year, about 1,200,000 million m³ of water flows from Himalayan Rivers⁵. IHR is home to nearly 4% of the country's population, and is a provider for their livelihoods.

However, the Himalayan ecosystem is highly vulnerable both due to geological reasons and on account of the stress caused by increased pressure of population, exploitation of natural resources and other related challenges. These effects may well be exacerbated due to the impact of climate change. Climate change may adversely impact the Himalayan ecosystem through increased temperature, altered precipitation patterns, episodes of drought, and biotic influences. This would not only impact the very sustenance of the indigenous communities in uplands but also the life of downstream dwellers across the country and beyond. Therefore, there

⁶ *Biodiversity in India: floristic aspects*, Bishen Singh Mahendra Pal Singh, Dehradun (1994)
⁷ *Medicinal Plants of Indian Himalaya: Diversity, Distribution, Potential Value*. GBPIHED (1998)
⁸ *Journal of Sustainable Dev. & World Ecol.* 10:157-168 (2000)
⁹ *State of Forest Report 2005*. FSI, Dehradun (2008).
¹⁰ *Forests of Himalaya: Structure, Function and Impact of Man*, Gyanodaya Prakashan (1992)
¹¹ *Current Science*, 82;1331-1335 (2002)

is an urgent need for giving special attention to sustain the Himalayan Ecosystem.

In this context, measures for the conservation of mountains have been specifically envisaged in India's National Environment Policy (NEP) 2006¹² (Box 1).

India has also released its National Action Plan on Climate Change (NAPCC) which envisages, among other things, a National Mission for Sustaining the Himalayan Ecosystem (Box 2)¹³.

In achieving the objectives of the NEP 2006 and the National Mission for Sustaining the Himalayan Ecosystem, certain specific guidelines for development and regulation of the region need to be formulated and implemented at the National and State levels. This is critical so that we have a clear consistent set of rules for regulation and management of the region. This document sets out a number of such guidelines.

Box 1

NEP – Measures for the Conservation of Mountains

- Adopt appropriate land-use planning and watershed management practices for sustainable development of mountain ecosystem
- Adopt “best practice” norms for infrastructure construction in mountain regions to avoid or minimize damage to sensitive ecosystems and despoiling of landscapes.
- Encourage cultivation of traditional varieties of crops and horticulture by promotion of organic farming, enabling farmers to realize a price premium.
- Promote sustainable tourism through adoption of “best practice” norms of eco-friendly and responsible tourism, creation of appropriate facilities and access to ecological resources, and multi-stakeholder partnerships to enable local communities to gain livelihoods, while leveraging financial, technical, and managerial capacities of investors.
- Take measures to regulate tourist inflows into mountain regions to ensure that these remain within the carrying capacity of the mountain ecology

¹² National Environment Policy, MoEF, GOI (2006). www.envfor.nic.in/nep/nep2006e.pdf

¹³ National Action Plan on Climate Change, GOI (2008). <http://pmindia.nic.in/Pg01-52.pdf>



A white yak with long, curved horns stands in a green field with mountains in the background. The yak is facing left, and its fur is thick and white. The background shows a range of mountains, some with snow, under a clear blue sky. The foreground is a lush green field with some yellow flowers.

Box 2

The NAPCC & The National Mission for Sustaining the Himalayan Ecosystem

The National Action Plan for Climate Change (NAPCC) which includes a comprehensive set of mitigation & adaptation measures, aims to promote our development objectives while yielding co-benefits for addressing climate change effectively.

There are eight National Missions which form the core of NAPCC, representing a multi-pronged, long-term and integrated strategy for achieving key goals in the context of climate change.

1. National Solar Mission
2. National Mission for Enhanced Energy Efficiency
3. National Mission on Sustainable Habitats
4. National Water Mission
5. National Mission for Sustaining the Himalayan Ecosystem
6. National Mission for a Green India
7. National Mission for Sustainable Agriculture
8. National Mission on Strategic Knowledge of Climate Change

In addition, it envisages 24 critical initiatives on issues ranging from renewable energy, protection of coastal areas, health and cross-cutting capacity development.

The National Mission for Sustaining the Himalayan Ecosystem is to be launched to evolve management measures for sustaining and safeguarding the Himalayan glaciers and mountain ecosystems. The mission, among others, aims to: (i) understand, whether and the extent to which, the Himalayan glaciers are in recession and how the problem could be addressed, (ii) establish an observational and monitoring network for the Himalayan environment; (iii) promote community-based management of the ecosystems through incentives to community organizations and panchayats for protection of forested lands.



A large, stylized letter 'B' graphic in a darker shade of green, positioned on the left side of the page. It has rounded, organic shapes.

GUIDELINES AND BEST PRACTICES



Sustainable Urbanization in the Himalaya

1.1

Solid Waste Management

The continued expansion in urban settlements, influx of visitors, trekkers and mountaineers in the Himalayan region has started to pose high biotic pressure and concomitant indiscriminate solid waste dumping. As a result, the IHR is getting adversely affected. In the absence of proper management practices and inadequate infrastructural facilities, human induced pollution, such as solid waste, untreated sewage and local air pollution due to vehicles has been continuously increasing in the IHR. A few attempts have been made at addressing these issues. These include efforts at solid waste management in Shimla (HP), banning the use of plastics in certain states (e.g., HP, Sikkim), formulation of 'do's and don'ts' guidelines by the Indian Mountaineering Foundation. These can be evaluated and considered for replication in other areas of IHR. In addition, best international experiences as well as practices followed in regard to preservation of surroundings and prevention of littering

in eco-sensitive places, e.g., Alaska, Gangotri/Leh region (for management of camp sites), Nepal and China (Tibet/

Sichuan region) should be examined and appropriately adopted. There is an urgent need for developing and enforcing guidelines/prescriptions disallowing indiscriminate disposal of garbage, particularly non-degradable waste, caused by accumulation of plastic bottles and polythene bags in hill towns in the Himalaya. Hill towns need to be planned particularly keeping in mind that tourists do not pay for municipal services. Many states have experimented – from banning plastics, to taxing tourists – to better respond to these issues (Box 3). However, they need support and innovative thinking

Box 3

Ban on Plastic in HP

Himachal Pradesh enacted the Himachal Pradesh Non-Biodegradable Garbage (Control) Act, 1995 in order to prevent throwing or depositing non-biodegradable garbage in public drains, roads.

- Himachal Pradesh then increased the minimum thickness of plastic carry bags to 70 microns of virgin material, which exceeded the 20 micron thickness recommended by Central Rules.
- Further, the state Government has taken a Cabinet decision to ban plastics altogether in the entire state with effect from 15.08.2009. This demonstrates the state's zero tolerance attitude to pollution caused by plastics in the Hill State.

<http://himachal.nic.in/environment/notifications.htm>

on different aspects ranging from traditional architectural practices, local water management through protection of springs, ponds and lakes, and diverse systems of sewage and garbage management. Specific action areas for Solid Waste Management have been highlighted (Annexure I). In addition, there is a need to motivate residents to switch

over to a more scientific waste disposal system in a participatory manner and promote dissemination of such success stories (Box 4).

1.2

Town Planning and Architectural Norms

Rapid unplanned growth of hill towns, construction activities without a proper plan, general non-compliance with prescribed norms and guidelines, and indiscriminate use of land for commercial outfits/tourist resorts has severely and adversely affected the fragile ecosystem of the Himalaya. Therefore, regulations for control on land use change (e.g., diversion of agricultural land for other purposes) and sale/

purchase of land are urgently needed across the IHR. Legal/policy initiatives taken by some State Governments (Box 5) could serve as a model to be promoted across the IHR after proper evaluation.

Large scale land instabilities, drying up of natural water sources, waste disposal problems and changing socio-cultural values are known impacts of unplanned construction activities. The “development” in the present context has become unsustainable. An integrated approach is, therefore, necessary to protect the environment and achieve required economic development at the same time. Advance planning based on timely and reliable data has become crucial for sustainable growth of hill towns.

Box 4

Participatory Conservation of Lakes in the Region

Conservation by residents of Nainital town

The Naini lake is the sole source of drinking water for Nainital town, an important tourist destination in Uttarakhand state, and is connected to 62 drains out of which 23 directly fall into it. Increasing inflow of tourists, urban waste making its way into the lake is adversely affecting water quality. To conserve this important water body, the residents have switched on to a scientific garbage disposal system – under the project name ‘Mission Butterfly’ by Nainital Lake Conservation Project. The sweepers, on a small monthly charge, collect waste from each household and directly transfer it to the compost pits. Apart from the residents, schools and hotel owners have extended full cooperation to the authorities, to save its precious eco-system. In addition to helping the authorities, in preventing the waste entering the lake, they are able to generate income and employment by converting it to manure, and the schools are educating their students about waste management.

<http://www.mycleanindia.com/states/Uttarakhand/missionbutterfly.html>

Conservation of Dal lake

Dal lake, besides being a favourite tourist destination attracting thousands of tourists in Jammu & Kashmir state, is also special for settlement of about 60,000 people within the lake. The lake is in peril due to anthropogenic pressure and overall deterioration of surrounding environment. The lake has been included in the lake conservation programme of the Ministry of Environment and Forests, Govt. of India. The Lake and Waterways Development Authority (LAWDA), Srinagar, in collaboration with Centre for Environment Education (CEE) and other Non-governmental Organisations (NGOs) has taken up the initiative for lake conservation through education and mass awareness. Dustbins have been placed by LAWDA at convenient locations and a practice of door to door household waste collection has been introduced. Use of polythene carry bags has also been banned in the lake area.

<http://www.cceindia.org/cee/north.html>





Box 5

Assam Hill Land and Ecological Sites Bill, 2006

The Assam Hill Land and Ecological Sites (Protection and Management) Bill, 2006 has been passed by the Assam Legislative Assembly to prevent indiscriminate cutting of hills and filling up of water bodies in urban areas, which had led to serious ecological problems in places like Guwahati. Prior to this, many assembly members had expressed apprehension that the Bill would take away traditional settlers' rights over the hills. However, the state government assured them that it is committed to granting land rights to those who have been living on the hills for the past 15 years or more. It also promised a new land use policy for such settlers. Under the Bill, the state government can bring any hill under its purview for protection.

Box 6

Urban Development through JNNURM

The JNNURM is a joint mission of the Ministry of Urban Development and the Ministry of Urban Employment and Poverty Alleviation, Govt. of India.

“The aim is to encourage reforms and fast track planned development of identified cities. Focus is to be on efficiency in urban infrastructure and service delivery mechanisms, community participation, and accountability of ULBs/ Parastatal agencies towards citizens”.

The duration of the mission is seven years starting from 2005-06. The Government of India has proposed substantial financial assistance to cities selected through the JNNURM over the seven-year period. The following 13 towns of IHR are included in the category of eligible cities to receive fund through JNNURM (Itanagar, Shimla, Imphal, Shillong, Aizawl, Kohima, Gangtok, Agartala, Dehradun, Nainital, Haridwar, Jammu, Srinagar).

<http://jnnurm.nic.in/nurmudweb/toolkit/Overview.pdf>

Location planning of residential buildings, tourist resorts, and other commercial buildings, etc. has a significant role in advance town planning. The 13 Himalayan towns in the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) can serve as models in this regard, and the finance provided under the Scheme can be used for this purpose to begin with (Box 6).

There is also a need to adopt best practice norms (e.g., National Building Code) for infrastructure construction in earthquake prone mountain region to avoid or minimize damage to life and property in the event of an earthquake, and to safeguard the sensitive eco-system and despoiling of landscapes (Annexure II). In any case, the existing environment, forest and wildlife regulations would need to be adhered to.

Regulated Tourism

2.1

Pilgrimage in Sensitive Areas

The Himalaya is known to be a home of saints, seekers of peace and enlightenment and a favoured destination of pilgrimage since time immemorial as it hosts a number of religious/sacred sites across the region. Each year, millions of pilgrims visit these sites. For example, Badrinath, Kedarnath, Gangotri- Yamunotri and Hemkund Sahib in Uttarakhand, Manimahesh, Jwala Devi, Chintpurni, Naina Devi in Himachal Pradesh, and Vaishnav Devi and Amarnath in Jammu & Kashmir, Khecheopalri and other sacred lakes in Sikkim are particularly important destinations. Unfortunately, most of these places lack adequate facilities of transport, accommodation, waste disposal and other amenities for the ever growing number of pilgrims that visit them every year. Also, there is a gross lack of regulatory mechanism for infrastructure creation, management, and for controlling the tourist inflow in such sites. As a result the sensitive ecosystems and cultural values of these areas are facing pressures far beyond their carrying capacities. There is an urgent need to develop and implement guidelines for sustainable pilgrimage in the region encompassing the concept of carrying capacity of the area. In a few cases some initiatives have been taken. For example, there are guidelines to enable regulated entry into the Gangotri area of Uttarakhand. The Government of Uttarakhand has restricted the number of tourists visiting the origin of the holy river Ganga to 150 per day. The new regulation has come into effect from the April, 2008. Also, there is a need to harness religious sentiments for the conservation of these areas (Box 7). Some suggested guidelines for pilgrimage in sensitive areas have been provided (Annexure III).

Box 7

Harnessing Religious Sentiments for Conservation

There is immense scope of harnessing the religious sentiments of tourists in the right perspectives of conservation and sustainable management of natural resources in the eco-sensitive Himalayan areas. This can be done through: (i) encouraging them to undertake participatory plantation for rehabilitation of degraded areas (e.g., Badrivan initiative of GBPIHED in Uttarakhand); (ii) promoting the concept of eco-cultural landscapes (e.g., Demazong – Buddhist landscape, Sikkim, and Apatani eco-cultural landscape, Arunachal Pradesh). Both landscapes are highly evolved with high level of economic and ecological efficiencies; (iii) involving them in maintenance and strengthening of sacred groves/landscape (e.g., Sacred Groves of Meghalaya: The tribal communities – Khasis, Garos, and Jaintias, have a tradition of environmental conservation based on religious beliefs. Certain patches of forests are designated as sacred groves under customary law and are protected from any product extraction. Such forests are rich in biological diversity and harbour many endangered plant species including rare herbs and medicinal plants).



2.2

Ecotourism and Regulation of Commercial Tourism

The impacts of tourism on mountain ecosystems and biological resources are of great concern because of the high biodiversity and environmental sensitivity of the Himalaya. Cultural identities and diversity in mountain regions are also under threat by the economic, social and environmental forces associated with mountain tourism. In this context, community based ecotourism emerges as one of the sustainable alternatives to the presently practised commercial tourism in already over saturated hill towns like Nainital, Mussoorie, Shimla, Kullu-Manali, Gangtok, etc. In spite of efforts by some state governments (e.g., Sikkim), the pace at which tourism is growing every year is rapid (from nearly 15,000 tourists in 1980 to 3,50,000 tourists in 2007 in Sikkim). Yet, the efforts that have been made by Sikkim can serve as a basis of responsible tourism in other Himalayan states.

In the above context, diversion of tourists towards other potential sites including the Biosphere Reserves and other conservation areas may be required. A few successful initiatives from the region (e.g., Ladakh initiative) have exhibited the potential of implementing the concept of 'Himalayan Homestays', which links cultural and natural heritage conservation through a commitment to reliability, protection and sensitive interpretation of local culture and nature heritage values (Box 8). Such initiatives need to be promoted across the IHR. Also, the approach of ecotourism in Sikkim (Box 9) is a good example for replication. Further, immense opportunities for adventure cum ecotourism in the Himalayan region (e.g., Annapurna Conservation Area project, Nepal; Nanda Devi Biosphere



Reserve ecotourism approach, Uttarakhand) could be harnessed through community involvement. Linking of tourism with initiatives like Rural Business Hubs (RBH), as introduced in North East region, which envisages promotion of quality rural products like handloom, handicrafts, agro products, herbal products, bio-fuel, etc., may be considered as yet another aspect of promoting eco-tourism in the IHR.

However, considering the sensitivity (both cultural and natural) of this region, strict operational guidelines are required to be enforced across IHR with region specific provisions for facilitating and promoting community based ecotourism (suggested guidelines for promoting ecotourism are listed in Annexure IV).

Box 8

Ladakh Himalayan Homestays- Transforming Local Mindsets towards Snow Leopards

The Himalayan Homestays programme fosters conservation-based community managed tourism development in remote settlements, by gradually building local capacity and ownership. It stands out as an example that aims to be sensitive to both host and visitor expectations without compromising the aspirations of host communities, and at the same time seeks to balance these aspects with conservation of the area's unique cultural and natural heritage. Himalayan Homestays seek to: (i) Ensure that hosts obtain fair returns for their services and investment; (ii) Ensure positive interactive cultural experiences for both the host and visitor; (iii) Ensure that Homestays contribute to conserving local cultural and natural heritage by ensuring that a percentage of the earnings go towards conservation activities; (iv) Create a distinctive, authentic, reliable, tourist accommodation and experience – homestay packages – for visitors in the world's highest mountain range, through participatory monitoring of standards and conservation linkages, as well as participatory evaluation by visitors, private tour operators, NGO's and the local community.

<http://geotourism.changemakers.com/en-us/node/24749>; www.himalayan-homestays.com



Box 9

Highlights of Sikkim's Ecotourism Policy

- “Sikkim - the Ultimate Tourist Destination” is the policy motto of the state. The state is employing a system of environmental fees, and permits for entries, and stay time restrictions in some environmentally sensitive high altitude/ pristine areas.
- Operationalization of tourism in various modes, such as village tourism, nature tourism, wildlife tourism, trekking/adventure tourism, and cultural tourism in the state and institutionalization of tourism management at the community level may be useful.
- Promotion and use of local art & craft, cuisines, etc., along with organizing tourism fairs and festivals.
- Imparting training in tourism related service industries.

Water Security through Rejuvenation of Springs and Catchments

Integration of conservation and development activities through stakeholder participation and collaboration among different institutions and social actors is increasingly being recognised as a promising approach for the rejuvenation of natural springs and degraded sites, and for sustainable management of resources at the watershed scale. Some efforts in this direction have been made in the states of Uttarakhand and Sikkim (Box 10). Several ministries and developmental agencies have accepted the concept of watershed for wasteland restorations, recharging of water sources, creating and empowering of decentralised village institutions and strengthening of participatory processes.

There is a need for promoting community participation in such policies and programmes using appropriate provisions already made through the 73rd Amendment of the constitution in 1992 which empowers local Government. The village level developmental plans (e.g., Village Environment Action Plan-VEAP of GBPIHED), as being applied under SWAJAL initiative of Uttarakhand, using participatory planning process, can be suggested as one of the options for integrating resource assessment, utilisation and conservation. Guidelines suggested for spring recharge and rainwater harvesting (Annexure V a-b), technologies for wasteland rehabilitation (e.g., Sloping Watershed Environmental Engineering Technology - SWEET of GBPIHED), and other appropriate technologies may form essential components of such plans.



Promotion of efforts to use modern techniques and knowledge base for improving efficiency as practised in Ladakh (Box 11) for traditional snow water harvesting would be needed to be applied in other areas to improve the quality of life in such harsh environmental conditions of the Himalaya.



Box 10

Watershed Management in States of IHR

- In small hilly degraded watersheds in the outer Himalaya of Doon Valley, construction of gully plugs and plantations (Sahastradhara and Nalotanala watersheds) resulted in reduction of peak rates of runoff and increased base flow, the latter released as lean flow which is used as a perennial irrigation source.
- Interventions carried out for SWAJAL Phase I project under Catchment Area Protection (CAP) programme in 165 villages in Uttarakhand also reported increase in the discharge of various springs after completion of the CAP work. Besides this, several other success stories have been reported from different parts of Uttarakhand where work has been carried out by villagers; examples include Gad Kharak (Ufrainkhal) and Dugar Gad in Pauri area in Uttarakhand. The Government of Mizoram through the Accelerated Rural Water Supply Programme (ARWSP) and Technology Mission Programme has provided as many as 5,993 rainwater tanks in individual houses of 198 villages at a cost of Rs 60 million; individual households are expected to carry out the maintenance.
- Spring sanctuary development using biological and physical measures to treat the catchment area is also underway in Sikkim.

Box 11

Snow Water Harvesting in Cold Deserts of J&K and HP

Among other environmental stresses, severe water shortage in remote cold deserts of the Himalayan region in particular makes these areas most difficult. Snow water harvesting in this region has traditionally played a significant role in the sustenance of farming communities. However, introduction of modern technologies in snow water harvesting have proved much beneficial for the region. Initiatives of Chewang Norphel, Ladakhs' "glacier man", in making low cost artificial glaciers during winters have enabled the villagers to get irrigation water during sowing season (April-May), thereby, improving crop growth. The added advantage is that the areas under artificial glaciers turn into green pastures during summers.



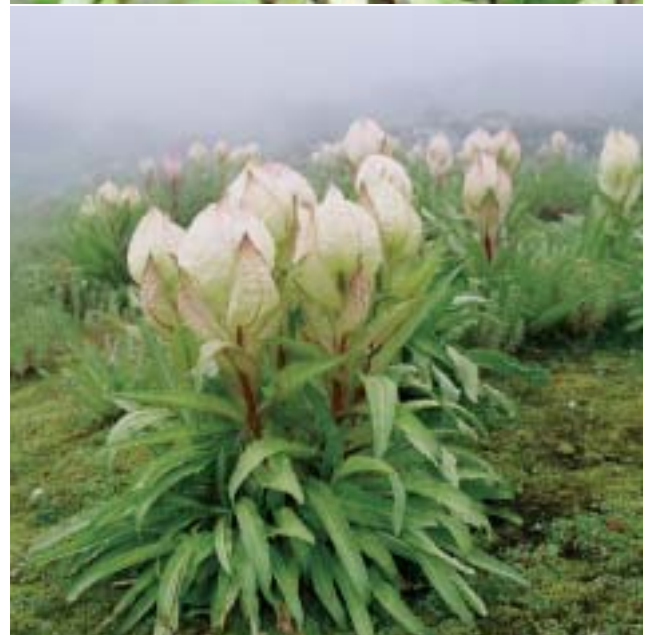
Building Environmental Awareness



There is a strong need for promoting awareness both among local communities and visitors about various issues pertaining to the specificities and sensitivity of the Himalayan environment. Effective use of media

and imparting training through informal conservation education is required (Box 12). Various research organizations and NGOs from the region can play important role in this context. A list of major institutions and their area(s) of operation is given in Appendix-1.

Apart from awareness and inculcating interest among school and college students, the programme subsequently needs to attract and motivate other stakeholder groups. In particular, there is a need for designing a special course on “Himalayan Ecology and People” and making it mandatory for those serving the region as administrators, natural resource planners, policy makers, and military & paramilitary forces, etc. The Institutions mandated for Himalayan Research & Development need to be strengthened to design and implement such courses in collaboration with Institutions of higher learning and Administrative Training Centres.



Box 12

Promoting Environmental Awareness

a. Use of Media

In the context of various issues listed earlier, use of electronic and print media particularly through audio visuals focusing on success stories and best practices which, in particular, target rural audiences need to be given greater and immediate attention.

b. Conservation Education

The growing concern over Environmental Education (EE) programmes calls for developing perspective guidelines for implementation in both formal and informal sectors in order to bring in a perceptible shift in the mindset of communities towards integrating conservation science with societal needs. With regard to the IHR, mountain specificities need to be accordingly included in such guidelines and programmes. Approaches developed through successful initiatives in the region; both in formal [e.g., initiative by an environmental NGO – Uttarakhand Seva Nidhi (UKSN), Almora (Uttarakhand)] and informal education [e.g., approach developed and tested by G.B. Pant Institute of Himalayan Environment & Development, Almora and Guwahati based CEE- North East] need to be promoted and considered for replication across the Himalayan states with area/location specific modifications. The concerned State Governments may initiate programmes in this direction and ensure implementation in consultation with suitable organizations.



Energy Options

Biomass is the main source of energy used at the level of households for cooking and heating. An increasing number of households have also started using LPG for cooking needs. Majority of households in the IHR still use traditional fuel for cooking purposes. Out of the total of 6.66 million households in IHR, 4.31 million use firewood as a primary source of cooking energy (64.8% of total IHR households). Among the modern fuels, LPG is also used for cooking (23.8% households) followed by kerosene (4.6%), cow dung cakes (3.6%) and crop residue (2.1%). In each Himalayan state, firewood is used as a primary source of cooking energy, but the total number of households using firewood as a primary source tends to vary, from 54.6% in Uttarakhand to 86.3% in Nagaland. Briquettes made of charred pine needles are being introduced in the hill regions of Kumaun and Garhwal in Uttarakhand. NGOs and private sector initiatives (e.g., through Green Energy Corporation) in Uttarakhand, produce charcoaled pine needle briquettes. In Himachal Pradesh, pine needles in combination with waste paper are used for making boards, file covers, etc. Use of pine needles as an alternative to fuel wood is a possibility and needs research on its economics and long term effects of removal from the pine forests.

The region requires strong supportive policy initiatives for conservation and energy generation particularly focusing on other sources of energy such as solar energy and hydropower. A few initiatives that are being undertaken in different states are given in Box 13.





Box 13

Supportive Policy and Measures by States for Energy Generation and Conservation

- Uttarakhand has recently implemented a policy for harnessing renewable energy sources with the private sector / community participation which targets power generation as well as power conservation. Power generation can be done by individuals, Gram Panchayats, Registered Societies, and Private Companies. State Government has also launched a scheme for BPL families by providing assistance in procuring primary infrastructure such as stove and cylinder for use of LPG.
- Himachal Pradesh & Sikkim Governments have a policy to allocate additional quota of clean fuels (LPG, kerosene) to residents of hilly areas and tour operators, respectively in order to prevent deforestation. Biomass-to-energy and small hydropower plants need to be encouraged in the mountain areas to meet the energy needs. Provision of LPG as a clean cooking fuel in appropriately sized cylinders should also be considered to reduce pressure on the forests.



Conservation Areas and Forest Zone Management for Community Development

6.1

Conservation area management through community involvement

The conservation areas in the Indian Himalaya cover nearly 10% of the area of IHR, which is higher than the national average of about 7.3%. However, both the figures are below the current global average of 12% coverage. In view of the biophysical values of the Himalayan region, there is a need to further strengthen the conservation area network in the region by considering various proposals. Based on the biodiversity values, to give coverage to all representative ecosystems of biogeographic units, additional biosphere reserves and other protected areas need to be designated. While initiatives for strengthening of conservation areas are essentially required, there is also a need for reorienting existing norms and management practices by harnessing the income generating potential of local communities (Box 14) so as to promote their interest and participation in conservation activities.

In the context of above, among other things, implementation of the concept of biosphere reserve, which promotes *in situ* conservation of all forms of life with its support system, an underlying referral system for monitoring and evaluating changes in natural ecosystems and indigenous communities, needs to be strengthened in the region. The wilderness of the Himalayan Biospheres, one of the biggest assets for the future [Dehang–Debang in Arunachal Pradesh; Nokrek in Meghalaya; Manas and Dibru-Saikhowa in Assam; Kangchendzonga in Sikkim; Nanda Devi in Uttarakhand; Cold Desert in Himachal

Box 14

Suggested Provisions for Income Generation from Conservation Areas

- Provision of entry fees for local community development
- Allow community access to such areas for collection of fallen wood/litter and controlled collection of forest products including economically important wild plants.
- Use of forest produce for value addition, like use of pine needles for making of bio-briquettes.
- Develop opportunities for employment of local communities for area conservation and nature interpretation through proper training
- Promote initiatives of value addition in traditional technology/knowledge such as handicraft, fermented food/beverages, apiculture and cattle breeding to upgrade the income of local inhabitants.

Pradesh], thus, requires special attention. Some of these landscapes, based on their bio-physical and socio-cultural features have potential to also emerge as areas of 'incomparable value' [e.g., the Cold Desert BR, HP (including the proposed landscape in J&K); Nanda Devi BR landscape, Uttarakhand; Dehang Dibang BR, Arunachal Pradesh and Kanchendzonga BR, Sikkim].



Box 15

Some Initiatives to Reward the Conservation Efforts

- In recognition of forests as national wealth, the 12th Finance Commission has recommended an incremental grant of Rs 1000 crore spread over the award period of 2005 – 10 for the maintenance of forests. This amount is to be distributed among the states based on their forest area for the preservation of forest wealth. The present system needs to be appropriately modified to adequately account for the Himalayan hill states.
- As two thirds of the geographic area of the IHR is targeted to be under forest cover, with the local communities playing an important part in its maintenance, payments for the ecosystem services (PES) of the standing forests of this region can be one such measure to involve the local communities in the conservation and adaptation efforts.
- Apple growers in Himachal Pradesh have started renting colonies of honey bees, for pollinating orchards, from the Department of Horticulture and private bee keepers. Rate of renting a colony was up to US \$ 20 (Rs 950) for a season in 2004. This highlights the need for strengthening the tradition of organic farming in the IHR.

6.2

Acknowledging community contribution through PES

Proper acknowledgment of the contribution of indigenous communities in the maintenance of goods and services emanating from the Himalayan ecosystem is an essential requirement. The stewardship role played by mountain farmers in maintaining the regional agrobiodiversity and local genetic heritage deserves priority recognition in the form of adequate incentives so as to ensure their long-term involvement. Likewise, in the context of growing recognition of the value of ecosystem services, there is a need for the identification of appropriate mechanisms to support and reward the indigenous communities which maintain

Box 16

Forests and Tree Cover as Carbon Sink

India's forests and tree cover accounts for about 23.4 % of the total geographical area of the country. The National policies of the country aimed at conservation and sustainable management of forests have transformed these resources into a net carbon sink of CO₂. The carbon stocks stored in the forests of the country have increased from 6244.78 to 6621.55 million tonnes (mt) in the last decade (1995- 2005) registering an annual increment of 138.15 mt of CO₂ equivalent. Afforestation and reforestation of 6 million hectare of degraded forest land covered under the National Mission for Green India with participation of Joint Forest Management (JFM) would be able to add another 18 mt of carbon by 2020. The annual addition of 6 mt of biomass will increase the annual emission removal capability of forests from 4.87 % to 5.18 % of the corresponding projected emissions by 2020.

Source: ICFRE 2009

or contribute towards the improvement of such services. Some potential initiatives to reward conservation efforts are listed in Box 15.

Special efforts must be made for the implementation of PES in the region under the upcoming international climate framework and steps must be taken to harness benefits from the programmes like 'Reduced Emission from Deforestation and Forest Degradation' (REDD) under the United Nations Framework Convention on Climate Change (UNFCCC). This would require the integration and involvement of diverse stakeholder groups for developing effective and feasible mechanisms to conserve carbon in the existing forests, and by slowing down the rate of deforestation and degradation of forests. The value of India's forests as carbon sink is given in Box 16.

In this context, there is need for a wide ranging campaign to promote 'Tree Farming' across the region in order to cover the hill slopes with such species of trees and shrubs which are of value to the hill people in the form of food,

fodder, fuel, fibre and leaf manure, etc. Under this initiative, planting of species of trees with edibility value for wildlife in forest gaps and margins is likely to minimize the incidence of crop and property damage by wild animals. This would also help in the reduction of man-animal conflicts.

6.3

Conservation through integration of traditional & cultural values

Realizing the need for maintaining the valuable gene pool of traditional varieties/land races of at least domesticated biodiversity, and for the promotion of indigenous 'best management practices' in mountain farming (as an adaptation and coping option under changing climate scenario), appropriate incentive mechanisms need to be framed and implemented for the benefit of indigenous farming communities of the region. In this context, the facilitation of organic farming, which encompasses commodities, value added foods, woollens, health products, has emerged as an effective option. Certain state governments (e.g., Mizoram, Uttarakhand, Sikkim) in the region have already taken the lead in this regard (Box 17).

Also, to harness community support to maintain and conserve the uniqueness of biodiversity (both wild and domesticated), there is a need for the integration of cultural values and indigenous knowledge practices with management (Box 18 a & b). It is also important to put in place an adequate reward system for the communities.

The contribution of the Himalayan medicinal plant diversity in traditional health care systems, and the knowledge available to traditional health practitioners and vaidyas also need to be studied and rewarded. The promotion of cultivation of medicinal plants in their respective altitudinal zones is a viable potential option for its conservation and sustainable utilization.

Shifting cultivation, the most prominent farming system of north east Himalaya, has been a way of life for a large number of ethnic groups and other marginalized upland communities. This practice, on account of its perceived negative environmental consequences, is often considered controversial. However, realizing its deep rooted linkages with indigenous ethnic culture and its importance for ensuring social and environmental security (Box 19), there is a need to find ways and means to reduce its ill effects and promote ecological (e.g., biodiversity conservation, forest and farm management), and economic values

Box 17

Mizoram Moves towards Organic Farming

The Legislative Assembly of Mizoram passed the Mizoram Organic Farming Act (2004) on 12.07.2004, to introduce, adopt areas for, promote and regulate organic farming in consonance with the National Organic Programme. The aims, among others, include:

- To notify areas of organic farming and to undertake such farming in such areas;
- To encourage the development of organic farming in private land and organic processing through various measures as may be prescribed;
- To facilitate certification of organic products in the state in conformity to the National Standards for organic products;
- To facilitate marketing of organic products in the local, national and international markets;
- To make infra-structure for organic farming including permitted inputs or material easily available to the intending farmers.

Source: The Mizoram Organic Farming Act, 2004; Act No 6 of 2004, passed on 12.07.2004)

(e.g., species of commercial value and innovative organic farming) for the overall development of the region and its people.

6.4

Improving indigenous stewardship through gender empowerment

Realizing the close association of women with nature (and its resources) in the entire Himalayan region, women can be further encouraged and adequately trained in increasing the protection of these resources. The world recognized 'Chipko' movement of Uttarakhand, which ultimately had an impact on government policies, also was an initiative led by rural women. For example, Gaura Devi, one of the champions of the cause had the support of her entire community. There are examples that clearly demonstrate that the promotion of participation of women in decision

Box 18a

Community Efforts – Sustaining Soil Fertility by Protecting the Forests

The Apatani tribe of Arunachal Pradesh having sound traditional ecological knowledge (TEK) of forest, land and water management, has highly developed valley cultivation of rice over centuries. Wet rice land agro-ecosystem is dependent upon nutrient flow from the hill slopes. With crop harvest, nutrients are lost. The farmers grow wet rice integrated with fish culture in terraces and finger millet on the risers. To maintain and regulate water supply and nutrients to the field, the surrounding hills are fully covered with forests and protected by the community. The Apatanis under the overall supervision of their village headman have optimized water use along with nutrient use in their rice fields.

Box 18b

Traditional Wisdom – Maintaining Soil Fertility

The Nagaland state produces horticulture crops like passion fruit, banana, ginger, orange, cardamom, French beans, black pepper, turmeric, pineapple, etc. Alder (*Alnus nepalensis*), a multipurpose, nitrogen fixing tree species is maintained along with the crops to enhance soil fertility. The value of alder tree was recognized by the tribal farmers long back and more than 200 years old trees can be seen. Agricultural crops, together with alder trees, form a very remunerative agro-forestry system. Knonome village in Kohima is proud of its alder plantations and alder tree based agriculture. Keeping in view their traditional approach, the state government has launched a programme called Communitisation of Public Institutions and Services.

Source: Envis Bulletin – Himalayan Ecology (2001); Vol 9 (1): 31-36

Box 19

Ensuring Equitable Access to Shifting Cultivation Patches – Strong Traditional Institution in Ukhrul, Manipur

There has been a growing realization and need for re-thinking the practices of shifting cultivation in north eastern region. The researches supported by ICIMOD have found that shifting cultivation, and the farmers' innovations in particular, while maintain agricultural and forest productivity also contribute to forest cover and biodiversity conservation. Commercial niche products and organic farming contribute to economic development. The local institutions developed, by communities that practice shifting cultivation, were found to be relatively strong, by enhancing social security and cultural integrity.

The land tenure system of the Tangkhuls in Ukhrul (Manipur) is a mix of private and community ownership. The traditional institution, known as Hangyu, decides on all matters relating to local governance, including land use, access and control of resources. The Hangyu ensures equitable access of all households to shifting cultivation patches. The tenure system follows a broad framework as in the case of other upland communities.

Source: ICIMOD 2006. Debating shifting cultivation in the Eastern Himalaya

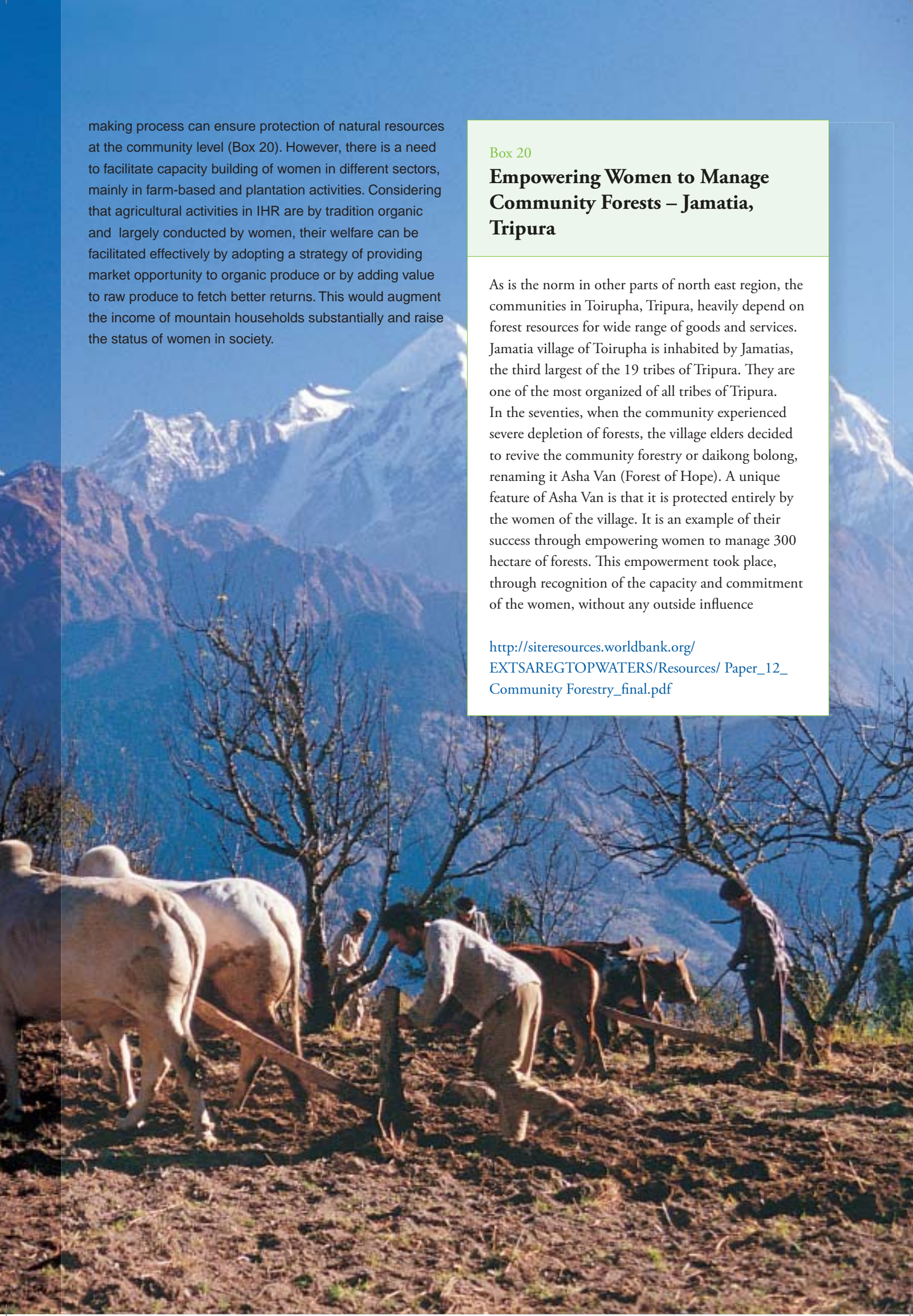
making process can ensure protection of natural resources at the community level (Box 20). However, there is a need to facilitate capacity building of women in different sectors, mainly in farm-based and plantation activities. Considering that agricultural activities in IHR are by tradition organic and largely conducted by women, their welfare can be facilitated effectively by adopting a strategy of providing market opportunity to organic produce or by adding value to raw produce to fetch better returns. This would augment the income of mountain households substantially and raise the status of women in society.

Box 20

Empowering Women to Manage Community Forests – Jamatia, Tripura

As is the norm in other parts of north east region, the communities in Toirupha, Tripura, heavily depend on forest resources for wide range of goods and services. Jamatia village of Toirupha is inhabited by Jamatias, the third largest of the 19 tribes of Tripura. They are one of the most organized of all tribes of Tripura. In the seventies, when the community experienced severe depletion of forests, the village elders decided to revive the community forestry or daikong bolong, renaming it Asha Van (Forest of Hope). A unique feature of Asha Van is that it is protected entirely by the women of the village. It is an example of their success through empowering women to manage 300 hectare of forests. This empowerment took place, through recognition of the capacity and commitment of the women, without any outside influence

http://siteresources.worldbank.org/EXTSAREGTOPWATERS/Resources/Paper_12_Community_Forestry_final.pdf



Monitoring Networks

The Himalayan ecosystem requires careful monitoring in order to develop a scientific basis for ascertaining their evolution and causes thereof. The key areas for monitoring are presented in Box 21.

Among the identified areas under physical systems, the Himalayan Glaciers, on account of their proven sensitivity to climatic perturbations and value of their downstream ecosystem services deserve priority attention (Box 22). Initiatives taken by the Government of India in the context of glacier studies are given in Box 23.

Further, the entire Himalayan region has been described by the IPCC Fourth Assessment (2007) as data deficient, in terms of climate monitoring. It is vital to adequately augment the initiatives for long-term ecological and weather monitoring (Box 24) across the region so as to address the issue of knowledge gaps which is at present considered a serious impediment. Since several other countries in the South Asian region share the Himalayan ecology, appropriate forms of scientific collaboration and exchange of information needs to be strengthened to enhance understanding of ecosystem changes and their effects. A noteworthy transboundary initiative to address the above gap is under active consideration through collaboration of the International Centre for Integrated Mountain Development (ICIMOD) with GBPIHED in India, and key partner institutions in other regional member countries of the Hindu Kush Himalayan Region.

Among the identified critical areas for biological systems, critical habitats deserve special consideration with respect to their responses to changing scenarios. Few attempts by institutions like GBPIHED on critical habitats (e.g., timberline zone) and other organizations, such as studies

Box 21

Key Areas for Monitoring Himalayan Ecosystems

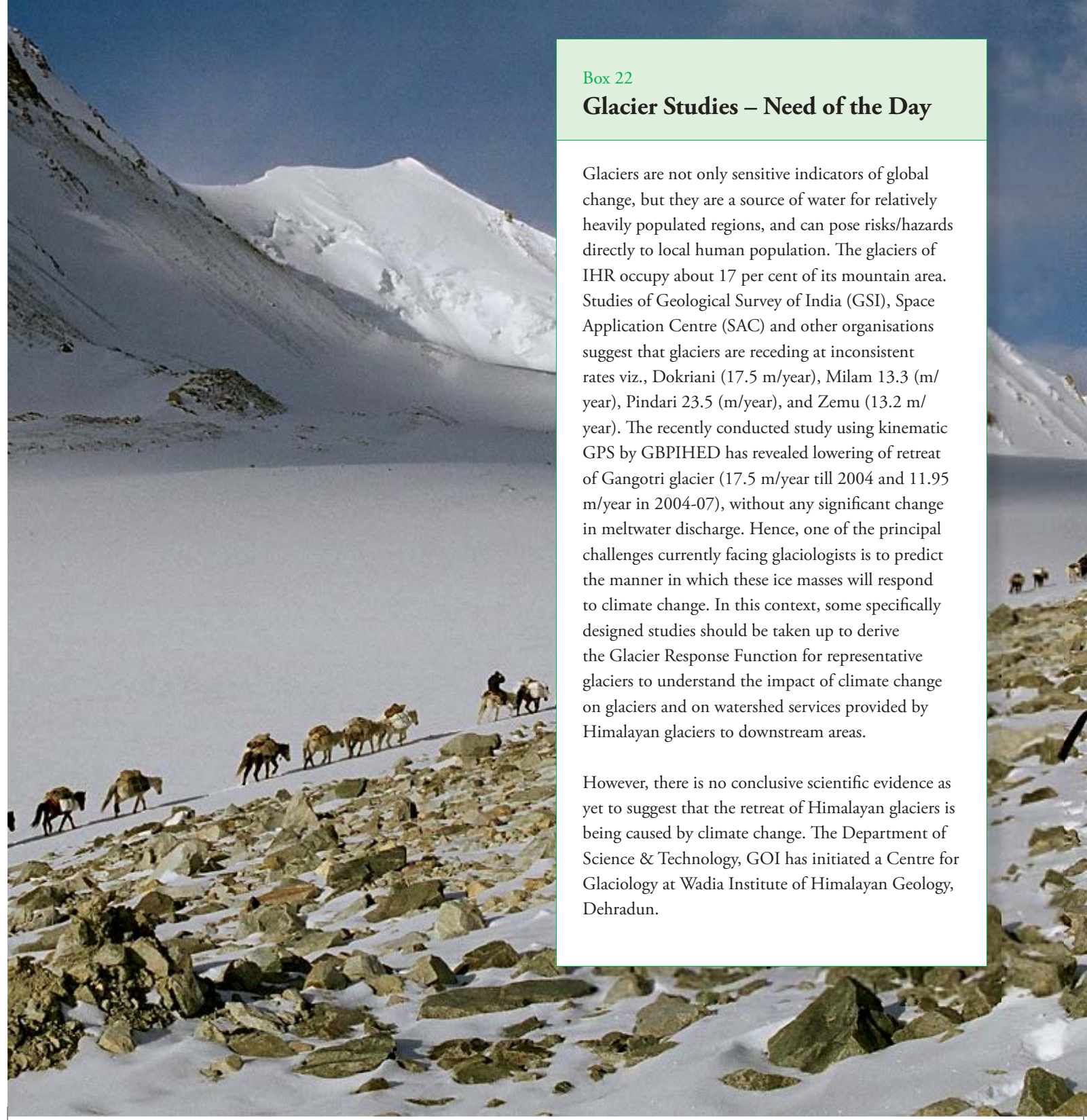
a. Physical systems

- Glaciers (glacial & seasonal snow covers)
- Snowmelt dynamics and its contribution to river water flows
- Water issues (regional water basins to location specific recharge issues)
- Weather and climate trends – relevant datasets (establishment of ‘weather towers’)
- Land degradation, land use land cover changes
- Energy systems (alternate energy and energy efficiency)

b. Biological systems

- Critical habitats (ecotones, wetlands, alpinas, etc.) and species (native, endemic, and economically valuable, etc.)
- Ecosystem structure, diversity, resilience
- Ecosystem functions (including carbon sequestration and water relations)

on alpine pastures by Wildlife Institute of India (WII) may form the base for detecting such responses (Box 25).



Box 22

Glacier Studies – Need of the Day

Glaciers are not only sensitive indicators of global change, but they are a source of water for relatively heavily populated regions, and can pose risks/hazards directly to local human population. The glaciers of IHR occupy about 17 per cent of its mountain area. Studies of Geological Survey of India (GSI), Space Application Centre (SAC) and other organisations suggest that glaciers are receding at inconsistent rates viz., Dokriani (17.5 m/year), Milam 13.3 (m/year), Pindari 23.5 (m/year), and Zemu (13.2 m/year). The recently conducted study using kinematic GPS by GBPIHED has revealed lowering of retreat of Gangotri glacier (17.5 m/year till 2004 and 11.95 m/year in 2004-07), without any significant change in meltwater discharge. Hence, one of the principal challenges currently facing glaciologists is to predict the manner in which these ice masses will respond to climate change. In this context, some specifically designed studies should be taken up to derive the Glacier Response Function for representative glaciers to understand the impact of climate change on glaciers and on watershed services provided by Himalayan glaciers to downstream areas.

However, there is no conclusive scientific evidence as yet to suggest that the retreat of Himalayan glaciers is being caused by climate change. The Department of Science & Technology, GOI has initiated a Centre for Glaciology at Wadia Institute of Himalayan Geology, Dehradun.



Box 23

Monitoring Snow and Glaciers of the Himalaya

In view of the importance of snow and glaciers in the context of water resources, hydrology, environment and the climate change, a project on monitoring of snow and glaciers in the Himalaya was taken up by the Space Applications Centre (SAC), Ahmedabad. It is a joint project of the Ministry of Environment & Forests and Department of Space which aims at: i) Basin wise monitoring of seasonal snow cover of Indian Himalaya (every 5 days) for the year 2004 to 2008 ii) Glacier inventory of the entire Himalayan region on 1,50,000 scale iii) Monitoring of glacier retreat/ advance for the selected glaciers in 14 representative basins of Indian Himalaya, and iv) Monitoring of snow line and mass balance estimation in 10 basins of the Himalaya. The project is being executed by the Space Applications Centre in collaboration with a large number of organizations in the country.

Based on the results obtained and experience gained during the course of the above project, the Ministry of Environment and Forests has decided to continue the work on snow and glacier monitoring in the Himalaya and has suggested that the Space Applications Centre take up this work in collaboration with all the organizations of the country working in this field. Accordingly, the monitoring of seasonal snow cover for the entire Indian Himalaya and monitoring the retreat/ advance of the glaciers in the representative basins will be taken up.

Box 24

Long Term Weather Monitoring Programme

Considering the IHR as data deficit in terms of climatic data, GBPIHED in collaboration with Centre for Mathematical Modelling and Computer Simulation (C-MMACS), Bangalore is initiating a long term weather monitoring programme in IHR. Under this program a series of 32 m high weather towers are proposed to be installed for the monitoring, analysis and modelling of Sustainability and Mitigation over the Himalayan Belt with Reference to Climate Variability.

A network of permanent GPS stations across IHR is also under implementation as a new venture of the GBPIHED.



Box 25

WII Initiatives for Studies on Sensitive Himalayan Wildlife

A considerable part of the existing protected areas (31.5%) and individual wildlife species (16) of the IHR have been covered in various research projects of the Wildlife Institute of India (WII). This gives ample scope to cover different biodiversity rich areas to study highly endangered and endemic species. The WII has also undertaken few projects on different subject matters as a part of its dissertation work. Till date, the topics covered, pertaining to IHR, include the following:

- Shifting cultivation and conservation of tropical forest bird communities in Mizoram.
- Food selection and ranging in hoolock gibbon (*Hylobates hoolock*, Harlan 1834) in Borajan Reserved Forests, Assam.
- Effect of habitat alternation on herpetofauna assemblages of evergreen forest in Mizoram.
- Habitat use by Rhino and other associate ungulates in Kaziranga National Park, Assam.
- Pattern in species composition and distribution among vascular epiphytes in low lying semi-evergreen forests of Arunachal Pradesh.

A proposal was also mooted by WII, and agreed upon, that each north eastern state must have a Wildlife Research and Training Cell within the forests department, to be headed by a senior officer, for developing permanent and viable liaisoning with a similar cell in the WII, on matters related to wildlife research and training needs. While four states (Mizoram, Manipur, Tripura and Meghalaya) have already created the Cell, other states are in the process of doing so. The WII has also drafted one Action Plan on Wildlife Research and Training specifically for the north eastern states, which has been circulated to each state for detailed discussions and finalization regarding identification and prioritization process of specific research and training needs. Most of the states have acted on this draft Action Plan and submitted a list of prioritized research and training issues for future course of action.

http://wiienvs.nic.in/rain_forest/chapter18.htm

Infrastructure Development – Integration of New Approaches

8.1

Ideal Himalayan Habitats

Creation of suitable human habitats under the changing economic and ecological scenario is an important issue in the IHR. The concept of an 'Ideal Himalayan Habitat' needs to be evaluated for its effective implementation, at least in representative sites (Box 26).

8.2

Ecologically safer roads – green roads

It is often argued that roads bring development by providing much needed connectivity and accessibility. As such, the road sector has been given high priority under the Indian Government's Pradhan Mantri Gram Sadak Yojana (PMGSY) to ensure connectivity to each village having a population of 250 or more in the hills. The present techniques used for hill road construction are often damaging to the sensitive Himalayan ecosystem (Box 27). Therefore, there is an urgent need for developing guidelines and bye laws to promote the Green Roads concept in the IHR. The Rural Roads initiative in Nepal is a good example of the successful implementation of the concept in the Himalaya. The broad guidelines for the Green Roads sector in the IHR are presented in the Annexure VI.

8.3

Comprehensive Environmental Impact Assessment of Developmental Projects

The country recognizes Environmental Impact Assessment as an important tool for maintaining ecological equilibrium. The Ministry of Environment and Forests issued the new Environmental Impact Assessment Notification on 14th September, 2006. The provisions of this notification impose certain restrictions and prohibitions on new projects or

Box 26

Ideal Himalayan Habitats

Considering the ecological fragility of the region, the concept of 'Ideal Himalayan Habitats' requires promotion. This would include formulation and implementation of holistic plans. Examples include implementation of Environment Action Plans at the watershed level, to help transform human habitats by catalyzing the innate aspirations of local communities towards greater sustainability and habitat conservation using participatory approaches. Such efforts would also include functional consolidation of land for promotion of natural resources based employment generation in the region. It is felt that the concept of 'Ideal Himalayan Habitats' should be implemented in such a way that it includes adequate representation of regions' cultural diversity and prevailing indigenous knowledge.

activities, or on the expansion or modernization of existing projects or activities based on their potential environmental impacts. Importance of such provisions is particularly relevant while considering the infrastructure development in the sensitive Himalayan ecosystem. Considering a series of developmental activities pertaining to hydropower projects in different basins, there has been a growing realization for undertaking comprehensive EIAs which consider carrying capacity assessment at the basin level. A few initiatives have been taken (Box 28).



Box 27

Impact of Road Construction in IHR: Some Examples

- The construction of 44,000 km road in the Himalaya generates about 2640m³ of debris (*Environmental Regeneration in Himalaya: Concepts and Strategies*. CHEA & Gyanodaya Prakashan, Nainital: 12-38. 1995).
- About 39% of the road bed is affected by rockfall and 38% by slumping, i.e., about 24 debris chutes/km² (*Kumaun Himalaya. Mountain Research and Development*, 9(1): 25-33. 1989).
- At the average rate of 550 m³/km/year, the total landslide debris on Himalayan roads would be of the order of 24 million cubic meter annually (*Environmental Geology: Indian Context T.M.H.*, New Delhi :583p. 1987).
- 72 landslides was reported larger than 10 m³ and total landslide sediment yield of 1105 m³/km along 66km reach of the Mussoorie-Tehri road in 1978 (*Geomorph N.F. sb 51:17-38*).

Box 28

Carrying Capacity Assessment at Basin Level

At the instance of the Ministry of Environment and Forests, Government of India, a study of Carrying Capacity of Teesta basin in Sikkim was conducted to suggest the optimum utilisation of hydropower potential with least environmental damage. The study helped in formulating guidelines for overall development of hydropower in Teesta basin over and above the usual individual project to project based EIAs. The MoEF is keen to make this a standard practice for all river basin areas in the country, especially in the IHR.

While considering the Himalayan Ecosystem, the provisions of the EIA notification now cover all new mining projects and/or expansion and modernization of existing mining projects, irrespective of minerals (i.e., major or minor). This will also help reduce illegal sand stone mining from riverbeds, thereby improving the ecological health of riverine habitats, in the IHR.

The image features a vibrant green background with abstract, darker green curved shapes. On the right side, there is a vertical strip showing a close-up of a dog's head and a person's arm in a blue shirt. The text 'CONCLUSION & OVERARCHING ISSUES' is centered in white, with a small white arrow pointing right from the end of the text.

CONCLUSION & OVERARCHING ISSUES



The sustainability of the IHR will depend on striking a balance between the fragile ecosystem components, namely forest, land & soil, water, and snow, representing the 'green', 'brown', 'blue' and 'white' colours, respectively¹⁴. In the light of best practices of resource management and based on the lessons learned thus far, we have suggested a set of practical guidelines for sustaining Himalayan ecosystem. For implementing this, one needs to visualize a picture of the region which is not only acceptable to those who live in the region, but also to those who live beyond.

The forests that presently occupy 41.5% (FSI, 2005) of the IHR and are the main contributors to the 'green' colour, should not decline but increase through appropriate guidelines and practices for linking its conservation with community initiatives and fiscal incentives for the local inhabitants. Mechanisms such as 'REDD Plus' which India is advocating at international climate change negotiations, and fiscal transfers to 'green' states may be considered for this.

The preservation of the land and soil of the region (representing the so called 'brown' colour) requires operational land conservation and town planning guidelines that will effectively regulate unplanned growth in the name of tourism. The IHR should be considered broader than a commercial tourist destination and should be developed as a major ecotourism centre as well as for pilgrimage and adventure tourism.

Due to the increasing importance of water security (representing the colour 'blue') conservation and protection measures need to be augmented to improve the natural water regimes of the IHR.

The snow and glaciers (representing the 'white') in the context of the Himalayan region, are key contributors to the sustenance of all other colours. Unfortunately, the white is also showing signs of wear and decline, and this is of particular importance in the wake of climate change. Establishment of an effective monitoring network for assessment and prediction of future changes of these vital resources along with conservation measures are urgently needed. The National Mission for Sustaining the Himalayan Ecosystem is a step in this direction.

The people who are born in the IHR continue to remain the primary stakeholders. So, improving awareness and providing knowledge, training and skills to these primary stakeholders, and developing appropriate policy and infrastructure for them, for sustainable harnessing of natural resources and broader socioeconomic development become indispensable.

This publication has attempted to suggest operational guidelines that should help restrict (and reduce) adverse effects on the sensitive ecosystem of the IHR, and maintain a critical dynamic equilibrium among key resources of the IHR, that are referred to as the 'green', 'brown', 'blue' and 'white' components.¹⁴

¹⁴ Draft Report on Comprehensive Development of Hill States & Hill areas (Indian Himalayan Region), prepared by GBPIHED for the Task force of Planning Commission, GOI (2009).

Bibliography (*Not necessarily cited in the text*)

- Agrawal, D.K., Krishna, A.P., Joshi, V., Kumar, K. and Palni, L.M.S. (Eds.) (1997). Perspectives of Mountain Risk Engineering in the Himalayan Region. Gyanodaya Prakashan, Nainital, India.
- Anonymous (1992). Action Plan for Himalaya. G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora.
- Anonymous (2003). National Policy for Integrated Development in the Himalayas. Planning Commission, Government of India, New Delhi.
- Anonymous (2004). Guidelines for Mountaineering Expedition in Uttaranchal. Govt. of Uttaranchal, Dehradun.
- Anonymous (2005). State of Forest Report 2005. Forest Survey of India, Dehradun.
- Anonymous (2006). National Environment Policy. Ministry of Environment & Forests, GOI, New Delhi.
- Anonymous (2006). Report of the Task Force on The Mountain Ecosystems [Environment and Forest Sector] for Eleventh Five Year Plan. Planning Commission, GOI, New Delhi.
- Anonymous (2006). Debating Shifting Cultivation in the Eastern Himalayas: Farmers' Innovations as Lessons for Policy. (Compiled -Kerkhoff, E. & Sharma), ICIMOD, Kathmandu, Nepal.
- Anonymous (2008). National Action Plan on Climate Change. Prime Ministers' Council on Climate Change, GOI, New Delhi.
- Anonymous (2009). Mountain Biodiversity and Climate Change. ICIMOD, Kathmandu, Nepal.
- Bandyopadhyay, J. and Gyawali, D. (1994). Himalayan water resources: Ecological and political aspects of management. Mount. Res. and Dev., 14(1): 1-24.
- Becker, A. and Bugmann, H. (2001). Global change and mountain regions. The Mountain Research Institute Initiative. IGBP Secretariat, the Royal Swedish Academy of Sciences, Sweden.
- Campbell, B.D. and Stafford Smith, B.D. (2000). A Synthesis of recent global change research on pasture and rangeland production: Reduced uncertainties and their management Implications. Agri. Eco. and Env., 82: 39-55.
- Haigh, M.J. (1984). Landslide prediction and highway maintenance in the lesser Himalaya, India. J. Geomorph N.F., (51):17-38.
- Haigh, M.J., Rawat, J.S. and Bartarya, S.K. (1989). Environmental indicators of landslide activity along the Kilbury road, Nainital, Kumaun Himalaya. Mount. Res. and Dev., 9(1): 25-33.
- Ives, J.D and Messerli, B. (1989). The Himalayan Dilemma: Reconciling Development and Conservation. Routledge, London, U.K.
- Jodha, N. S. (2000). Globalization and fragile mountain environment: Policy challenges and choices. Mount. Res. and Dev., 20(4): 296-299.
- Jodha, N.S. (2005). Adaptation strategies against growing environmental and social vulnerabilities in mountain areas. Himal. J. Sci., 3(5): 33-42.
- Joshi, R. and Dhyani, P.P. (2009). Environmental sustainability and tourism-implications trend synergies of tourism in Sikkim Himalaya. Curr. Sci., 94 (2): 258-261.
- Kishwan, J., Pandey, R. and Dadwal, V.K. (2009). India's Forest and Tree Cover: Contribution as a Carbon Sink. Technical Paper, ICFRE, Dehradun.
- Khoshoo, T.N. (1992). 2nd Pt. Govind Ballabh Pant Memorial Lecture. Plant Diversity in the Himalaya: Conservation and Utilization. GBPIHED, Kosi-Katarmal, Almora.
- Kumar, K., Dhyani, P.P. and Palni, L.M.S. (Eds.) (1996). Land Utilization in the Central Himalaya: Problems and Management Options. Indus Publishing Co., New Delhi.
- Kumar, K., Dumka, R. K., Miral, M. S. and Satyal, G. S. (2008). Estimation of retreat rate of Gangotri glacier using rapid static and kinematic GPS survey. Curr. Sci., 94 (2): 258-261.
- Kumar, K., Miral, M.S., Joshi, V. and Panda, Y.S. (2002). Discharge and suspended sediment in the meltwater of Gangotri glacier, Garhwal Himalaya, India. Hydro. Sci., 47 (4): 611-620.
- Kuniyal, J.C. (2008). Solid waste management in Himalayan hill spots: A case study of Kullu-Manali in Himachal Pradesh, India. In: Urban Environment Management, B.R.Publishing Corporation, Delhi, pp. 170-185.
- Maharana, I., Rai, S.C. and Sharma, E. (2000). Valuing ecotourism in a sacred lake of Sikkim Himalaya, India. Env. Cons., 27: 269-277.
- Messerli, B. and Ives, J.D. (Eds.) (2004). Mountains of the World: A Global Priority. Parthenon Publishing Group, New York and London.
- Messerli, B. (2009). Biodiversity, environmental change and regional cooperation in the Hindu-Kush Himalayas. In: Biodiversity and Climate Change. ICIMOD, Kathmandu, Nepal. pp.3-6.
- Nandy, S.N., Dhyani, P.P. and Samal, P.K. (2006). Resource Information Database of the Indian Himalaya. GBPIHED, Kosi-Katarmal, Almora.
- Negi, G.C.S. and Joshi, V. (2002). Drinking water issues and hydrology of springs in a mountain watershed in Indian Himalaya. Mount. Res. and Dev., 22(1): 28-31.

- Negi, G.C.S., Joshi, V. and Kumar, K. (1998). Spring sanctuary development to meet household water demand in the mountains: A call for action. In: *Research for Mountain Development: Some initiatives and Accomplishments*. Gyanodaya Prakashan, Nainital, pp. 25-48.
- Rai, S.C. and Sundriyal, R.C. (1997). Tourism and biodiversity conservation: the Sikkim Himalaya. *Ambio*, 26(4): 235-242.
- Rai, S.C., Sharma, E., Lepcha R. and Sundriyal, R.C. (1998). Tourism development in Sikkim. In: *Sikkim: Perspectives for Planning and Development* (S.C. Rai, R.C. Sundriyal and E. Sharma, Eds), Bishen Singh Mahendra Pal Singh, Dehra Dun, pp. 697-712.
- Rai, S.C., Lepcha, R. and Sharma, E. (1998). Ecotourism: A strategy for conservation and development. In: *Research for Mountain Development: Some Initiatives and Accomplishments*, Gyanodaya Prakashan, Nainital. pp. 195-214.
- Raina, V.K. and Srivastava, D. (2008). *Glacier Atlas of India*. Geological Survey of India, Bangalore.
- Ramakrishnan, P.S. and Saxena, K.G. (2006). *Shifting Agriculture and Sustainable Development of North-Eastern India: Tradition in Transition*. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
- Ramakrishnan, P.S. (2009). Linking traditional ecological knowledge systems with modern approaches. In: *Biodiversity and Climate Change*. ICIMOD, Kathmandu, Nepal. pp.16-18.
- Rao, R.R. (1994). *Biodiversity in India (Floristic Aspects)*. Bishen Singh Mahendra Pal Singh, Dehradun.
- Rawal, R.S. and Dhar, U. (1997). Sensitivity of timberline flora in Kumaun Himalaya, India: Conservation implications. *Arct. and Alp. Res.*, 29:112-121.
- Rawal, R.S. and Dhar, U. (2001). Protected area network in Indian Himalayan region: Need for recognizing values of low profile protected areas. *Curr. Sci.*, 81 (2):175 – 184.
- Rees, G.H. and Collins, D.N. (2006). Regional differences in response of flow in glacier-fed Himalayan rivers to climate warming. *Hydro. Proc.*, 20: 2157-2167.
- Samant, S.S. , Dhar, U. and Palni, L.M.S. (1998). *Medicinal plants of Indian Himalaya: Diversity, Distribution, Potential Value*. Gyanodaya Prakashan, Nainital.
- Samal, P.K., Palni, L.M.S. and Agrawal, D.K. (2003). Ecology, ecological poverty and sustainable development in Central Himalayan region of India. *Int. J. Sustain. Dev. World. Ecol.*, 10:157-168.
- Sharma, E., Chettri, N. and Kerkhoff, E. (2005). Opportunities for income through biodiversity conservation. *ICIMOD Newsletter*, 48: 9-11.
- Singh, J.S. (2006). Sustainable development of Indian Himalayan Region: linking ecological and economic concerns. *Curr. Sci.*, 90:784-788.
- Singh J.S. and Singh, S.P. (1992). *Forests of Himalaya- Structure, Functioning and Impact of Man*. Gyanodaya Prakashan, Nainital.
- Singh, P. and Bengtsson, L. (2005). Impact of warmer climate on melt and evaporation for the rainfed, snowfed and glacierfed basins in the Himalayan region, *J. Hydrol.*, 300: 140-154.
- Singh, S.P. (2002). Balancing the approaches of environmental conservation by considering ecosystem conservation as well as biodiversity. *Curr. Sci.*, 82:1331-1335.
- Srivastava, D. (2003). Recession of Gangotri glacier. In: Srivastava, D., Gupta, K.R., Mukerji, S.(Eds). *Special Publication No. 80*. Geological Survey of India, Kolkata, pp. 21-32.
- Tiwari, B.K. (2005). Shifting agriculture in north-eastern India: some insights in spatiotemporal patterns and processes. Paper presented in workshop on “Shifting Agriculture, Environmental Conservation and Sustainable Livelihoods of Marginal Mountain Societies”, 6-10 October 2005, NIRD, Guwahati.
- Valdiya, K.S. (1985). Accelerated erosion and landslides prone zone in the Central Himalayan region. In: J. S. Singh (Ed), *Environmental Regeneration in Himalaya: Concepts and Strategies*. CHEA & Gyanodaya Prakashan, Nainital, pp. 12-38.
- Valdiya, K.S. (1987). *Environmental Geology: Indian Context*. T.M.H., New Delhi.
- Valdiya, K.S. and Bartarya, S.K. (1991). Hydrological studies of springs in the catchment of Gaula river, Kumaun lesser Himalaya, India. *Mount. Res. and Dev.*, 11(3):239-258.
- Vedwan, N. and Rhoades, R.E. (2001). Climate change in Western Himalayas of India: A study of local perception and response. *Climate Res.*, (19): 109-117.
- Zobel, D.B. and Singh, S.P. (1997). Himalayan forests and ecological generalizations. *BioScience*, 47:735–745.
- Zomer, R. (2009). Acknowledging the contribution of mountain communities – investing in the future. In: *Biodiversity and Climate Change*. ICIMOD, Kathmandu, Nepal. pp.19-21.

Solid Waste Management

- Guidelines/prescriptions disallowing indiscriminate disposal of garbage, particularly the non-degradable waste, caused by accumulation of plastic bottles and polythene bags in hill towns in the Himalaya should be immediately put in place.
- Good quality potable water may be made available at various locations in hill towns so that people can fill their bottles, on payment basis.
- Preventive and management steps for solid waste management need to be initiated at the point of origin itself, i.e., households in the urban/rural localities, trekking routes and camps, and expedition tops.
- Documentation about the varying composition of waste from the hill towns to expedition tops is essential. The nature and extent of solid waste will enable identification of the source(s).
- Techniques such as conversion of biodegradable waste into biocompost, or vermicompost should be promoted in place of land filling, open dumping or burning.
- The four 'R's principle' should be applied for waste management problem: Refuse waste prone commodities, Reuse discarded commodities for other uses, Reduce through segregation into broad categories—biodegradable and non-biodegradable at household/ individual level, and Re-manufacturing once fully used or completely unusable commodities/items from factories such as ruptured plastic into plastic noodles for new products. Such practices would also help generate income.
- Awareness and capacity building of the stakeholders like urban/rural dwellers, municipalities, tourists, trekkers, expedition members in promoting the suggested management plan in a particular geographic region would greatly help in managing the waste in the IHR.

Hill Town Planning and Architectural Norms

- Fragmentation of habitat in hill areas should be prevented. The habitats in hill/mountain areas should be consolidated in order to avoid demands for creation of additional infrastructure.
- Specific areas for rural/urban development should be designated beyond which construction may not be permitted.
- No construction should be undertaken in areas having slope above 30° on areas which fall in hazard zones or areas falling on the spring lines and first order streams identified by the State Governments on the basis of available scientific evidence.
- Construction should be permitted in areas with slope between 10° to 30° or spring recharge areas or old landslide zones with such restrictions as competent local authority may decide.
- Architectural and aesthetic norms for construction of buildings in mountain/hill areas should be enforced.
- Tourist resorts, commercial complexes and institutional buildings should be located in areas with surplus water and electricity so as not to affect the rights of existing users without their prior consultation.
- Where cutting in an area causes ecological damage and slope instability in adjacent areas, such cuttings shall not be undertaken unless appropriate measures are taken to avoid such damages.
- An integrated development plan may be prepared taking into consideration environmental and other relevant factors including ecologically sensitive areas, hazard zones, drainage channels, steep slopes and fertile lands. Areas rich in ground water may not be diverted for construction activities.
- In highly seismic areas like Himalaya, all construction should incorporate earthquake resistant features as prescribed in building codes, guidelines, manuals and other bye-laws.
- Location-specific technologies should be deployed for construction of buildings (including use of hollow blocks for better insulation of buildings, and making use of passive solar heating (e.g., in extreme cold areas like Leh in Laddakh).
- Regulation of sale/purchase of land and residential/commercial buildings may be considered in order to prevent violation of land use planning norms.
- "Green roads" having channels for collection of water for irrigation purposes should be made a part of the construction norm.

Annexure III

Regulating Tourists and Pilgrimage to Sensitive Areas

- Pilgrimage tourism in the Himalaya requires both development and regulation so as to reduce congestion and resultant pollution.
- The accommodation and road transport infrastructure needs to be developed in pilgrimage sites. Existing accommodation in the pilgrimage sites needs to be improved with adequate amenities and facilities throughout the region wherever it has potential.
- All existing sites should have adequate provision of garbage disposal and management.
- Sacred groves in the Himalaya, particularly the NE region, have been proving to be the best means of conservation for natural resources such as forests; emphasis should thus be placed on spreading the idea in other parts of Himalaya with a provision for the villagers for some earnings from the visitors.
- An inventory of historical, sensitive and sacred sites including sacred groves should be prepared and their vulnerability should be assessed.
- The number of tourists to vulnerable sites should be regulated and limited, e.g., Gangotri glacier.
- The pilgrimage tourism is a kind of “economy class” tourism in the Indian Himalayan Region since most pilgrims generally belong to middle income group and prefer to stay in Dharamshalas and moderately priced accommodation. Suitable accommodation and other facilities need to be made available accordingly. This will also help in identifying carrying capacity of the area in accommodating the inflow of tourists.
- The access to such (and other) sites of incomparable value through vehicles needs to be restricted beyond a certain zone.

Annexure IV

Promoting Ecotourism and Regulation of Commercial Tourism

- 5-Star approach in respect of hospitality industry should be replaced by homestead approach to promote mountain tourism.
- Eco-tourism villages, parks, sanctuaries and other areas should be identified to establish a primary base for ecotourism.
- Village communities, especially youths, and rural women should be involved in Ecotourism.
- Restriction should be placed in terms of visitors per day/ per group to the eco-tourist sites in order to minimise adverse impact and maintain the sustainability of the eco-tourist destination.
- Economic instruments and product diversification can also be used for regulation of tourist numbers.
- Restrictions on the entry of vehicles should be imposed in sensitive ecological sites.
- Fund raised should be used for basic resources, eco-tourism element conservation, and education and awareness campaigns for visitor/ host community sensitization.
- Incentive structures should be developed by according specific roles to the locals in management of tourism and allied industries. Their capacity building in different segments of the enterprise should be built so that they feel involved and react in a responsible manner.
- Local art, crafts, cuisines, and dishes should be promoted and made an integral part of tourist experience in order to ensure that most benefits go to locals and, at the same time, their cultural integrity/ entity is not lost in the face of acculturation and cultural drift.
- It should be mandatory for expedition to remove and take out the garbage, refuse and particularly the non-degradable materials. Expeditions should be asked to leave a deposit as security with an appropriate authority to ensure that the regulation is met.
- It should be mandatory for all trekking parties to demonstrably have sufficient kerosene/gas fuel for their entire need. Penalties on the use of wood should be imposed.
- Best practices on commercial trekking should be imposed on a mandatory basis in consultation with institutions having the necessary expertise and Government approval.
- Interactive websites relating to mountain access, trails, availability of facilities should be set up which should also provide the facility of online request, approval for visit to parks, restricted sites and payment of fees, etc.
- Creation of log/bamboo huts should be promoted in busy mountain areas.

Rejuvenation of Springs and Degraded Sites

- Special attention should be paid to recharge of ground water and improvement of hydrology and quality of mountain lakes/wetlands through restoration of forests.
- Detailed geological mapping should be conducted to identify the spring recharge zone and locate structures such as, joints, faults, shear zone fractures and cleavage, etc.
- Nuclear water prospecting technologies available with National Institute of Hydrology and Bhabha Atomic Research Centre (BARC) should be used to map the water sources and prevent the construction activities in such locations that could damage or adversely affect such sources.
- There should be engineering measures to protect recharge zone from biotic interferences, such as grazing, felling of trees and cutting of grasses and other vegetation, mining, wildfire, etc. in the form of barbed wire/stone wall fencing.
- Social fencing measures, e.g. (i) digging shallow infiltration trenches (1-1.5 ft. deep) along contours and small percolation ditches on sites showing open joints, fractured or sheared rocks and providing stone gravel mulch in these trenches to reduce evaporation losses and soil erosion; (ii) construction of stone-mud check dams in gullies to store rainwater and check soil erosion; and (iii) land levelling, maintenance of crop field bunds to allow stagnation of rainwater should be enhanced.
- Vegetative measures include clothing the recharge zone with grasses, shrubs and broadleaf trees at suitable distances with the aim to enhance rainwater infiltration and reduce rainwater runoff. The selection of plants should be made from the local flora after consultation with the local people. Shallow-rooted plants are most desirable for this purpose. Leaf litter and weed mulching at barren spots would induce rainwater infiltration and reduce evaporation loss of soil moisture.
- Involvement of stakeholder community should be ensured at every step of the Spring Sanctuary Development. The maintenance and aftercare of the interventions have to be ensured through their involvement.

Rain Water Harvesting

- All buildings to be constructed in future in urban areas should have provision for roof-top rain water harvesting commensurate with its plinth area with minimum capacity of 5 KL for plinth area above 200 sq. m., 2 KL for plinth area of 200 sq. m. or below in case of residential buildings and minimum capacity of 0.01 cum per sq. m. of plinth area in case of commercial and institutional buildings such as tourist complexes, hotels, shopping complexes and Government buildings.
- Minimum standards for commercial and institutional buildings shall also apply to such buildings in areas not covered within the limits of urban areas.
- Where minimum standards have already been laid down by the State Government such standards shall take precedence;
- The institutional and commercial buildings should not draw water from existing water supply schemes which adversely affect water supply to local villages or settlements.
- In rural areas rain water harvesting should be undertaken through such structures as percolation tanks, storage tanks and any other means.
- Spring sanctuary development should be undertaken in the spring recharge zones to augment spring water discharge.
- Rain water collected through storm water drains should be used to clean the waste disposal drains and sewers.
- Ground water aquifer recharge structures should be constructed wherever such structures do not lead to slope instabilities.

Ecologically Safer Roads

- For construction of any road in the Himalayan region of more than 5 km (including extension/widening of existing roads) length where the same may not be tarred roads and environmental impact assessment is otherwise not required, environmental impact assessment should be carried out in accordance with the instructions to be issued for this purpose by the State Governments.
- Provision should be made in the design of the road for treatment of hill slope instabilities resulting from road cutting, cross drainage works and culverts using bio-engineering and other appropriate techniques by including the cost of such measures in the cost estimate of the proposed road.
- Provisions should also be made for disposal of debris from construction sites in appropriate manner at suitable and identified locations so as not to affect the ecology of the area adversely; further, the dumped material should be treated using bio-engineering and other appropriate techniques and the cost of such measures should be included in the cost estimate of the proposed road.
- Wherever hot mix plants are used, they should be set up at least 2 km away from settlements and a minimum area of 200 sq. m. surrounding the site should be devoid of vegetation.
- No stone quarrying should be carried out without proper management and treatment plan including rehabilitation plan and financial provision for rehabilitation of the site should be included in the cost of the management plan.
- All hill roads should be provided with adequate number of road side drains and these drains shall be kept free from blockage for runoff disposal; in the event that this is not done and this fact leads to damages that could otherwise have been prevented, the persons responsible should be liable for prosecution/damages; further, the cross drains shall be treated suitably using bio-engineering and other appropriate technologies so as to minimise slope instability.
- The runoff from the road side drains should be connected with the natural drainage system in the area.
- Fault zones and historically land slide prone zones should be avoided during alignment of a road, where for any reason it is not possible to do so, notice should be given providing full justification and the construction should be carried out only after sufficient measures have been taken to minimize the associated risks.
- Notice should be given about all fault zones and land slide zones along the roads indicating the beginning and the end of such areas.
- Ridge alignment should be preferred to valley alignment.
- Alignment should be selected so as to minimise loss of vegetal cover.
- South or South-west alignment should be preferred to avoid moist areas.
- Appropriate design standards should be followed while designing the roads including mass balancing of cut and fill and avoidance of unnecessary cutting.
- Encouragement should be provided for use of debris material for local development.

List of Selected Institutions in the IHR**S.N. Institution**

- 1 Forest Research Institute (FRI), Dehradun
- 2 Himalayan Forest Research Institute (HFRI), Shimla
- 3 Rain Forest Research Institute (RFRI), Jorhat
- 4 Central Soil & Water Conservation Research & Training Institute (CSWCRTI), Dehradun
- 5 Botanical Survey of India, (BSI), Kolkata
- 6 Forest Survey of India (FSI), Dehradun
- 7 G.B. Pant Institute of Himalayan Environment & Development, (GBPIHED) Almora
- 8 Wildlife Institute of India (WII), Dehradun
- 9 Zoological Survey of India (ZSI), Kolkata
- 10 State Forest Research Institute, Itanagar
- 11 Central Institute of Temperate Horticulture (CITH), Srinagar
- 12 Central Potato Research Institute (CPRI), Shimla
- 13 Vivekanand Parvatiya Krishi Anusandhan Sansthan (VPKAS), Almora
- 14 National Research Centre for Mithun (NRCM), Jharnapani
- 15 National Research Centre for Yak (NRCY), Dirang
- 16 National Research Centre for Orchids (NRCO), East Sikkim
- 17 National Research Centre for Mushroom (NRCM), Solan
- 18 National Research Centre on Coldwater Fisheries (NRCCWF), Bhimtal
- 19 National Bureau of Plant & Genetic Resources (NBPGR), Delhi
- 20 Regional Research Laboratory, Jammu, Jorhat, Itanagar
- 21 National Botanical Research Institute (NBRI), Lucknow
- 22 Institute of Bioresources & Sustainable Development, Imphal
- 23 Institute of Himalayan Bioresources and Technology (IHBT), Palampur
- 24 Wadia Institute of Himalayan Geology (WIHG), Dehradun
- 25 Indian Institute of Remote Sensing (IIRS), Dehradun
- 26 Geological Survey of India (GSI), Kolkata
- 27 High Altitude Plant Physiology Research Centre, (HAPPRC), Srinagar (Garhwal)
- 28 Indian Institute of Technology, Roorkee
- 29 Defence Research Development Organisation (DRDO)
- 30 Snow and Avalanche Study Establishment (SASE), Manali
- 31 North East Region Institute for Water & Land Management (NERIWALM), Tezpur
- 32 The Energy Research Institute (TERI), New Delhi
- 33 World Wide Fund for Nature
- 34 Ashoka Trust for Research on Environment & Ecology (ATREE), Bangalore
- 35 North Eastern Region Community Resource Management Society (NERCRMS), Shillong
- 36 The Missing Link
- 37 CHIRAG, Nainital
- 38 MRDS, Shillong

Focus	Geographical Coverage	Remarks
Forest Resources	NW India	ICFRE (MoEF)
Forest Resources	NW Himalaya	ICFRE (MoEF)
Forest Resources	NEI	ICFRE (MoEF)
Soil & Water Conservation	IHR	ICAR
Plant resources	All India Regional offices in IHR	MoEF
Forest resources	All India	MoEF
Himalayan Environment and Development	IHR -5 Units in IHR	MoEF
Wildlife management, PA management, Conservation	IHR	MoEF
Animal resources	All India Regional offices for mountain areas	MoEF
Forest Resources	Arunachal Pradesh	Arunachal Pradesh
Horticulture	IHR	ICAR
IHR	ICAR	
Agriculture	IHR	ICAR
Mithun	NEI	ICAR
Yaks	EH	ICAR
Orchids	EH	ICAR
Mushroom	All India	ICAR
Coldwater fisheries	IHR	ICAR
Plant resources	All India, Centers in IHR	ICAR
Bioresources Utilization Development	J&K Himalayas	ICAR
Plant Resources	All India	CSIR
Biological resources	NEI	CSIR
Biotechnological applications bioresources Himalayas	Indian Himalayan Region	CSIR
Himalayan Geology	IHR Unit in AP	CSIR
Remote Sensing (all resources)	All India - Significant work in IHR	NRSA
Geological resources, hazards	All India coverage in IHR	
Plant resources, particularly high altitude MAPs and NTFPs	Indian Himalayan Region	Garhwal University
Hydropower, Seismic-proof Housing, Mountain Hazards	All India Focus on Mountain	Autonomous
High Altitude crop and vegetables	IHR	MoD
Avalanche control measures	WH	MoD
Land and Water resources	NEI	
Energy Resource Management	All India covering IHR	NGO
Nature Conservation, Threatened Species, Wetlands	All India Centers in IHR	NGO
Ecology & Conservation	All India, NEI	NGO
Resource management & Poverty alleviation in uplands	NEI; 6 districts, 800 villages	NGO
	Assam	NGO
	UA	NGO
	Meghalaya	NGO

Appendix I contd.

List of 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
- Dibrugarh University, Dibrugarh
- GB Pant University of Agriculture & Technology, Pantnagar
- H.N.B. Garhwal University, Srinagar (Garhwal)
- Kumaun University, Nainital
- Y.S. Parmar University of Horticulture & Forestry, Solan
- Himachal Pradesh University, Shimla
- Sher-e-Kashmir Agricultural University, Srinagar
- Kashmir University, Srinagar
- Jammu University, Jammu

Source: Report of the Task Force on the Mountain Ecosystems (Environment & Forest Sector) for Eleventh Five Year Plan, Planning Commission, GOI, 2006



G.B. Pant Institute of Himalayan Environment & Development

G.B. Pant Institute of Himalayan Environment and Development (GBPIHED) was established in 1988-89, during the birth centenary year of Bharat Ratna Pt. Govind Ballabh Pant, as an autonomous Institute of the Ministry of Environment and Forests (MoEF), Govt. of India. The Institute has been identified as a focal agency to advance scientific knowledge, to evolve integrated management strategies, demonstrate their efficacy for conservation of natural resources, and to ensure environmentally sound management in the entire Indian Himalayan Region (IHR). The Institute has headquarters at Kosi-Katarmal, Almora (Uttarakhand) and four regional units, namely, Himachal Unit at Mohal (Kullu, HP), Garhwal Unit at Srinagar (Garhwal, Uttarakhand), Sikkim Unit at Pangthang (Sikkim) and North East Unit at Itanagar (Arunachal Pradesh).





For further details, please contact:

Shri Hem Pande, IAS
Joint Secretary, GOI
Ministry of Environment & Forests
Paryavaran Bhawan, CGO Complex
Lodhi Road, New Delhi -110 003

Tel: 011-24362551
Fax: 011-24360894
email: hempande@nic.in

Dr. L.M.S. Palni, FNASc
Director
G. B. Pant Institute of Himalayan Environment & Development
Kosi-Katarmal
Almora - 263 643 (Uttarakhand)

Tel: 05962-241015
Fax: 05962-241014
email: psdir@gbpihed.nic.in

Photo credits :

Alex Treadway, Ravindra Joshi, Abhay Bahuguna, Balwant Rawat, Anup Sah, Sanjay Nainwal, Chewang Motup, Stanzin Tsethal, DS Negi, Akshay Shah, Jogendra Bisht, Shailza Daramwal