Governance
for Sustaining
Himalayan Ecosystem

G-SHE
AN UPDATED VERSION

Ministry of Environment, Forest and Climate Change (MoEF&CC)
Government of India

G.B. Pant National Institute of Himalayan Environment and Sustainable Development (GBPNIHESD)
Kosi-Katarmal, Almora 263 643 (Uttarakhand)

This document of G-SHE series is an outcome of rounds of consultations with diverse stakeholders of Indian Himalayan Region (IHR). Being an evolving document, the GSHE editions are enriched and updated periodically based on the suggestions and inputs received from the State Governments of IHR, the academic/ research institutions and individuals on various governance themes of topical interests. The G-SHE drafts and publications are uploaded on websites of 'Ministry of Environment, Forest and Climate Change, Govt of India' (www.envfor.nic.in) and 'G. B. Pant National Institute of Himalayan Environment and Sustainable Development' (http://gbpihed.gov.in) for wider readership, consultations, and suggestions for upcoming versions.

Abbreviations used

ACWADAM	Avanced Center for Water Resources Development and Management		JFM	Joint Forest Management
			JFMC	Joint Forest Management Committee
CAMPA	Compensatory Afforestation Management and Planning Authority		JNNURUM	Jawaharlal Nehru National Urban Renewal Mission
CBD	Convention on Biological Diversity		MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
CBDM	Community Based Disaster Management			
CBDRM	Community Based Disaster Risk Management		MNRE	Ministry of New and Renewable Energy
CBET	Community Based Eco-tourism		MoEF	Ministry of Environment & Forests
CCA	Community Conserved Area		MoEF&CC	Ministry of Environment, Forest & Climate Change
CDM	Clean Development Mechanism			
CFL	Compact Fluorescent Lamp		NAP	National Afforestation Programme
CHIRAG	Central Himalayan Rural Action Group		NAPCC	National Action Plan on Climate Change
C-MMACS	Centre for Mathematical Modeling and Computer Simulation		NDMA	National Disaster Management Authority
			NEP	National Environment Policy
COP	Confrence of the Parties		NGO	Non-governmental Organization
CPCB	Central Pollution Control Board		NGT	National Green Tribunal
CSE	Centre for Science & Environmental		NMHS	National Mission of Himalayan Studies
DDMA	District Disaster Management Authority		NMSHE	National Mission for Sustaining the Himalayan Ecosystem
DoS	Department of Space			
DRR	Disaster Risk Reduction		PAMC	Programme Advisory & Monitoring Committee
DSS	Decision Support system		PES	Payment for Ecosystem Services
DST	Department of Science and Technology		PSI	People's Science Institute
EEAT	Environmental Education, Awareness and Training		PWRD	Public Works (Roads) Department
			RBH	Rural Business Hubs
FDA	Forest Development Agency		RET	Rare, Endangered and Threatened
GBPIHED	G. B. Pant Institute of Himalayan Environment & Development		SAC	Space Application Centre
			SAPCC	State Action Plan on Climate Change
GBPNIHESD	G. B. Pant National Institute of Himalayan Environment & Sustainable Development		SBM	Swatch Bharat Mission
			SCM	Smart City Mission
GHG	Green House Gas		SDC	Swiss Agency for Development & Cooperation
HEP	Hydro Electric Project		SDMA	State Disaster Management Authority
HICAP	Himalayan Climate Change Adaptation Programme		SEBS	Science Express: Biodiversity Special
			SFDA	State Forest Development Agency
HIMURJA	Himachal Pradesh Energy Development Agency		SWEET	Sloping Watershed Environmental Engineering Technology
HPKCCC	Himachal Pradesh State Knowledge Cell on Climate Change			
			SWM	Solid Waste Management
HGP	Himalayan Glaciology Programme		TAAS	Travel Agents Association of Sikkim
ICCA	Indigenous and Community Conservation Areas		UNESCO	United Nations Educational, Scientific and Cultural Organization
ICIMOD	International Centre for Integrated Mountain Development			
			UNDP	United Nations Development Programme
IEC	Information Education and Communication		UPCL	Uttarakhand Power Corporation Limited
IHCAP	Indian Himalayas Climate Adaptation Programme		UPFR	Uttarakhand Panchayati Forest Rules
IHMP	Integrated Himalayan Meteorology Programme		VEAP	Village Environment Action Plan
IHR	Indian Himalayan Region		VPMC	Van Panchayat Management Committee
IMD	India Meteorological Department		WWF	World Wide Fund for Nature
IPCC	Intergovernmental Panel on Climate Change			
IUCN	International Union for Conservation of Nature			

Contents

From the Minister's Desk

Himalaya, also known as the Abode of Gods, is the pride of India. Besides it mythological significance, the Himalayan environment is very much important for its value as the Water Tower of Asia, climate regulator, and a wide range of eco-system services that it provides to its inhabitants, dependent economies and societies in the North India. It is a unique ecosystem characterized distinctly due to its rich repository of biodiversity and colourful shades of landscapes and cultures. The Himalayan rivers have supported the growth of settlements and contributed to the economic development of the areas along their course. The shrines and natural aesthetics of the Himalaya attract a large number of tourists to the region, the peace, tranquility, and environmental quality make the Himalaya an ideal place for yoga, meditation, and spiritual pursuits. The Himalaya, therefore, is important for us for its strategic values, mythological significance, ecosystem service flows, economic development, and hence for the well-being of the people and the nation.

The conservation and development in Himalaya have several conflicting issues associated with its environmental fragility, remoteness, inaccessibility, etc., hill specificities which either way involve compromises with people's aspirations and environmental trade-offs with inter/intra-generational and trans-regional implications. The development in Himalaya, therefore, requires a balanced approach, indicating towards the need for and efficient environmental governance.

This issue of updated G-SHE, prepared by the MoEF&CC and G.B. Pant National Institute of Himalayan Environment and Sustainable Development, is a compendium of several policies and practices that are being used and practised to address such issues across various sectors and regions in the Himalaya.

I feel extreme pleasure in presenting this issue of updated G-SHE to all stakeholders concerned with sustainable development of the Himalaya.

Harsh

Dr. Harsh Vardhan
Minister of Environment, Forest & Climate Change
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[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.*

Foreword

Reconciling development to the ecological limits is a major concern and challenge that the developed as well as developing economies are facing alike today. The environmental governance for implementing such models in the Himalayan ecosystems' context that are characterized by high degree of environmental fragility, and vulnerability to natural and climatic disasters together with increasing anthropogenic interference is a tough challenge. The inherent ecological and structural fragility of the Himalayan system involves a huge cost of developmental trade-offs.

The sustainability issues of Himalayan ecosystems are diverse, and related to the use and management of resources that have cross-sectored linkages and impacts. The general degradation of environment, climate change and climate-induced disasters, water scarcity and shrinking wetlands, deforestation leading to biodiversity loss, urban proliferation and outmigration are some of the major environmental problems of the area awaiting interventions. The issues of coordination, jurisdictional problems and lack of awareness are the main factors afflicting the ecosystem and resource governance in the IHR, which need a thorough revisit and rethinking for effective environmental governance.

However, some of the development and environment issues of the Indian Himalayan Region (IHR) can be smoothly tackled by adopting good governance measures, taking lessons from the "good practices" of the region and by developing suitable policy environment for their up-scaling and institutionalization. This version of the updated G-SHE tends to touch upon some of the ecosystem governance issues of IHR and highlights the efforts that are being made at community, institution, and state levels across the IHR to resolve such problems.

A. N. Jha, IAS
Secretary
Government of India
Ministry of Environment, Forest & Climate Change

Preface

Indian Himalayan Region (IHR) plays an important role in shaping the sustainable development strategy of India. This complex mountain system consists of narrow and deep valleys, glaciers and fertile terrains. The region is a reservoir of over 9,000 glaciers with permanent ice and snow from which rivers like the Indus, the Ganges and the Brahmaputra emanate. The Himalayan region harbours probably one of the highest hydropower potential in the world. This mountain system represents one of the richest natural heritage sites in the world. One-tenth of the world's known species of higher altitude plants and animals occur in the Himalaya. Notwithstanding these features, the rich environmental heritage of the Himalayan region is under pressure from natural and human-induced stresses such as earthquakes, landslides, construction activities (roads and dams), deforestation, over-harvesting and poaching, etc to name a few; and the changing global climate has further exacerbated the situation.

To minimize the adverse effects of human-induced stresses on the sensitive ecosystems of the IHR, and maintain a critical dynamic equilibrium among key resources of the region, the Ministry of Environment, Forest & Climate Change (MoEF&CC) and G.B. Pant National Institute of Himalayan Environment and Sustainable Development (GBPNIHESD) have jointly prepared the updated version of "Governance for Sustaining Himalayan Ecosystem – Guidelines and Best practices (G-SHE)" that is based on a series of discussions with diverse stakeholders. The first volume of G-SHE was published in 2009 which needed to be revised and updated with best practices on immerging issues related to the Himalayan Environment and Development. This updated document contains background information about the Indian Himalayan Region (IHR), guidelines and best practices covering a wide variety of issues namely, sustainable urbanization, tourism and ecotourism, rejuvenation of springs and river basin, building environmental awareness, green energy solutions, conservation area and forests zone management, monitoring networks, integrating new approaches of infrastructure development and disaster risk reduction, etc. A new section on Road Map for Implementation of the G-SHE adds value to this version and provides a way forward to the state governments and other agencies.

I congratulate the team of scientists, researchers and other staff from MoEF&CC and GBPNIHESD who have compiled the information and presented it in this document in simple and easy to understand manner. I hope that the IHR states and other mountainous regions in neighboring Himalayan countries will be benefitted by this joint effort of the Ministry and the Institute. As this being a working document, valuable suggestions of the readers are always welcome.

(signature) 6.9.17

Dr. Amita Prasad, IAS
Additional Secretary
Government of India
Ministry of Environment, Forest & Climate Change

About the Book

The majestic Himalaya in its entirety has a great existence value not only for a variety of ecosystems but also for myriads of inhabitants within and outside its geographical extent. However, the ecosystems of Himalaya are presently undergoing lot of trials and tribulations due to some unscientific developments, over-exploitation of resources, anthropogenic interferences, climate change, extreme events, and natural and man-made disasters. The governance to sustain these eco-systems of Himalaya, therefore, is utmost important in the wider interest of the region and the nation.

Across all different states and parts of the Indian Himalayan Region (IHR), certain corrective and preventive measures are being taken to address these governance concerns at various levels through adoption/implementation of several 'Best Practices' and suitable 'Packages of Policies'. In our previous edition of G-SHE, we attempted to present a compilation of such exemplary policies and best practices that are practiced across the IHR for general understanding and awareness of stakeholders and the G-SHE was widely appreciated across the government circles and by the various stakeholders of the Indian Himalaya. In 2015, the Governing Body of G.B. Pant Institute of Himalayan Environment and Development advised the Institute to upgrade the edition with time. Accordingly, this updated version of G-SHE has been prepared, which contains several examples of good practices from important sectors including one new chapter namely, "Disaster Risk Reduction". This upgraded compilation was widely circulated to various stakeholders in the states of Indian Himalaya and also uploaded in the Institute website for further comments, which were duly incorporated to finalize the current edition.

Now I feel pleasure in presenting this latest G-SHE issue updated with valuable reviews and comments of diverse stakeholders concerned with sustainable development of IHR. As this is an ever-evolving document, which is likely to be updated and improved with the passage of time, so I also welcome your suggestions and comments for facilitating in bringing up its future versions/editions. I also thank my colleagues in the Institute for putting-in their efforts towards compilation of this document as per the need of time as well as based on the voices of stakeholders from all across the Indian Himalaya.

P.P. Dhyani
Director
G.B. Pant National Institute of Himalayan Environment and Sustainable Development (GBPNIHESD)

List of Boxes, Annexures and Appendix

BOXES

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APPENDIX

BACKGROUND ▶

The Himalaya represents one of the youngest and most complex mountain systems on the planet Earth. The Himalayan Region, encompassing the Hindu Kush Mountains and Tibet Autonomous Region of China, covers an area of more than 3.44 million km[2] spread over Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal and Pakistan. It stretches across a length of over 3000 km, from low laying valleys to an altitude of around 8848m asl[1] . The Himalaya is characterised by a high degree of geological fragility, extreme variability of landscapes, rich biodiversity and forests, glaciers, perennial rivers, lakes and wetlands, religious shrines/ monasteries, places of exquisite scenic beauty, and diversity of human races, religions and cultures.

The Himalaya holds a strategic significance as a natural boundary between countries and the Himalayan ecosystem contributes significantly towards the ecological and economic security of the countries it passes through. It has a regional relevance as a climate regulator[2] and water tower of Asia; the interaction of orography of the Himalayan landmass with the Indian Summer Monsoon and East Asian Monsoon generates a huge amount of precipitation.

It is also the largest depository and storehouse of snow and ice outside the two poles; ten of the major rivers of the world originate and drain through the Himalayas, and the basins of these rivers are home to about 1.35 billion people[3]. More than three billion people benefit from the water supply, food and energy produced with the water from these river basins[5]. The Himalayan ecosystems are a rich repository of biodiversity, which is characterised by the richness, representativeness and uniqueness of its biodiversity elements from gene level to ecosystem levels[5]. A part of the region is also recognised as a global biodiversity hotspot. This biodiversity has contributed to the development of a whole range of cultures, traditions, and knowledge systems in the region. The Himalayan forests provide subsistence and livelihood to inhabitant populations and raw material for industries; the water of its rivers carries rich soil/ sediment and energy, contributing to the agricultural productivity of downstream lands, and opportunities for hydropower development.

The Indian Himalayan Region - The Indian Himalayan Region (IHR) spans over 5.37 lakh km[2] (0.537 million km[2]) between 21°57'–37°5'N and 72°40'–97°25'E and covers

PAKISTAN
CHINA
NEPAL
BHUTAN
CHINA
ASSAM
BANGLADESH
WEST BENGAL

01. Jammu & Kashmir
02. Himachal Pradesh
03. Uttarakhand
04. Sikkim
05. Arunachal pradesh
06. Nagaland
07. Manipur
08. Mizoram
09. Tripura
10. Meghalaya
11. Assam*
12. West Bengal*

* Only the hill districts
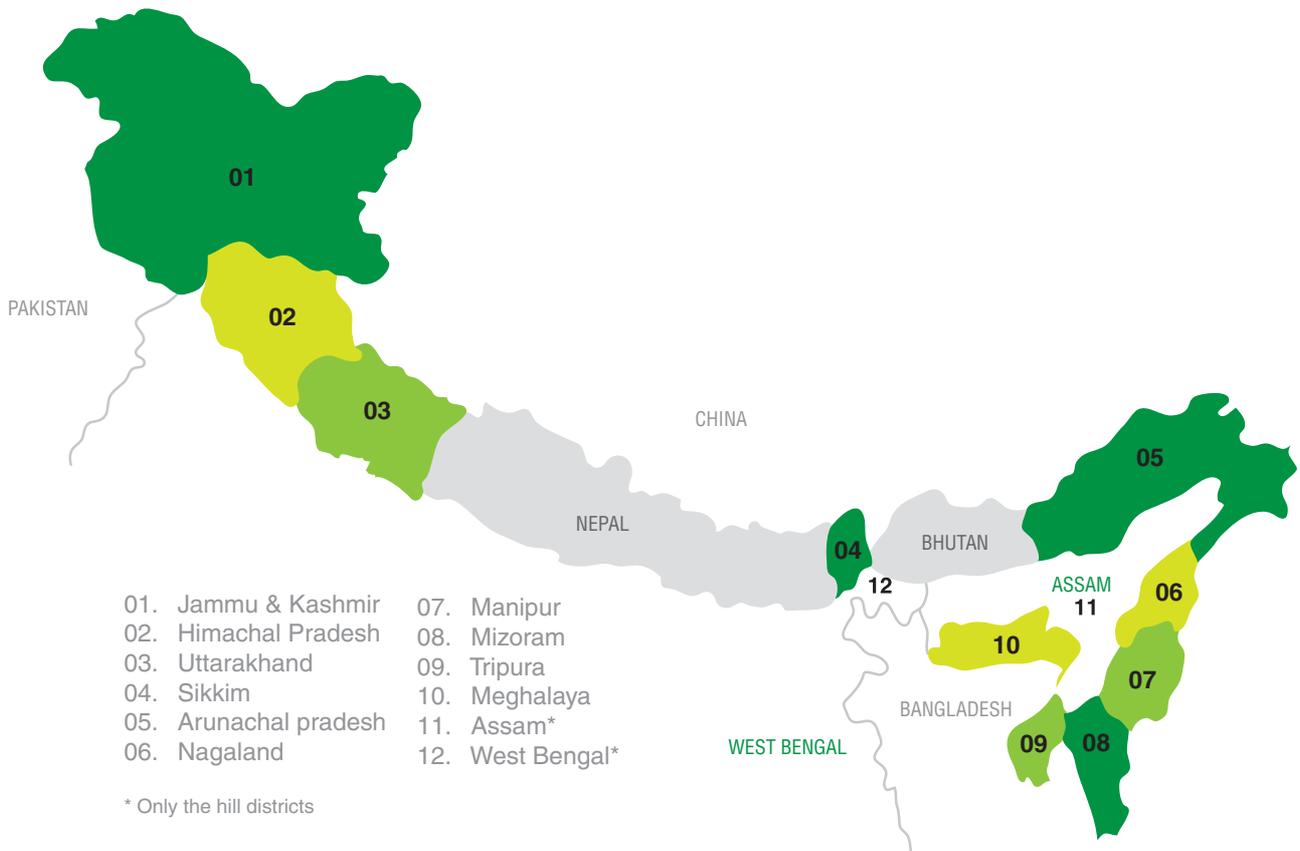
Figure1 - Indian Himalayan Region (IHR)

[1]19th Pandit Govind Ballabh Pant Memorial Lecture, GBPIHED(2013)
[2]Bioscience, 47: 735–745 (1997).
[3]Bandyopadyay and Gyawali (1994)
[4]http://www.icimod.org/?q=3487
[5]2nd Pandit Govind Ballabh Pant Memorial Lecture, GBPIHED (1992)

S. No.	States / Regions	Geographical area - GA (km2) (year 2013)	Decennial population (year 2011)	Sex ratio (2011)	Literacy rate (%)	Forest cover km² (% of GA) (year 2011)	Forest cover km² (% of GA) (year 2013)*	Decadal growth rate (2001-2011)
Table 1: Important Features of States Falling Within IHR								
1	Jammu & Kashmir	222,236	12,540	889	68.74	22,539 (10.14)	22,538 (10.14)	23.64
2	Himachal Pradesh	55,673	6,864	972	83.78	14,679 (26.37)	14,683 (26.37)	12.94
3	Uttarakhand	53,483	10,117	963	79.63	24,496 (45.80)	24,508 (45.82)	18.81
4	Sikkim	7,096	608	890	82.2	3,359 (47.34)	3,358 (47.32)	12.89
5	Arunachal Pradesh	83,743	1,383	938	66.95	67,410 (80.5)	67,321 (80.39)	26.03
6	Nagaland	16,579	1,980	931	80.11	13,318 (80.33)	13,044 (90.38)	-0.58
7	Manipur	22,327	2,722	992	79.85	17,090 (76.54)	16,990 (76.10)	24.50
8	Mizoram	21,081	1,091	976	91.58	19,117 (90.68)	19,054 (90.38)	23.48
9	Tripura	10,486	3,671	960	87.75	7,977 (76.07)	7,866 (75.01)	14.84
10	Meghalaya	22,429	2,964	989	75.48	17,275 (77.02)	17,288 (77.08)	27.95
11	Assam hills	19,153	5,517	954	-	12,985 (67.80)	13,024 (68.00)	NA
12	West Bengal hills	3,149	1,847	970	-	2,289 (72.69)	2,378 (75.52)	14.77
	India	32,87,263	12,10,193	943	74.04	6,92, 027 (21.05)	6,97,898 (21.23)	

(Source: Economic Survey 2012-13, Government of India; India State of Forest Report, 2013)

nearly 16.2% of the total geographical area of the country (Figure 1). Administratively, the ten states i.e. Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura and Meghalaya are fully covered in IHR, while West Bengal and Assam are partially covered including only the hill districts. The major statistics of IHR are depicted in Table 1.

Nearly 17% area of IHR is under permanent snow cover and glaciers, and about 30-40% under seasonal snow cover that feeds the important rivers of North India and provides water for household and industrial use to its inhabitants and downstream populations and economies. Every year around 1,200,000 million m³ water flows through the Himalayan rivers[6].

The IHR has a rich forest cover with more than 41.5% of its geographical area under forest cover. This represents one-third of the total forest cover in India and nearly half (47%) of the 'very good quality' forest cover of the country. These forests provide a wide range of goods and services and act as a 'sink' for carbon dioxide, providing a service of global relevance[7]. The region also covers a large portion of the Himalayan biodiversity hotspot; the IHR flora includes about 8,000 species of angiosperm (40% endemic), 44 species of gymnosperm (16% endemic), 600 species of pteridophyte (25% endemic), 1737 species of bryophyte (33% endemic), 1,159 species of lichens (11% endemic) and 6,900 species of fungi (27% endemic), representing 1748 species of medicinal plants with traditional and modern therapeutic uses, 675 species of wild edible plants, 118 species of essential oil-yielding medicinal plants, 279 species of fodder, and 155 sacred plants. The IHR harbours many shrines and places of tourist interest. It is the home of about 4% of the country's population that derive their livelihood and subsistence from the region. The innumerable ecosystem service benefits provided by the IHR such as fresh water, food, life-saving medicinal products, energy and biodiversity are not only important to the people living in this region but also to those living downstream within and outside the country.

The sensitive and fragile Himalayan ecosystems are now facing the threats of unscientific development and climate change, manifested as general degradation of environment, melting of glaciers, increased intensity of extreme events, deforestation and loss of biodiversity etc., implying a reduced availability of raw material/ resources for subsistence and economic growth, and likely threats to development and human well-being. The hill specificities, non-remunerative agriculture, and outmigration are also adversely affecting the ecosystem conservation interests and development. In recent years, incidences of recurring

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[6] Current Science, 90 (6) 784-788 (2006)

[7] Current Science, 82;1331-1335 (2002)

floods, landslides and forest fires causing huge loss to life, property and natural resources have become a regular phenomenon and pose a constant threat to inhabitant and downstream economies and civilizations.

The sustenance of Himalayan ecosystems is important for its existence value, resources, and the wide variety of service flows that emanate from them. In addition, it also has a trans-boundary relevance and links across the limits of national boundaries for supplemental service flows and climate risk mitigation.

The governance for sustenance, therefore, needs a holistic assessment of all the perspectives. At the national level, the sustenance efforts need recognition of the relevance of the Himalayan ecosystem for downstream economies, prevalent poverty in IHR, the outmigration, the susceptibility to disasters, climate risks and their repercussions and should consider issues like eco-friendly development, payment/ compensation for services, hazard/ climate-proof developmental planning, enforcement of municipal codes, carrying capacity, awareness and participation of people, incentives and stakes, and development of guidelines and best practices. This volume focuses on important governance issues, best practices and relevant guidelines that have been developed for the region and could be implemented across the IHR states.

Understanding the importance of the Himalayan ecosystem, the measures for conservation of mountains and Himalayas have been specifically envisaged in India's National Environment Policy (NEP) 2006[8] (Box 1). India has also launched its National Action Plan on Climate Change (NAPCC) which among other things also envisaged a dedicated mission for Himalaya known as "National Mission for Sustaining the Himalayan Ecosystem (NMSHE)" (Box 2)[9].

Recently, the Government of India has initiated a new National Mission on Himalayan Studies (NMHS) to conduct focused studies in IHR (Box 3).

For achieving the objectives of these initiatives, specific guidelines for sectors relevant to the development of the region need to be formulated and implemented at the state level. Issues that are relevant to the sustainable development of the Himalayan ecosystem, such as pilgrimage and tourism, resource degradation, urbanization, disaster risk reduction and awareness building have been outlined in the following pages.

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[8] National Environment Policy, MoEF, GOI (2006). www.envfor.nic.in/nep/nep2006e.pdf
[9] National Action Plan on Climate Change, GOI (2008). http://pmindia.nic.in/Pg01-52.pdf
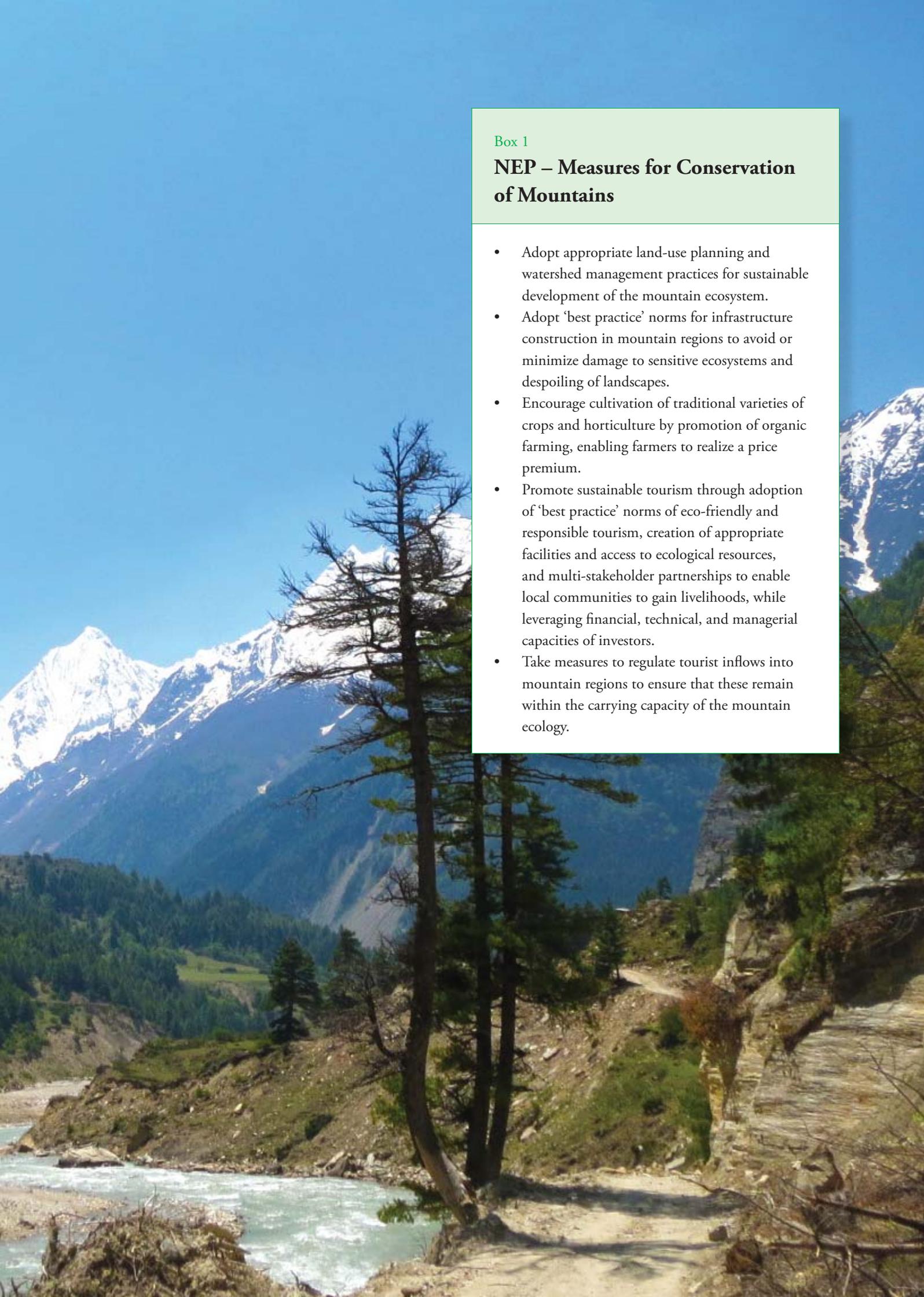
NEP – Measures for Conservation of Mountains

- Adopt appropriate land-use planning and watershed management practices for sustainable development of the 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.

National Action Plant for Climate Change (NAPCC) & National Mission for Sustaining the Himalayan Ecosystem (NMSHE)

The NAPCC, which includes a comprehensive set of mitigation & adaptation measures, aims to promote the nation's development objectives by integrating climate change perspectives in development planning. The eight National Missions under NAPCC represent a multi-pronged, long term, and integrated strategy for achieving key developmental goals in the context of climate change. The Missions are:

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 issues such as capacity development.

The National Mission for Sustaining the Himalayan Ecosystem (NMSHE) has been launched to evolve management measures for sustaining and safeguarding the Himalayan glaciers and mountain ecosystems. The major objectives of the mission are:
i) to understand, whether and the extent to which, the Himalayan glaciers are in recession and how the problem could be addressed, ii) to establish an observational and monitoring network for the Himalayan environment, and iii) to promote community based management of the ecosystems through incentives to community organisations and panchayats for protection of forested lands.
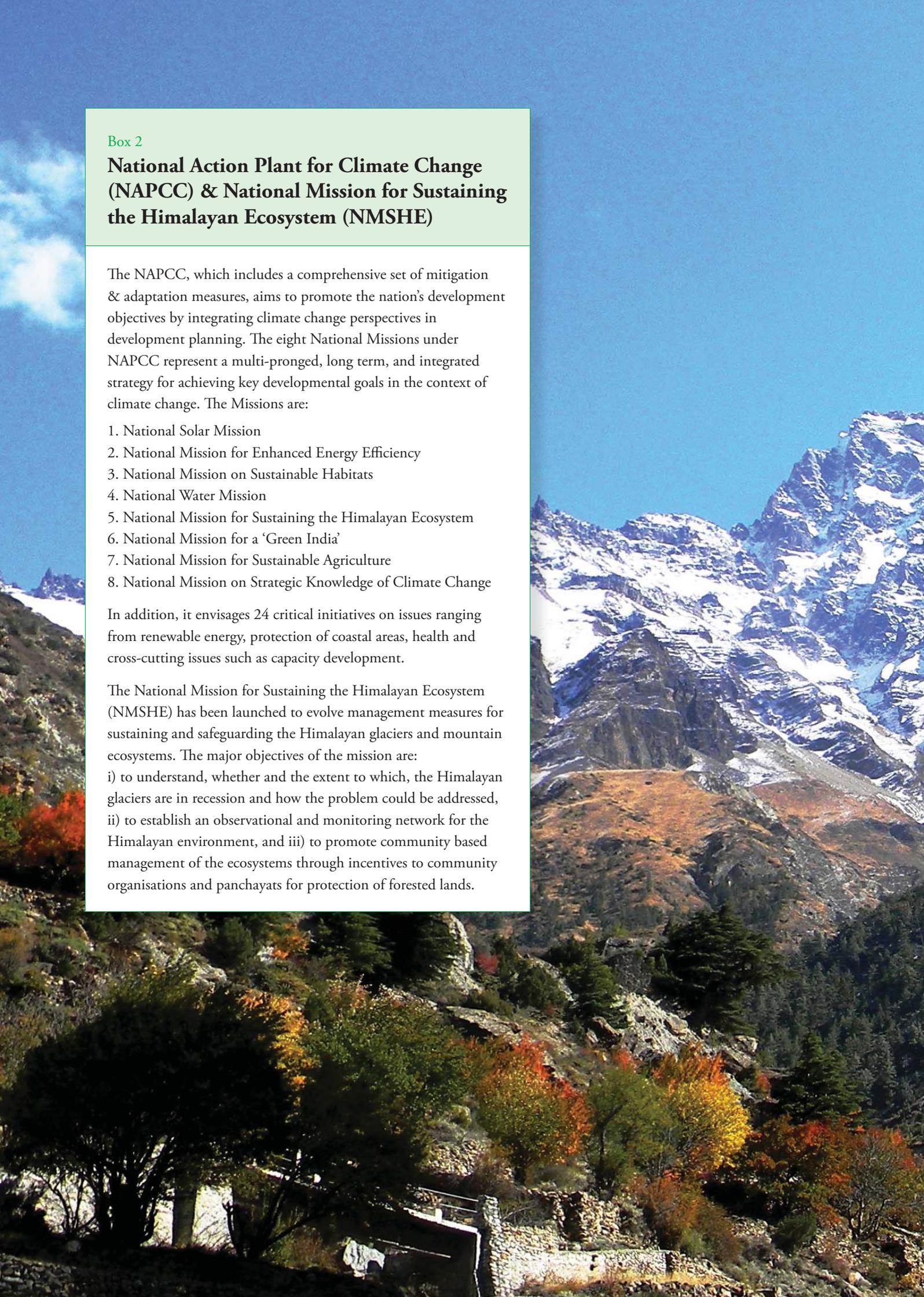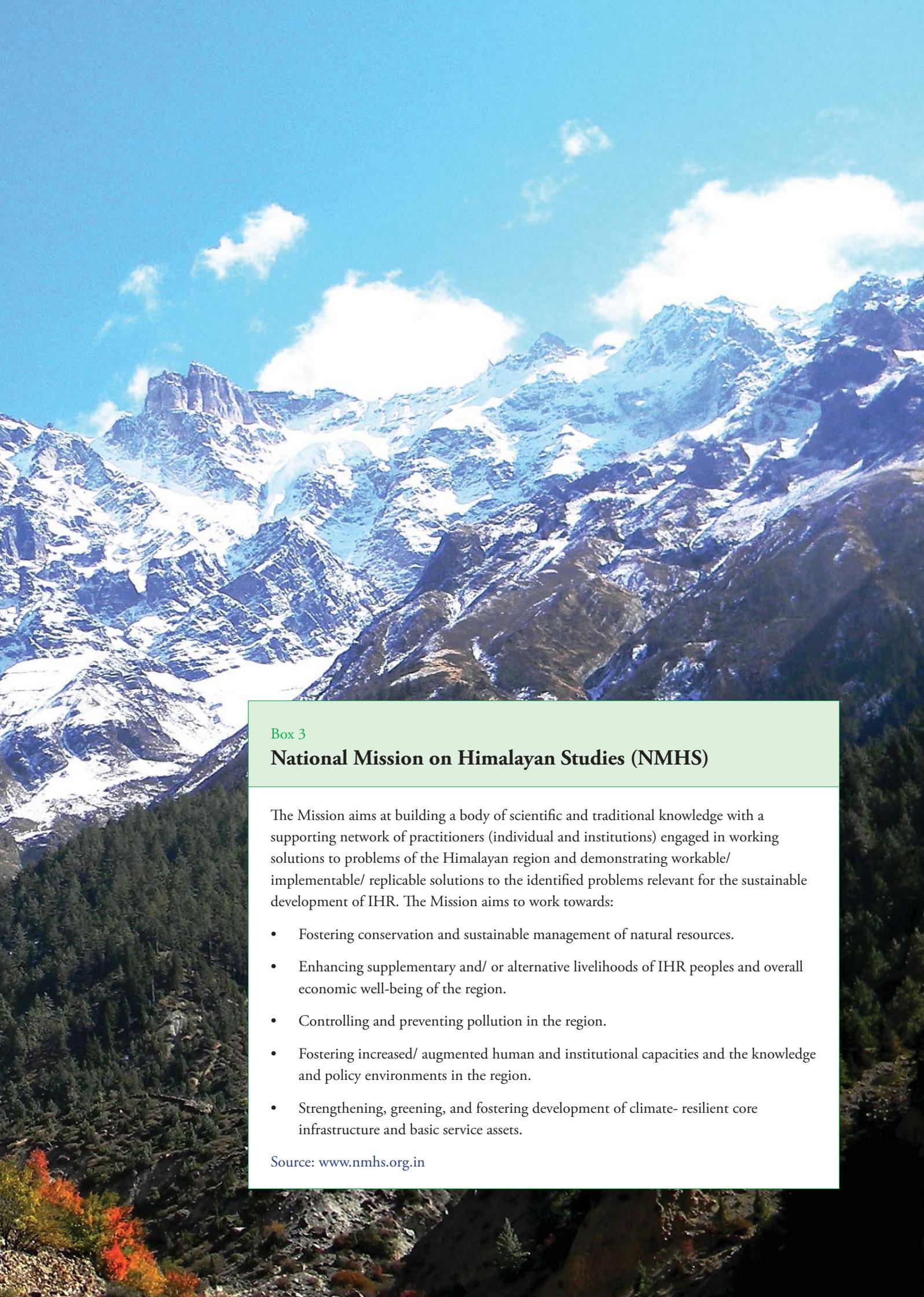
National Mission on Himalayan Studies (NMHS)

The Mission aims at building a body of scientific and traditional knowledge with a supporting network of practitioners (individual and institutions) engaged in working solutions to problems of the Himalayan region and demonstrating workable/ implementable/ replicable solutions to the identified problems relevant for the sustainable development of IHR. The Mission aims to work towards:

- Fostering conservation and sustainable management of natural resources.

- Enhancing supplementary and/ or alternative livelihoods of IHR peoples and overall economic well-being of the region.

- Controlling and preventing pollution in the region.

- Fostering increased/ augmented human and institutional capacities and the knowledge and policy environments in the region.

- Strengthening, greening, and fostering development of climate- resilient core infrastructure and basic service assets.

Source: www.nmhs.org.in
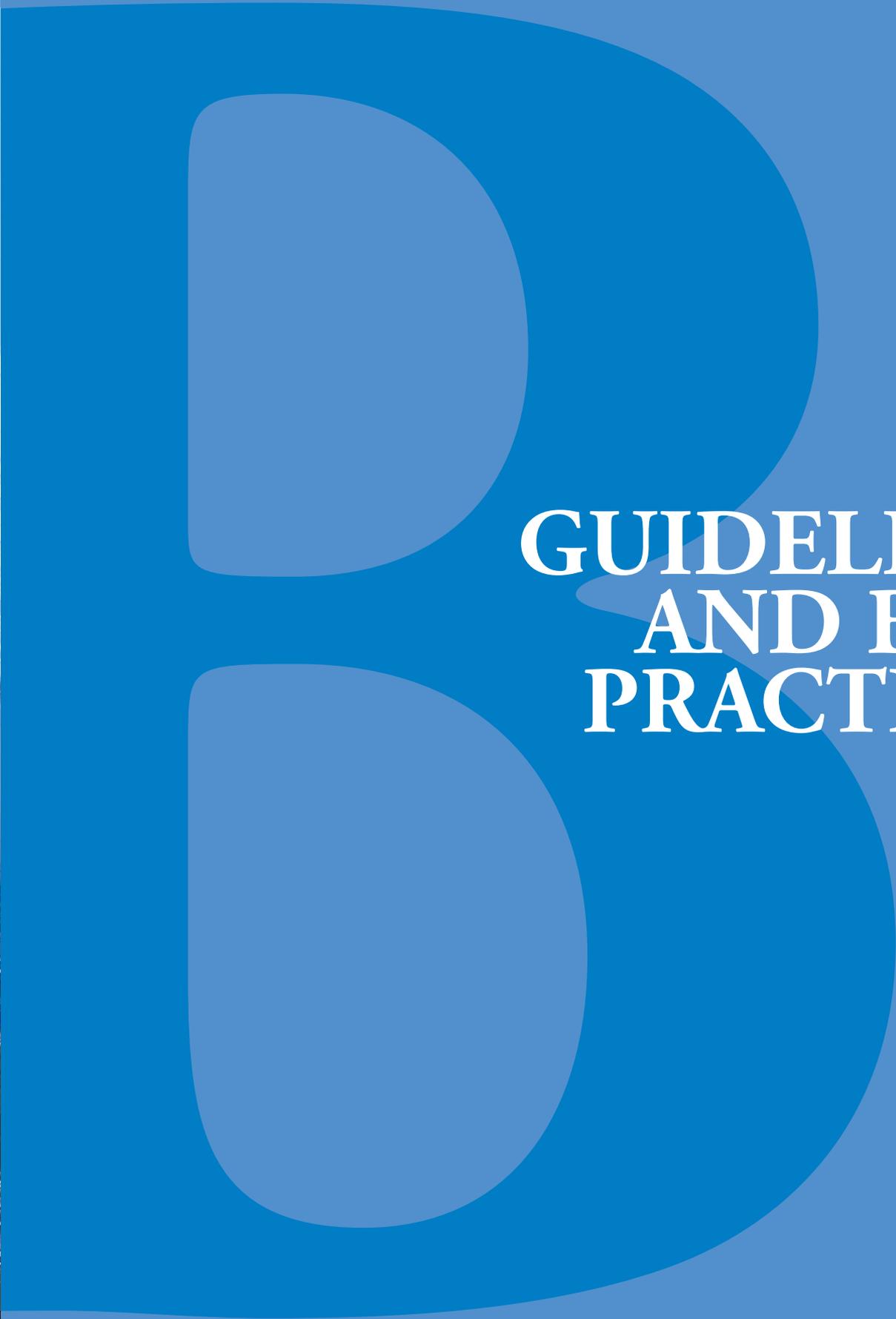
GUIDELINES AND BEST PRACTICES

1

Sustainable Urbanization in the Himalaya

1.1
Sustainable Development of Hill Towns

The hill towns are presently facing natural hazards like landslides, earthquakes, floods, cloudbursts and fire, problems of pollution of lakes and streams, destruction of scenic beauty and visual blight, insufficient traffic movement, inadequate source of water supply, and disturbances in natural drainage, which are the outcome of massive urban development and unplanned building construction without adhering to safety provisions against natural hazards, influx of tourists and migrants, population beyond carrying capacity, and construction/ development activity on high and unstable slopes in and around hill towns. As a consequence of this, the fragile ecosystem of the Himalaya has been severely and adversely affected along with deterioration in the quality of life of the people.

To resolve these crucial problems, amendments in building regulations combining different missions enacted by the government of India for sustainable town planning, and advance location planning are necessary to protect the environment and achieve the required economic development at the same time. Existing building regulations enforced in hill towns are mostly inspired from National Building Code, Delhi Master Plans and other Indian Standards (IS)[10], which are not appropriate in the context of hill towns. Therefore, a holistic approach, which includes geo-environmental, developmental and technological aspects, is required to change existing building regulations and make them appropriate to the peculiar context of Indian hill towns (Box 4).

Box 4
Smart City Mission

A 'Smart City' model is to be implemented in nine cities (Shimla, Dehradun, Haridwar, Roorkee, Gangtok, Pelling, Yuksam, Bishnupur, Chandel) of the IHR and may also be adopted in other major towns located in the IHR, which are important from a tourism point of view. With combined planning based on best practice norms (e.g., National Building Code) and guidelines of Smart City Mission, the Mission can provide core infrastructure, totally sanitised, healthy and liveable cities and towns, and give a decent quality of life to its citizens with a clean and sustainable environment.

Source: http://smartcities.gov.in/ writereaddata/SmartCityGuidelines.pdf

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[10] *Centre for Good Governance, Administrative Staff College of India, JNNURM Rapid Training Programme on Governance & Reforms, 2011.*

1.2
Solid Waste Management

The incessant population growth from 395 lakh in the year 2001 to 468 lakh in the year 2011, expansion of economic activities, influx of tourists, and intensive urbanization process in the IHR have led to indiscriminate dumping of solid waste and other waste such as e-waste, etc. According to a survey conducted by the Central Pollution Control Board (CPCB) in the year 2005 the e-waste generation in the IHR states is around 10% of the total e-waste of India. Due to unregulated accumulation and recycling, the problem of solid waste has become an immediate and long term concern which can lead to major environmental harm and endanger human health.

To address the problems of solid waste and its ill-effects, the government of India on 2nd October 2014 launched an ambitious 'Swachh Bharat Mission' which undertakes to make India a clean country by 2nd October 2019. The main objective of this mission is to ensure personal and community hygiene by focusing on the scientific management and disposal of municipal solid waste (Box 5). This mission is being implemented in the whole country, and the IHR states. As most of the Himalayan states lack an effective scientific solid waste management plan which poses a serious threat to the local environment and ecology.

Box 5
Swachh Bharat Mission (SBM)

The mission envisages to:
- Bring about an improvement in the general quality of life in the urban and rural areas, by promoting cleanliness, hygiene and eliminating open defecation.
- Accelerate sanitation coverage in rural areas to achieve the vision of Swachh Bharat by 2nd October 2019.
- Motivate communities and panchayati raj institutions to adopt sustainable sanitation practices and facilities through awareness creation and health education.
- Encourage cost-effective and appropriate technologies for ecologically safe and sustainable sanitation.
- Develop where required, community-managed sanitation systems focusing on scientific solid and liquid waste management systems for overall cleanliness in the rural areas.
(The IHR states - Manipur and Meghalaya have been successful in managing more than 50% of the total municipal solid waste in the states under SBM.)

Source: http://moud.gov.in/sites/upload_files/moud/files/SBM_Guideline.pdf

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Box 6

Door-to-Door Garbage Collection Bye-Laws 2006
(Municipal Corporation, Shimla)

Some of the important features of the Bye-Laws are:

- Prohibition on throwing degradable garbage in public drains and sewage.

- Restriction/prohibition on use of certain things manufactured from non-biodegradable materials.

- Provision for placement of receptacles and places for deposit of non-biodegradable garbage.

- Duty of owners and occupiers to collect and deposit non-biodegradable garbage.

- Power to local authority or competent authority for removal of non-biodegradable garbage/ material from private properties.

- Studies, research and support programmes.

Source: http://www.shimlamc.gov.in/file.axd?file=2010

For effective management of solid waste, many attempts have been made so far under government of India enacted rules and guidelines such as the National Green Tribunal, 2009, the Municipal Solid Waste Management and Handling Rules-2000, Hazardous Waste Management and Handling Rules-2000, Plastic Waste Management and Handling Rules-2011, E-Waste Management and Handling Rules-2011, JNNURM SWM Toolkit 2012, and through state/ local level legislations such as - solid waste management in Shimla (HP), banning the use of plastic in some states (Himachal Pradesh, Uttarakhand, Sikkim, Tripura), the Door-to-Door Garbage Collection Bye Laws (MC Shimla)- 2006 (Box 6) and the Uttarakhand Plastic and other Non-Biodegradable Garbage (Regulation of Use and Disposal) Act - 2013, etc.

For the sustainable management of solid waste, some important local practices such as the Door-to- Door (D2D) garbage collection schemes in cities like Shimla, Dehradun and Agartala have also been implemented. This demonstrates the zero tolerance of the IHR states towards pollution caused by plastic in the region (Box 7). Realising the growing concern over e-waste, the government of India has also supported several initiatives. The guidelines for e-waste collection, transportation, recycling and disposal were issued in March 2008[11] by the MoEF&CC and the CPCB, which came into effect from 1st May, 2012. Waste-to-Energy (WtE) initiative is actively promoted by the Ministry of New and Renewable Energy (MNRE). There is a potential of about 1700 MW energy from urban waste (1500 from MSW and 225 MW from sewage) and about 1300 MW from industrial waste. Waste-to-Energy provides a solution towards complying with government regulations, and achieving integrated solid waste management.

The measures and model guidelines for solid waste management are compiled in Annexure 1.

[11]Guidelines for Environmentally Sound Management of E-waste (as approved vide MoEF letter no. 23-23/2007-hsmd dated 12th March, 2008, Ministry of Environment & Forests, Central Pollution Control Board, Delhi, March, 2008)

Tourism and Ecotourism

2. 1
Tourism and Pilgrimage in Sensitive Areas

The Himalaya has a long history of Religious tourism. It is known to be the home of many religious shrines and sacred places and is also endowed with places of scenic beauty and natural bounties. The pilgrim destinations of the Himalaya such as Badrinath, Kedarnath, Gangotri, Yamunotri, and Hemkund Sahib, etc. in Uttarakhand, Manimahesh, Jwala Devi and Chintpurni in Himachal, Vaishno Devi and Amarnath in J&K, Khecheopalri and Gurudongmar lakes and the Buddhist monasteries in Sikkim are visited by millions of pilgrims every year.

There are many other places located in the Himalaya that cater to commercial tourism. These are mostly thickly forested areas with rich biodiversity and scenic beauty. Unfortunately, most of these places lack adequate facilities of transport, accommodation, waste disposal and other amenities to cater the ever growing number of pilgrims and commercial tourists 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 resources of these areas are facing pressures far beyond their carrying capacities.

Therefore, there is an urgent need to develop and implement guidelines based on the concept of their carrying capacity, for growth of sustainable pilgrimage and commercial tourism in the region. In this context, the Draft Tourism Policy 2015 and state level policies and guidelines have been formulated (Annexure II).

Box 8

Major Initiatives for Community Based Ecotourism(CBET)

- The major initiatives taken by Uttarakhand state to promote community-based ecotourism include home stays at Bhakrakat, Tolma, Agora, Lata, Chotti-Haldwani; Village Camp at Kyari - Kyari village; Chipko Trail at Reni village, Jim Corbett Heritage Trail, Boar Canal Trail and Brahm Booboo Trail; folk music, cultural exchange, village walk and bird watching at Rampur Mandi etc.

- The Assam government has initiated home stays with the Mishing tribe - Majuli Island - La Maison De Ananda, Manas National Park and Potasali Nameri Eco-Camp.

- The other North Eastern states such as Arunachal Pradesh have started home stays with the Monpa tribe, Meghalaya initiated Tree house and Tribal home stays with the Khasi tribe at Mawlynnong, and Nagaland built tourist cottages with the Angame tribe.

Source: http://uttarakhandtourism.gov.in / utdb/?q=uttarakhand-home-stay-details; http://www.thegreenerpastures.com/ Community%20 Development#.Vlb0pr_Qies

2.2
Ecotourism and Regulation of Commercial Tourism

2.2.1 Ecotourism

Ecotourism, a sub-component of sustainable tourism, has the potential to enhance wilderness protection and wildlife conservation, while providing nature-compatible livelihoods and better income opportunities for a large number of local inhabitants living in and around the natural ecosystems[12]. Today, the IHR attracts a large number of tourists from across the world; the unregulated movement of tourists especially around protected and eco-sensitive areas, however, is leading to exploitation, disturbance and misuse of the fragile ecosystem of the Himalaya. In the year 2011, the Ministry of Environment and Forest (MoEF) issued draft guidelines for promoting ecotourism in and around protected areas. These guidelines state that the local ecotourism plan of the respective protected areas should evolve through a participatory strategy keeping in view the livelihood interests and the long term benefit of the local community. Under these guidelines, the state governments have prioritised several ecotourism projects in the various parts of their states. Community-based ecotourism (CBET) has been recommended as the most viable sustainable alternative to the presently practiced commercial tourism. A variety of activities and initiatives undertaken to encourage and support a wide range of objectives for socio-economic development and conservation under CBET are described (Box 8).

The CBET provides incentives and encouragement to local communities for paticipation in various ecotourism activities. As a result of the promotional activities and its popularization in IHR the mountain ranges of northern India with the snow-clad slopes, forests and rivers have become an important attractions for eco-tourists. Further the prevalent forms of ecotourism such as wildlife tourism, agro tourism, village tourism, etc., also provide a variety of opportunities at various levels to assure the future of ecotourism in the region. The case of Sikkim and Assam presents a good example of strategies being implemented to promote ecotourism; the initiatives taken in Sikkim are summarized in Box 9. Further, immense opportunities for adventure-cum-ecotourism in the Himalayan region could

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[12]Draft guidelines for ecotourism in and around protected areas dated 02 June, 2011, Ministry of Environment and Forest (MoEF), Govt. of India.

be harnessed through community involvement. Linking of tourism with initiatives like Rural Business Hubs (RBH), as introduced in the 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.

2.2.2 Regulation of Commercial Tourism

Mass tourism, the commercial type or pilgrimage related, is a common feature of the important tourist destinations of the Indian Himalaya. Such tourism creates a lot of environmental problems for the destinations and their adjoining tourist pockets. The infrastructural carrying capacity of the destinations is exceeded in terms of accommodation, civic amenities, traffic, and waste collection and disposal activities. One of the sustainable ways is to deal with mass tourism is regulation (Box 10). The influx of visitors needs to be controlled by imposing number restrictions, and by way of product diversification through development of low impact tourism in vicinity tourist areas. Such measures will also help in curtailing the vehicular influx, traffic jams, and noise and air pollution in tourist areas. A few successful initiatives from

Box 9

Ecotourism Activities in IHR States

- Development of a Tourist Circuit (Western Assam Circuit) - Dhubari- Mahamaya-Barpeta-Hajo has been sanctioned for an amount of Rs. 4.97 crore.

- Sikkim Biodiversity and Ecotourism Project - developing collaboration between Travel Agents Association of Sikkim (TAAS), local organisations and communities for biodiversity, conservation and income generation.

- Submitted a proposal for inclusion of Khangchendzonga Biosphere Reserve with area 2619.92 km2 in the World Network of Biosphere Reserve under 'UNESCO - Man and Biosphere Programme' to the MoEF on 17th August 2011.

Source: Environment & Wildlife Management Department, Govt. of Sikkim.

the region (e.g. Ladakh initiative) have exhibited the potential of implementing the concept of 'Himalayan Homestays', which link cultural and natural heritage conservation through a commitment to reliability, and protection and sensitive interpretation of local culture and nature heritage values. Such initiatives need to be promoted across the IHR.

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

Water Security through Rejuvenation of Springs and River Basins

Springs and rivers are the main source of fresh water, providing life to people in the mountain regions. In IHR too, the springs and rivers cater to the water demands of the majority of households, settlements and industries. Springs also feed rivers, streams and other water bodies, and hence are vital for the people and the ecosystem. In recent decades, the growth of settlements, infrastructural development, construction of roads and the accompanying deforestation and landscape changes have caused degradation of the river/ spring catchments, and alteration of subterranean water regimes resulting in reduced seasonal flow and drying of rivers and springs. Now, in view of the increasing demands of the rising population, new settlements and industries, and for sustenance of hill agriculture; scientific and community- based management needs to be promoted for ensuring water supply for different uses and overall water security in the IHR.

3.1
Spring-shed Development

Now several ministries and developmental agencies have accepted the concept of watershed for wasteland restoration, recharging of water sources, creating and empowering of decentralised village institutions, and strengthening of the participatory processes. Of late, some of the states in IHR, namely Sikkim, J&K, Uttarakhand and Meghalaya, have initiated the revival of springs by building on this concept and using several catchment treatment techniques.

3.2
Rejuvenation of Rivers Basins

Indian Himalayan states have been identified as India's future power house and a large number of power projects have been and continue to be constructed on many of the mountain rivers to generate hydropower. These projects often alter the natural flow patterns, which adversely affect ecological functions and the social, economic, cultural and religious significance of these rivers. River rejuvenation

Spring-shed Development (Dhara Vikas) Programme of Government of Sikkim

In the year 2008, the government of Sikkim started a programme under the name 'DharaVikas' for the rejuvenation/ revival of drying springs, streams, and lakes in the state:

- This programme was implemented through Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), where local expertise and experience was developed, and used to identify the recharge area of springs based on the structure, weathering and fracture patterns of the rocks.

- The programme from the year 2010 also included rainwater harvesting in their technology set. Within five years from inception, the 400 sites covered under spring-shed development resulted in an annual ground water recharge of 900 million litres.

- The spring-shed development was supported by different agencies such as WWF-India, PSI (Dehradun), ACWADAM (Pune), and CHIRAG (Nainital) who were technically trained as para- geohydrologists and helped to bridge the knowledge gap between geo-hydrology and revival of springs at the village level.

Source: http://www.sikkimsprings.org/dv/
Educational%20research/dharavikashandbook.pdf

will require a combination of basin-wide interventions that are coordinated to reduce pollution loads from point and nonpoint sources, improve water-use efficiency, augment flows during lean periods, and maintain appropriate environmental flows. Recently, rejuvenation of the Ganga has been prioritised as restoration of the wholesomeness by ensuring maintenance of minimum quantity and desirable quality of flows. These conditions are necessary to maintain the ecological integrity and biodiversity of the river, and for non-disruptive biota movement and sediment transport. The guidelines for minimum river flows in the country are gradually evolving and these are specified by different agencies such as the MoEF&CC, State Pollution Control Boards, Water Resources Departments, and other state government agencies (Box 13).

Spring Recharge Initiatives in IHR

- **Spring Recharge through Village Environmental Action Plan (VEAP)** - The Village Environmental Action Plan developed by GBPNIHESD, was implemented under the 'Swajal' initiative in Uttarakhand. The plan combines participatory planning with integrated resource assessment, utilization and conservation. It also provides guidelines for spring recharge and rainwater harvesting (Annexure IVa-b), model technologies for wasteland rehabilitation e.g., Sloping Watershed Environmental Engineering Technology (SWEET) of GBPNIHESD, and other appropriate area-specific technologies.

- **Spring-shed Management Initiative (Meghalaya)** – The government of Meghalaya launched 'State's Spring-shed Management Initiative', under which India's largest spring mapping exercise is to be carried out and yield some 2000-4000 spring data points. The state Panchayati Raj institutions are also involved in this programme, so that the members from the village council can be trained as para-professionals.

- **Springs of Hope (Himachal Pradesh)** – Under this programme, the state of Himachal Pradesh, with the help of World Bank, has started several Mid-Himalaya watershed development projects in IHR. The overall goals of the projects are to: (i) reverse the process of degradation of natural resources base and improve the productive potential of natural resources and incomes of the rural households and (ii) support policy and institutional development in the state.

Box 13

Minimum Flow Policy for Hydropower Sector

- The HP government has mandated 15% of lean season water discharge as a pre-condition for upcoming HEPs in their Hydro Power Policy (2006). The government further amended the minimum lean season flow requirement, in March 2009, by including the average discharge of the lean months i.e., December to February, in accounting.

4

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. Various research organisations and NGOs working in the region can play an important role in this context. A list of major institutions and their area(s) of operation is given in Appendix-1.

Some of the major initiatives implemented across IHR by the central and state governments are presented in Boxes 14 & 15. The focus of the programme needs to be broadened to attract and motivate other stakeholder groups. There is a need for designing a special course on 'Himalayan Ecology and People' and making it mandatory for the officials/ personnel serving in the region as natural resource planners, policy makers, and in military & paramilitary forces, etc. The institutions mandated for research & development in the Himalaya need to be strengthened to design and implement such courses in collaboration with institutions of higher learning and administrative training centres.

National Initiatives for Environmental Awareness

- *Environmental Education, Awareness and Training (EEAT)* – This is a flagship scheme of MoEF&CC which aims to enhance the understanding of people at all levels about the human - environment relationship, and develop capabilities/ skills to improve and protect the environment.

- *Green Haat 2012* - This initiative of MoEF&CC tends to showcase various value-added forest based products which are developed by rural artisans. The main purpose is to create awareness about the rich forest and biodiversity heritage of the country amongst the growing urban population often living far off from the forests.

- *Science Express: Biodiversity Special (SEBS)* – This scheme launched on 5th June 2012, is solely dedicated to showcasing the myriad biodiversity forms spread across the bio-geographical zones including Trans-Himalaya and the Himalayas.

Source: http://envfor.nic.in/division/environmental-education-awareness-and-training-eeat; http://www.moef.nic.in/sites/default/files/green-haat-12.pdf; http://www.sciencexpress.in /about-science-express.html

Sikkim Government towards Environmental Awareness

- Eco Clubs and Green Funds have been instituted for schools and colleges since the year 2000.
- Environmental Education was introduced in schools from nursery to class- VIII; implemented various action oriented schemes like National Green Corps Programme, National Environmental Awareness Campaign, and Green School Programme.
- Green School Programme of Centre for Science and Environment (CSE) in co-ordination with the ENVIS Centre of the Science and Technology Department was launched at the state level in all schools of Sikkim.

Source: Forest, environment & wildlife Management Department, Sikkim Govt.

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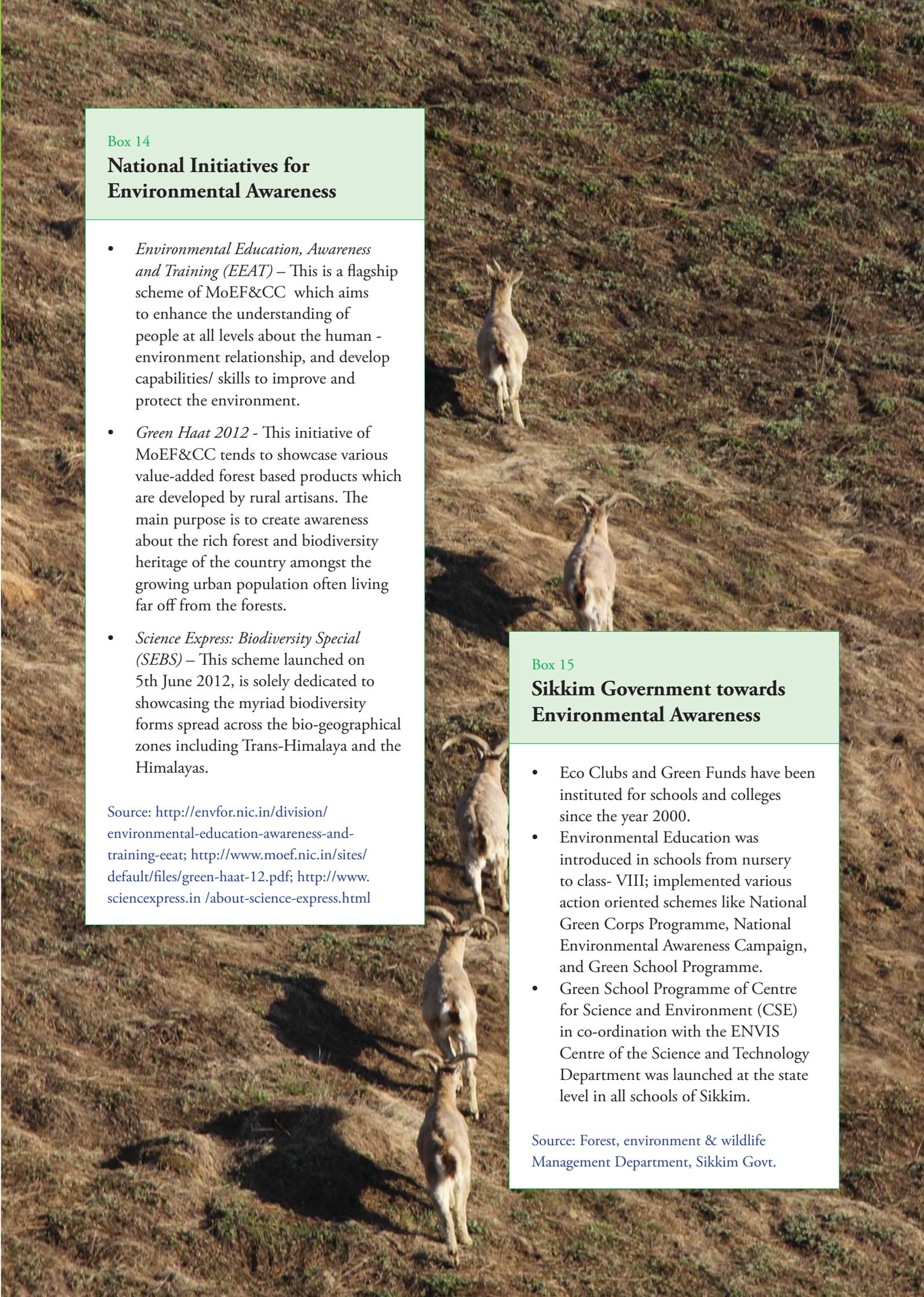
Green Energy Solutions

The majority of households in IHR states still use traditional fuel such as fuel wood, agro and animal residues for meeting the energy requirements of domestic cooking and space heating. Per household fuel consumption in IHR varies with regions and seasons. The percentage of households using firewood, crop residue or cow dung cakes varies from 44.49 to 80.47%, 0.28 to 2.53%, and 0.05 to 4.19% respectively. Nowadays, an increasing number of households have also started using energy from commercial sources such as LPG and kerosene etc., for cooking use. But due to lack of access to commercial sources in remote areas and for economic reasons, a large population of rural households still depend upon fuel wood (biomass energy) for their daily requirements. The fuel wood demands are mainly catered by the forests and its collection involves opportunity cost in terms of time elapsed and the efforts put in. The collection also results in nibbling of forests, removal of tree growth and forest degradation. Further, biomass burning also contributes to carbon emissions and health problems. Poor economic capacity also restricts energy use, adversely affecting the energy security. Therefore, the substitution of energy requirements through affordable green (renewable) resources becomes the imminent need of the region. This provides an alternative way to address the issue of meeting energy needs from perennial green energy sources such as solar, wind, biomass, hydro, and geothermal energy. Use of these sources will minimise the traditional fuel dependency to a great extent and help in mitigating environmental pollution and forest degradation, also enabling minimum forest cover as per the goals of the National Forest Policy, and counteracting the climate change impacts.
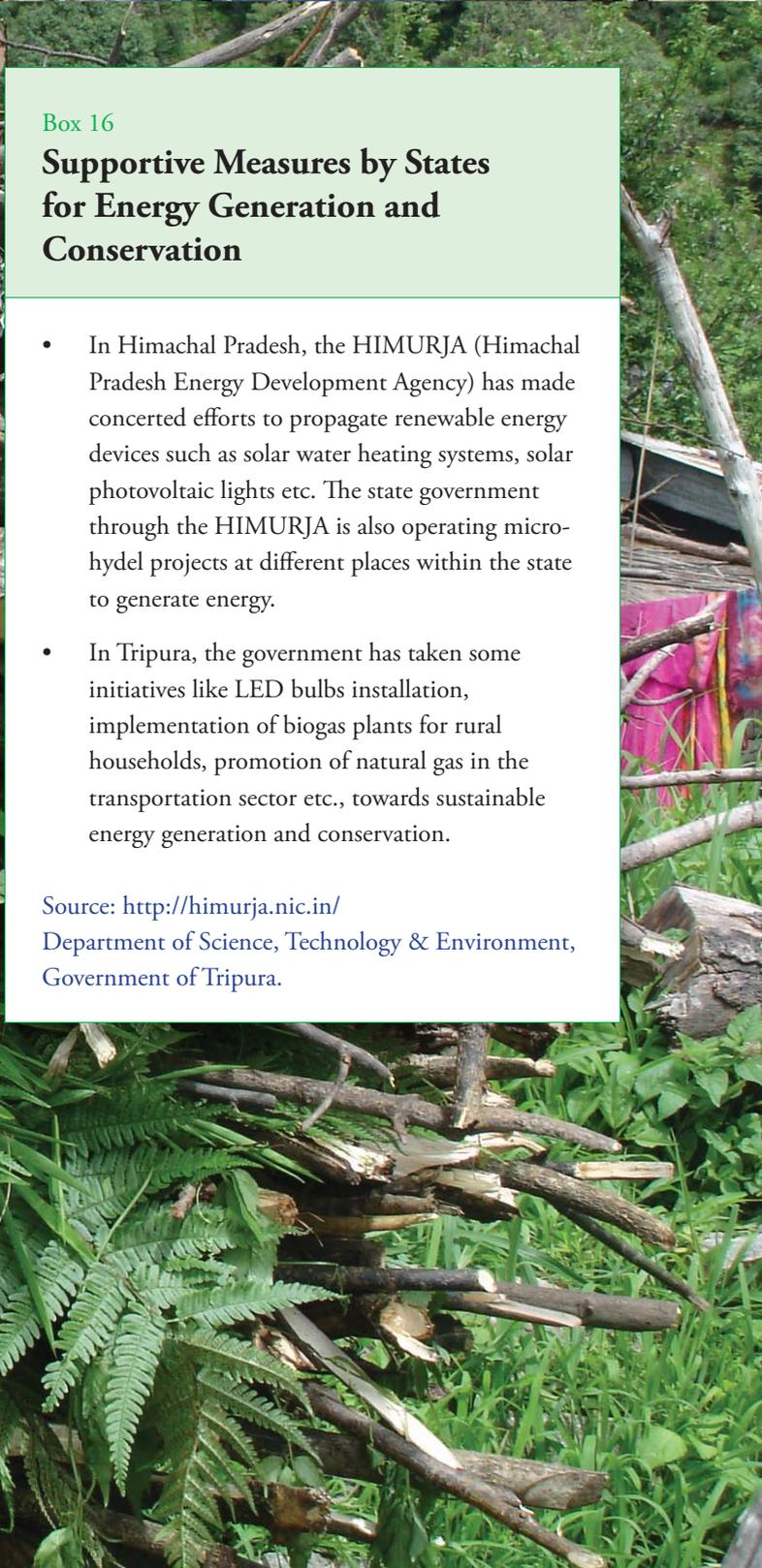
Box 16

Supportive Measures by States for Energy Generation and Conservation

- In Himachal Pradesh, the HIMURJA (Himachal Pradesh Energy Development Agency) has made concerted efforts to propagate renewable energy devices such as solar water heating systems, solar photovoltaic lights etc. The state government through the HIMURJA is also operating micro-hydel projects at different places within the state to generate energy.

- In Tripura, the government has taken some initiatives like LED bulbs installation, implementation of biogas plants for rural households, promotion of natural gas in the transportation sector etc., towards sustainable energy generation and conservation.

Source: http://himurja.nic.in/
Department of Science, Technology & Environment, Government of Tripura.

The IHR provides immense opportunity for harnessing locally available and often wasted green (renewable) energy resources for meeting its growing energy demands. Energy conservation and increased efficiency is gradually taking an important place in the perspective of energy security. The initiatives of the state governments of the IHR for obtaining energy self-sufficiency in the future are described in Boxes 16 & 17. Production of bioenergy from pine needles at the village level has also been demonstrated successfully by an NGO in Uttarakhand (Box 18).

Box 17

Measures for Energy Conservation in Uttarakhand

- The Uttarakhand Green Energy Cess Act, 2014 has been passed by the Uttarakhand Legislative Assembly to promote electricity production from renewable power sources with the help of private developers and community co-operation. It has a provision of Green Energy Cess to be levied at the rate of 10 paisa per unit in the case of electricity generated in the state by those generators which transmit the generated power outside the state and the electricity supplied to commercial and industrial consumers of the state. The Cess in such cases would be collected by UPCL and remitted to the Green Cess Fund for promoting Green Energy.

- The government of Uttarakhand has formulated guidelines under the title 'Uttarakhand: Regarding Efficient Use of Energy and its Conservation' by making the use of Compact Fluorescent Lamps (CFL), energy efficient tube lights and solar water heating systems in notified buildings (government., schools, colleges, hostels, housing complexes, hospitals, hotels etc.) and adoppion of energy efficient systems, mandatory in this state.

Source: http://ureda.uk.gov.in/newwhat/view/98

Initiative on Biomass Energy Generation from Pine Needles

To supplement the energy requirements of rural people and mitigate the threats of forest fire, AVANI Bio Energy, Pithoragarh (Uttarakhand) has taken an initiative for harnessing the destructive energy of pine needles for electricity generation that can be sold to the power companies through the existing grid. The other associated environmental advantages of this initiative are: (i) it generates electricity through a 9 KW gasifier which is a comparatively cheaper, easily accessible and durable technology, (ii) yields charcoal as by-product that can be used for cooking purposes, (iii) provides a smoke-free environment to the villagers and reduces GHG emissions, (iv) helps Removal of pine needles from the forest floor to protect the biodiversity of the region, (v) help providing surplus revenue through sale of electricity to create more employment for local youth to incentivise collection of pine needles and (vi) increasing demand would create alternative livelihood opportunities for the villagers.

Source: http://avani-kumaon.org/

6

Conservation Areas and Forest Zone Management

Forest Conservation and Management

Forest is the major land use/ land cover category in IHR, which covers about 41.32% of its total geographical area. However, this figure is below the mandate of the National Forest Policy for hill states, which provides for 66% of the geographical area to be brought under forest cover. Therefore, there is a need to conserve, manage and enhance forest resources because they provide a variety of ecosystem goods and services to the inhabitants of the region as also to the people residing in the lowlands.

In this context, various measures have been taken up by the government of India, which include the Green India Mission under the ambit of the National Action Plan for Climate Change (NAPCC). The mission promotes scaling up of planting activities especially in degraded areas through funds to be made available under the Compensatory Afforestation Management and Planning Authority (CAMPA). Recently, the MoEF&CC has also strengthened the National Afforestation Programme (NAP), which envisages eco-restoration of degraded forests and adjoining areas throughout the country through people's participation. The scheme is being implemented in a decentralised way by the State Forest Development Agency (SFDA) at the state level, Forest Development Agency (FDA) at the forest division level, and Joint Forest Management Committees (JFMCs) at the village level. In the past few decades, traditional, religious and spiritual motivations have also been used to mobilize efforts for forest conservation (Box 19).

Box 19

Initiatives to Promote Conservation Efforts

- In recognition of forests as national wealth, the 13th Finance Commission recommended an incremental grant of Rs 5000 crore for the years 2010-15 towards the maintenance of forests, amongst the states based on their share of area under forest. This amount is five times more than that allocated during the 12th Finance Commission.

- Apple growers in Himachal Pradesh have started renting colonies of honey bees from private bee keepers and the Department of Horticulture for pollinating their orchards. The 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
Community Based Conservation and Management

Community-based conservation is likely to be more cost effective and sustainable. It requires the creation of communicating networks and participatory research linkages between the public sector, NGOs and rural people

Community Based Forest Management Practices

- *Joint Forest Management* - The concept refers to partnership in forest management between the state forest department and the village communities. It evolved as a result of some incidents and field experiences during 1970s and was later provided statutory support for its implementation through National Forest Policy 1988, and Joint Forest Movement Guidelines 1990 of the government of India. It capitalizes on resource dependence, management experience, and participatory strength of community, and technical expertise of the state forest agencies/ departments for protection, regeneration, and development of degraded forests in the village vicinities through participatory management. The model works on adjustments in property rights and incentive provisioning to elicit community participation for safeguarding the forest resources. JFM got widespread acceptance in the country and was implemented in many states across IHR such as Arunachal Pradesh, J&K, Manipur, Mizoram, Nagaland, Sikkim, Tripura, Uttarakhand, and the Assam & West Bengal hills.

- *Community Conserved Area Approach* - The approach, like the 'Indigenous and Community Conservation Areas (ICCA)' has been recognized by IUCN and CBD COP -7, and is being envisioned as an effective policy practice to meet twin objectives of biodiversity conservation, and livelihood security of tribal communities in Arunachal Pradesh. The state of Arunachal Pradesh, which covers 43% of the Himalayan Biodiversity Hotspot and is a designated globally important endemic bird area, is inhabited by large populations of tribal communities, who traditionally own and depend on forests governed by the customary laws, for their livelihood and cultural sustenance. The CCA reconciles conservational concerns with community interests, as it aims to institutionalise the community- owned tribal forest areas which are mainly covered under 'unclassed state forests' through recognition of customary rights of communities, thereby eliciting their active participation supported by awareness and empowerment for decision making; leading to better livelihood security, and cultural sustenance of communities by conservation and sustainable use of forest resources, and also yielding long term ecological benefits to the state.

involved in conservation areas. This is now being seen as critical for the long term success of any conservation programme.

The three major community forestry regimes that exist in IHR are: i) State sponsored Joint Forest Management (JFM) programme which is being implemented in all the IHR states, ii) Van Panchayat system in Uttarakhand, and iii) Traditional systems of north-eastern Himalaya.

In Uttarakhand, after the 2005 amendment of Panchayati Forest Rules, a Van Panchayat was structured as a group of nine elected members to be known as the Van Panchayat Management Committee (VPMC). The constitution of VPMC as per the Uttarakhand Panchayati Forest Rules (UPFR) - 2001, also includes provisions for reservation for women and weaker sections of society i.e. Scheduled Castes and the Scheduled Tribes. Though the forests are protected and managed by VPMCs and come under the jurisdiction of the State Revenue Department, the State Forest Department after 2001 began providing technical and financial assistance through the Forest Development Agency (FDA) for the management of a sizeable number of Van Panchayats. Another approach being followed in Arunachal Pradesh is the Community Conserved Area (CCA) approach which is a conservation approach recognized by IUCN and CBD COP-7, and refers to natural and modified ecosystems that are voluntarily conserved by indigenous people and local communities through customary laws or other effective means, for their significant biodiversity, ecological and related cultural values (Box 20).

6.3
Payment for Ecosystem Services

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 Ecosystem Services (PES) of the standing forests of this region can be a better strategy to elicit participation of the local communities in conservation and adaptation efforts.

The hill communities and tribes of IHR living in and around forests have a long history of conservation and sustainable use of the forests. Their heavy dependence on forests for fuel, food, timber, subsistence and livelihood might have forced them to adapt to lifestyles and institutional arrangements that would have helped such efforts. This forest wealth not only catered to requirements of the inhabitant communities but also provided the necessary

Policy on Payments for Ecosystem Services (PES) in Himachal Pradesh 2013

The Himachal Pradesh government has notified a state PES model to protect and manage natural resources for sustained production of ecosystem services, addressing the impacts of climate change on such services, and for generating additional economic incentives to the communities for conserving natural ecosystems. The policy objectives are as under:.

• To provide a sustained flow of ecosystem services.
• To facilitate an interface mechanism between ecosystem service generators and users.
• To incentivize ecosystem service generators for ecosystem conservation for incremental and continued flow of ecosystem services.
• To enable the PES programme in the state by identifying the necessary elements.
• To adopt an ecosystems approach in decision making.
• To enable experimentation and pilots that inform and refine ecosystem service approaches.

Source: http://hpforest.nic.in/files/PES_Policy%20 Notification-5-11-2013.pdf

ecosystem service flows for the development of economy and civilizations outside the IHR. Today, the sustenance of these flows, to meet the growing demands of increasing population and economy, requires more concerted efforts by local communities which entail trade-off with their developmental aspirations. Therefore, provision of incentives or compensation mechanisms to support conservation and perpetuity of service flows to mark acknowledgement of community contributions is a must. Payments for Ecosystem Services and recognition of Forest Rights are some of the appropriate practices being used to support the communities which maintain or contribute towards the improvement of such ecosystem services (Box 21). The PES is used to promote community-based ecosystems' management through incentives to community organizations/ panchayats for protection and enhancement of forest lands.

7

Monitoring Networks

The Himalayan ecosystem is vital for the ecological security of the Indian landmass. Therefore, it requires careful monitoring to develop a scientific basis for ascertaining their evolution and the changes occurring over time. The key areas for monitoring are presented in Box 22. Among the identified areas under physical systems, the Himalayan glaciers, on account of their proven sensitivity to climatic perturbations and the value of their downstream ecosystem services, deserve priority attention (Box 23).

In the IPCC Fourth Assessment (2007)13 the entire Himalayan region, in terms of climate monitoring, has been described as a 'data deficient' area. To address the above issues, long term weather monitoring is needed across the Himalayan region (Box 24). The government of India has also initiated weather and glacier monitoring programmes such as the Himalayan Glaciology Programme (HGP) under DST since 1986 and Integrated Himalayan Meteorology Programme (IHMP) of the IMD since 2012 (Box 25).

> Box 22
>
> ## Key Areas for Monitoring Himalayan Ecosystems
>
> **a. Physical systems**
> - Snow and glaciers (glacial and 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, and land cover changes.
> - Energy systems (alternate energy and energy use & efficiency)
>
> **b. Biological systems**
> - Critical habitats (ecotones, wetlands, alpines, etc.) and species (native, endemic, RET categary and economically valuable, etc.).
> - Ecosystem structure, diversity, and resilience.
> - Ecosystem functions (including carbon sequestration and water relations).

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[13] *IPCC (2007) Climate Change 2007; The Scientific Basis, Working group I contribution to the Intergovernmental Panel on Climate Change Fourth Assessment Report. Cambridge University Press.*
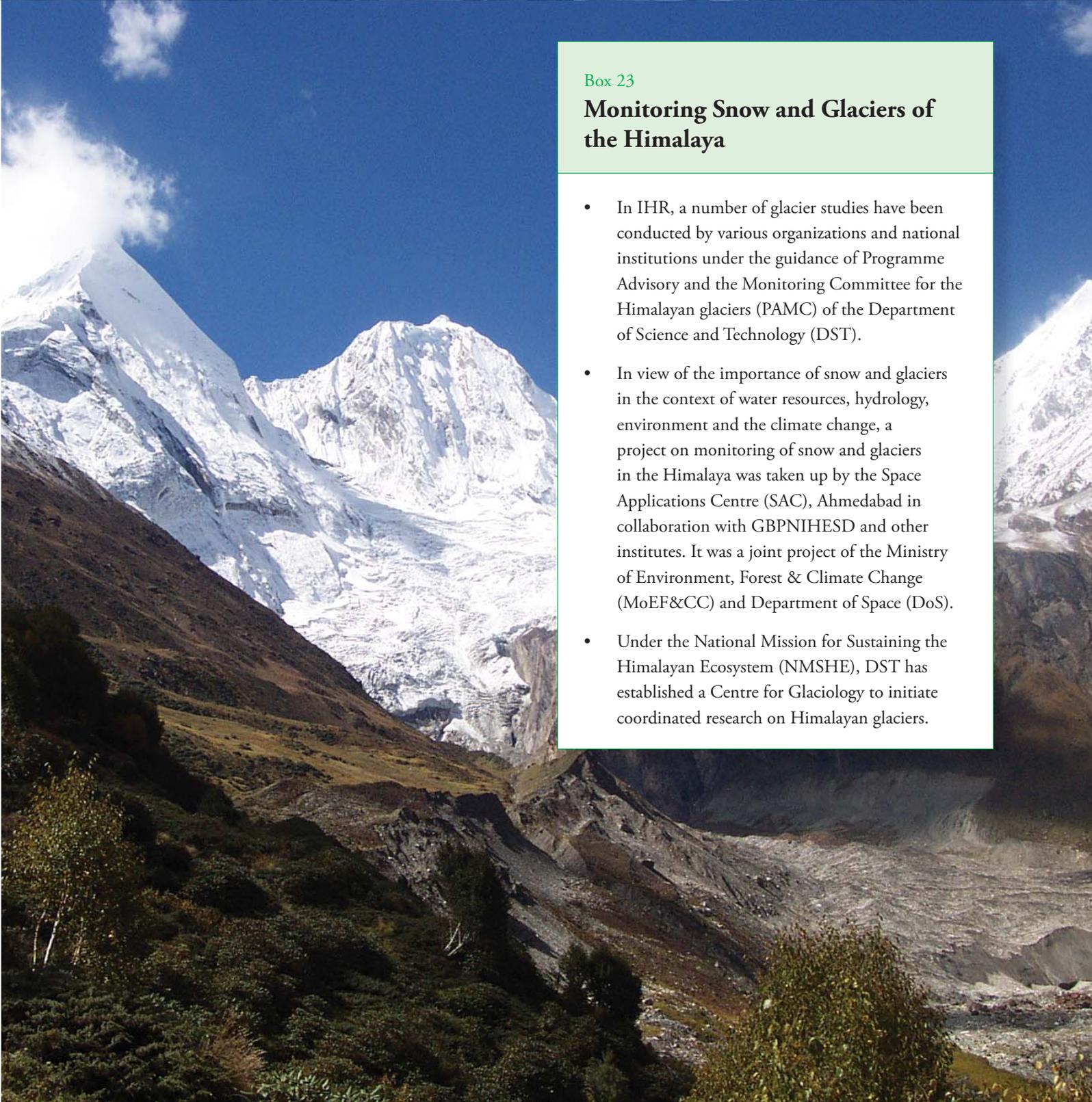
Monitoring Snow and Glaciers of the Himalaya

- In IHR, a number of glacier studies have been conducted by various organizations and national institutions under the guidance of Programme Advisory and the Monitoring Committee for the Himalayan glaciers (PAMC) of the Department of Science and Technology (DST).

- 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 in collaboration with GBPNIHESD and other institutes. It was a joint project of the Ministry of Environment, Forest & Climate Change (MoEF&CC) and Department of Space (DoS).

- Under the National Mission for Sustaining the Himalayan Ecosystem (NMSHE), DST has established a Centre for Glaciology to initiate coordinated research on Himalayan glaciers.

Monitoring with Weather Profilers

The GBPNIHESD in collaboration with the CSIR 4th Paradigm Institute for Mathematical Modelling and Computer Simulation (C-MMACS), Bengaluru installed four 32m permanent meteorological towers at the GBPNIHESD headquarters at Kosi-Katarmal (Almora, Uttarakhand) and its units at Kullu (Himachal Pradesh), Srinagar (Uttarakhand), and Pangthang (Gangtok, Sikkim). These weather monitoring facilities are providing continuous real-time weather data, and net carbon exchange between the atmosphere and the vegetation underneath for the Himalayan region.

Box 25
Monitoring of Surface Data under IHMP

In view of the importance of surface and upper air observation systems in Himalayan regions for weather forecasts and warnings, mountain meteorological services, army operations, agriculture, tourism, power generation, water management, hydro-meteorological hazards preparedness, and risk reduction planning, Integrated Himalayan Meteorology Project (IHMP) involving an investment of 300 crores for the period 2012-17 has been implemented. The project is being run by India Meteorological Department (IMD) and it aims to: a) improve and upgrade mountain weather and climate monitoring and forecast services over the Himalayan region through establishment of additional and critical state-of-the-art surface and upper air observatories for generating real-time observations; b) interface the Indian side observational network for integration with those of neighbouring countries in the Himalayan region for a comprehensive analysis of mountain weather phenomena; c) establish a robust mechanism to exchange scientific analysis-based meteorological information towards the holistic Himalayan development through customized weather, climate, hydrological, ecological and environmental services; d) develop enhanced understanding of weather and climate processes over complex Himalayan terrain and render quality forecasting services; e) build improved understanding of physical processes along with rapid intensification of valley scale high impact weather phenomena leading to heavy rainfall, snowfall, cloudbursts, flash floods, avalanches etc. towards the development of early warning systems; and f) develop exclusive Himalayan climatology database for the region to capture the significant climate variability indices to meet the requirements of all the users.

Source: http://moes.gov.in/programmes/integrated-himalayan-meteorology
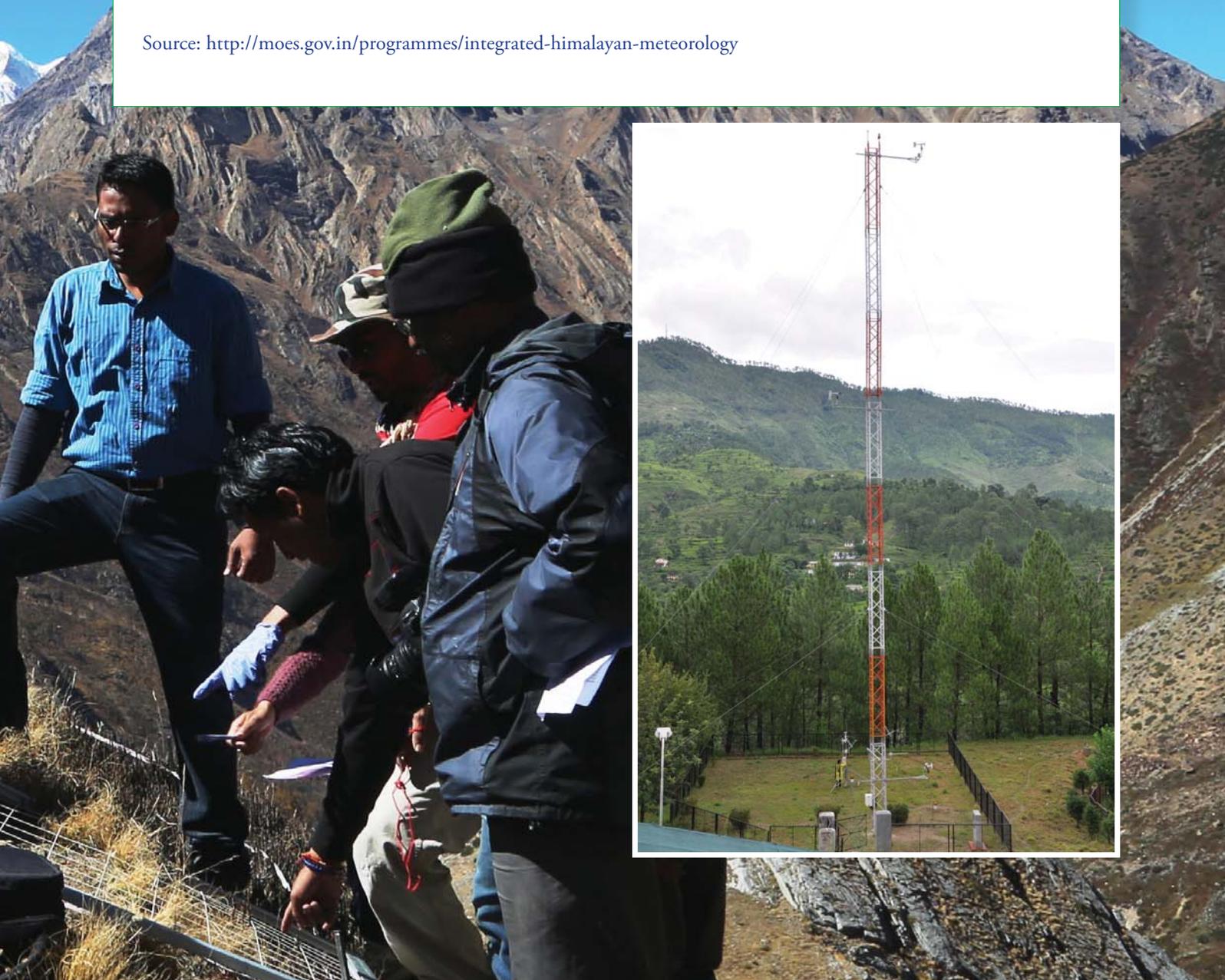
Infrastructure Development: Integration of New Approaches

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). The government of Himachal Pradesh has set up the 'HP State Knowledge Cell on Climate Change' (HPKCCC) under NMSHE for various climate change related functions including ideal Himalayan habitats. The Smart City Mission has been launched by the government of India in 2015 with the aim of promoting cities that provide core infrastructure and give a decent quality of life to its citizens, a clean and sustainable environment and application of 'Smart' solutions (Box 27).

8.2
Ecologically Safe Roads and Green Roads

Roads are the only viable means of transportation and an important infrastructure for economic development in mountain regions. But the construction and maintenance of roads in IHR is often challenged by its topography, fragile geology and the adverse climatic conditions. The development of conventional roads often causes landslides and deforestation, increases slope instability, air pollution and deterioration of ecosystems. The concept of 'Green Roads' provides an appropriate eco-friendly solution to environmental problems. This technology is based on the philosophy of promoting energy efficiency and minimum disruption to existing vegetative cover and reutilisation of the excavated/ construction material. The stabilization of roadside slopes, reduced soil erosion, off-farm employment opportunities, and less transportation cost are the other associated advantages. Recognizing the importance of

> ### Box 26
> ### Ideal Himalayan Habitats
>
> The ecological fragility of the IHR, requires promotion of concepts like 'Ideal Himalayan Habitats'. Such concepts would evolve from multi-dimensional thinking, and formulation and implementation of holistic plans. The environmental action plans for such habitats should emphasize on self-sustenance of such systems which should be based on considerations relating to landscape aesthetics, waste recycling, organic production/ produce, enhancement and maintenance of ecosystem functions and processes, pollution abatement and control, renewable energy, health infrastructure, building codes, parks and forests, institutions promoting participatory development and woman empowerment. 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 a region's cultural diversity and prevailing indigenous knowledge.

'green roads' in IHR states, a few initiatives have been undertaken (Box 28).

These initiatives aim to achieve sustainable development by harnessing the socio-economic and environmental benefits of Cold mix technology for rural and state roads,

Box 27

Smart City Mission (SCM)

A total number of 100 smart cities have been distributed among the states and union territories on the basis of equitable criteria. All IHR states will have at least one city identified under the Mission for development as a Smart City. Thus far Sikkim has received Rs 2.00 crore as advance for preparation of a Smart City proposal under SCM guidelines with respect to Namchi Municipality.

Source: http://smartcities.gov.in/oms.htm

and help the country benefit from the prospective earning of carbon credits under the CDM mechanism. There is also a need for development of multiple alternate routes of mass transport like railways and ropeways and enforcing fuel quality standards and clean filters, especially for diesel vehicles. The ropeways are useful alternatives to roads in steep, short stretches. Guidelines for hill town planning and architectural norms, and that related to ecological safe roads are compiled in Annexures V & VI.

Box 28

Green Infrastructure Initiatives

- The government of India has taken a new initiative towards sustainable development called 'Green Highways' and framed a policy named 'Green Highways Plantation and Maintenance Policy-2015'. The major components of the policy include -
- ❖ Development of green corridors which would not only sustain biodiversity and regenerate natural habitat but also benefit all stakeholders, from road users to local communities and spur eco-friendly economic growth and development.
  - ❖ Development of eco-friendly national highways with participation of the community, farmers, NGOs, private sector, institutions, government agencies, and the forest department.
  - ❖ Reduction of air and noise pollution through planting trees and shrubs along the highways, which would act as a natural sink for air pollutants and be noise absorbent.
  - ❖ Employment generation for local people through their involvement in planning and maintenance.
  - ❖ Soil erosion control along embankment and slopes.
- The 'green road' building norms have been included in the Himachal Pradesh and Sikkim SAPCC. On 10th October, 2015, the Assam Public Works Roads Department (PWRD), in association with Central Road Research Institute, New Delhi, and Bitchem Asphalt Technologies Limited, launched a 'Green Roads Mission' for the state.

Source: http://www.indiaenvironmentportal.org.in/files/file/Green%20Highways%20%28Plantation%20&%20Maintenance%29%20Policy-2015.pdf

9

Disaster Risk Reduction

The geologically fragile Himalaya is vulnerable to hazards and disasters. Unscientific developments associated with urbanization, growth of infrastructure, development of road networks, commissioning/ implementation of hydropower projects, deforestation, mining and overexploitation of natural resources are the major anthropogenic threats that have exacerbated the hazards and disaster vulnerability of the region. Now, climate change has further aggravated the hazard and disaster risks in the IHR. The events in recent years e.g. the earthquake of Sikkim (Sept 2011), Kedarnath tragedy and the aftermath (June 2013), floods in Kashmir (2014), and increasing incidents of cloudbursts are telltale examples of the area's active tectonics, inherent fragility and the likely scale and dimension of risk to life and property possible under climate change enhanced events. The impact of these disasters is further aggravated due to poor environmental governance and weak disaster preparedness in the region. The recent earthquake in adjoining Nepal in 2015 also provides learning as to how the cluttered urban growth can increase the fury of the havoc. The forest fire is another man-made hazard which causes heavy damage to the precious forest wealth and flora and fauna of the region every year. Of late, the trend of hazards across IHR has changed; floods/ flash floods have now emerged as the most dominant type of hazards occurring in the region. The institutional framework to deal with (combat/ mitigate) disaster (Box 29) has been fully implemented in the country and across the IHR. The traditional knowledge of communities, related to use of natural resources, and risk aversion practices, is very crucial for hazard reduction.

Climate change (CC) has increased the susceptibility of IHR to hazards. The impacts of 'Climate plus change' are becoming manifest in terms of: a) rapid hazards

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Box 29

DRR - Governance Issues and Developments

- Creation of institutional structures i.e. National Disaster Management Authority (NDMA), State Disaster Management Authority (SDMA), and District Disaster Management Authority (DDMA) for disaster management.
- Incorporation of disaster risks accounting in development planning and SAPCCs for IHR.
- Early Warning Systems, effective disaster communication and information systems.
- Enforcement of developmental codes and prohibiting development in eco-sensitive zones.
- Prioritisation of areas/ regions/ states/ districts in terms of hazard vulnerability and development of mitigation and risk reduction strategies / actions.
- Rescue, relief and post-disaster management.
- Awareness and Sensitization.
- Exploring science, policy and practice connect for DRR planning and policy solutions i.e. using scientific evidence-based research in disaster risk reduction planning and policy formulation/ uptake.
- Negotiating trans-boundary links of hazards/ disasters through conventions and agreements (Regional Conventions).
- Development of database requirements, institutional coordination and roles.
- Using the DRR experiences of other mountain areas/ countries for IHR.

such as flash floods, and b) slow onset hazards such as melting of glaciers, drying of wetlands and springs, loss of biodiversity/ agro-biodiversity and associated knowledge base etc. For proper addressing of this vulnerability and prioritisation of mitigation/ adaptation action, a suitable framework for vulnerability assessment/ analysis is required (Box 30). The frameworks that are tried in the Himalaya vary with regard to these issues; there is also no definite consensus with regard to minimum scale of assessment, data needs, time/ horizon of planning, and the output type i.e. index-based or Decision Support System (DSS) type. The deficiency of data is another problem that plagues the process, adversely affecting the projections.

Disaster management has been institutionalised at the state level (Box 31) through creation of district and state level institutions, defining of roles and responsibilities of state line departments, creation of disaster response and mitigation funds, and handling of disaster management with a proactive prevention, mitigation and preparedness-driven approach. In IHR states, various capacity building and awareness exercises are being conducted for: a) enhancement of capacities of disaster management committees, b) search, rescue, and first aid trainings, c) implementing standard operating procedures and knowledge of best practices, d) hosting of disaster-specific seasonal and earthquake related regular mock drills for disaster preparedness, e) spreading of awareness through

rallies, mass meetings, programmes at school/ college levels and distribution of IEC material through government sponsored and UNDP funded programmes.

The importance of community based disaster management has been widely acknowledged in all IHR states and is being promoted through various programmes; the guidelines in this context are given in Annexure VII.

Box 30
Vulnerability Frameworks in Use

Currently in IHR, two types of frameworks are being used on trial basis/ as pilot studies to address climate-related vulnerabilities and risk assessments:

- Indian Himalayas Climate Adaptation Programme (IHCAP) Framework of SDC which uses exposure, sensitivity and adaptive capacity as input parameters for vulnerability assessment and also includes features of traditional framework, and is compliant to use of proxy indicators, and knowledge of existing studies for vulnerability assessment.

- Himalayan Climate Change Adaptation Programme (HICAP) Framework of ICIMOD, which relies mainly upon poverty-vulnerability assessments-based, mountain-specific multidimensional livelihood vulnerability index.

Box 31
State Initiatives on DRR

- In Sikkim, the building standards/ regulations for this purpose are derived from various laws pertaining to planning and development of various states. Efforts are also being made to ensure construction of new buildings with natural hazard-safe engineering measures, and the retrofitting of the old buildings in public and private sectors.

- In Himachal Pradesh, the relevant regulations in bye-laws warranting amendments are being revisited and modified, and also include provisions for periodic review for identification of safety gaps related to seismic, flood, and landslide disasters.

- National School Safety Project is being implemented by National Disaster Management Authority (NDMA) in different schools in all 12 IHR states. This is a demonstration project to promote a culture of safety in schools by initiating policy level changes, capacity building of officials, teachers, students and other stake holders by undertaking information, education and communication activities, promoting non-structural mitigation measures and demonstrating structural initiatives in a few schools.

CONCLUSION & OVERARCHING ISSUES

Ecosystems are important as they provide goods and services and therefore, contribute towards economic development. The Himalayan ecosystems are vital for their forests, biodiversity, water resources, hydropower potential, and aesthetic and cultural relevance which not only contribute towards subsistence of inhabitant societies and growth of the local economy, but also support the sustenance and growth of downstream civilizations and economies. The mountains and forests also provide a service by facilitating climate moderation in the subcontinent by absorbing atmospheric carbon dioxide, which mitigates global warming. These ecosystems are highly vulnerable due to their inherent ecological and structural fragility, factors and threats related to hill specificities, overexploitation of resources, climate change, and impacts of trans-boundary pollution. The poor or complete absence of environmental governance is also a major factor responsible for their degradation. The important governance problems pertaining to the sustenance of Himalayan ecosystems relate to institutional issues, unscientific development and exploitation of resources, poor enforcement, non-acknowledgement of IHR's ecosystem values, lack of incentive mechanisms for ecosystem conservation, void in trans-boundary effects and agreements, lack of climate and hazard-proof developmental planning, conservation/ management guidelines, awareness building and promotion of good practices. Therefore, the governance for Himalayan ecosystems is complex and needs a holistic and multipronged approach, with due consideration of cross-sectored linkages and participation of stakeholders at all levels. The best practices and guidelines are the initiatives that can be practiced and implemented at the local levels and micro-scales.

This revised edition of G-SHE provides a compilation of suitable guidelines and practices that have been prescribed for/ implemented in or can be of potential use for guiding resource conservation and use across the different sectors of economy in the IHR. It also contains the new issues and challenges that the IHR is confronting and provides short descriptions of the government initiatives for conservation or governance for sustaining the Himalayan ecosystems. In this context, a new chapter on Disaster Risk Reduction has been included, and a brief description of Himalaya-specific missions such as NMSHE and NMHS initiated to support science, policy and practice connect has been given. In addition, some new policies, guidelines, initiatives such as National Water Management Policy, Solid Waste Management Policy, Swachh Bharat Mission, Smart Cities, CBDM/ CBDRM guidelines etc. have been added to this edition. An attempt is also made to suggest the roadmap for the implementation of G-SHE by different stakeholders (Annexure VIII).

The MoEF&CC jointly with GBPNIHESD aims to revise the contents and scope of G-SHE regularly to make it more broad- based and updated. We expect that the best practices and the guidelines of the G-SHE be replicated/ implemented with the support of state governments across the IHR for better sustenance of the Himalayan ecosystems.

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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 Himalayas 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 different composition of waste from the hill towns to the expedition tops is essential. The nature and extent of solid waste will help in identifying the waste source/type and individuals responsible for waste problem.
- Energy driven 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 the waste management problem: Refuse waste prone commodities, Reuse once discarded commodities for other uses, Reduce through segregation into broad categories – biodegradable and non-biodegradables 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.
- Awakening and capacity building of the stakeholders like urban/ rural dwellers, municipalities, tourists, trekkers and expedition members in promoting the suggested management plan in a particular geographic region would help a lot in managing the waste in the Himalaya.

Regulating Tourists and Pilgrimage to Sensitive Areas

- Pilgrimage tourism in the Himalayas 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 accommodations in the pilgrimage sites need 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 Himalayas, 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 the Himalaya with a provision for some earnings for the villagers 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 e.g. the Gangotri glacier, should be regulated and limited.
- Pilgrimage tourism is a kind of 'economy class' tourism in the Indian Himalayan Region since most pilgrims generally belong to the 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 the 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. norm.

Promoting Ecotourism and Regulation of Commercial Tourism

- 5-Star approach with respect to the hospitality industry should be replaced by a 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 the youth and rural women should be involved in ecotourism.
- Restriction should be placed in terms of visitors per day/ per group to the ecotourism sites in order to minimise 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 entries of vehicles should be imposed in sensitive ecological sites.
- Funds raised should be used for base resource, ecotourism elements conservation, and education and awareness campaigns for visitor/ host community sensitisation.
- 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 the tourist experience in order to ensure that most of the 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 expeditions 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 and availability of facilities should be set up, which should also provide the facility of online requests, 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 groundwater 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 the Institute of Hydrology and BARC should be used to map the water sources and prevent the location of construction activities that could damage or adversely affect such sources.
- There should be engineering measures to protect the 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 and 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 the 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 the future in urban areas should have provision for rooftop rainwater 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:

  Provided that 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, rainwater harvesting should be undertaken through such structures as percolation tanks and 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.
- Groundwater aquifer recharge structures should be constructed wherever such structures do not lead to slope instabilities.

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 a slope above 300 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 slopes between 100 - 300 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 the 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.

Ecologically Safe Roads

- For construction of any road in the Himalayan region of more than 5 km length (including extension/ widening of existing roads) 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 bioengineering 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 an appropriate manner at suitable and identified locations so as to not affect the ecology of the area adversely; further, the dumped material should be treated using bioengineering 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 a proper overall 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 roadside 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 bioengineering 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 landslide 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 minimise the associated risks.
- Notice should be given about all fault zones and landslide 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.

Community Based Disaster Risk Management

- Undertaking groundwork within government agencies working at village, block and district levels to explore possibilities for CBDRM to occur and flourish. This includes the analyses of administrative and financial environments within national, state and local governments.
- Selection of communities through risk assessment by identification of vulnerable community and venue of risk reduction actions.
- Building rapport and understanding community priorities to gain trust and confidence of the community to understand their needs and capacities.
- Participatory disaster risk management planning to evolve and plan a risk management strategy through constructive dialogue with selected community.
- Community-managed implementation of risk reduction measures for implementing a CBDRM programme within a selected community/ communities
- Community-based participatory monitoring and evaluation (usually community devised) to measure progress of risk reduction measures and follow-up actions for improved management.
- Ensuring of establishment, strengthening, and sustenance of community level organization mechanism for implementation of CBDRM by involving the local residents in the community.
- Preparation of community hazard vulnerability capacity map (HVCM) to form a basis for community-based disaster risk reduction and community learning.

Road Map for Implementation of G-SHE

Sl No.	Stakeholder/s	Suggested action in different stages	Identified Agency for action	Expected outcome
1.	State Governments from IHR	Stage 1: Letter to all CS from Secretary DST to identify Nodal Officer (ex. Officio)	MoEF&CC/ DST	Identified Nodal Officer
		Stage 2:Organizing the structured meetingof all nodal officers	MoEF&CC/ DST through identified support agency	Framework for state specific action plan for implementation of G-SHE guidelines
		Stage 3: Submission of action plan by Nodal officers of IHR states	Nodal Officers of states	Actionable areas of guidelines with resource requirements for implementation New areas for R & D in states
		Stage 4: Evaluation of the Action Plan and acceptance for implementation	Expert Committee	Operationalization of G-SHE guidelines by states
		Stage 5: Progress monitoring and evaluation	Steering/ monitoring Committee	Implementation of G-SHE guidelines
2.	Central Ministries	Stage 1: Communications at the Secretary level with relevant ministries	Mountain Division at MoEF&CC/ DST	Identification of nodal officers from Ministries representing different sectors
		Stage 2: Discussion meeting of the nodal officers	Mountain Division at MoEF&CC/ DST	Present status and agenda for facilitation of policy changes with mountain perspective
		Stage 3: Sector wise meet with central and state nodal officers	DST/ MoEF&CC	Areas of policy support needed from the Centre
		Stage 4: Progress monitoring and feedback	Steering Committee	Policy changes with mountain perspectives
3.	Research Community	Stage 1: Establishment of technical secretariat for implementing G-SHE at GBPNIHESD	DST/ MoEF&CC/ GBPNIHESD	Facilitation of technical support to states for G-SHE implementation
		Stage 2: Making the Technical Secretariat functional and updating of G-SHE	GBPNIHESD/ Mountain Division	Creation of technical support group and database with partner Institutions, monitoring protocol for G-SHE, updated G-SHE
		Stage 3: Establishment of linkages with IHR states-meetings /communications	GBPNIHESD/ Mountain Division	Network of agencies for transfer of information and feedback and monitoring
		Stage 4; Feedback to DST/ MoEF&CC on progress	GBPNIHESD/ Mountain Division	Status paper/ report on G-SHE implementation
4.	Mountain Community	Stage 1: Planning for mass awareness campaign	DST/ MoEF&CC with identified support agency	Strategy and action points Identification of mode and agencies
		Stage 2: Implementation of awareness program	DST/ MoEF&CC with identified support agency	Organisations of citizen yatras, media campaigns, student awareness programs, etc.
		Stage 3; Feedback to DST/ MoEF on progress	Support agency	Assessment report on awareness about G-SHE implementation

Appendix I
List of Select Institutions Working in IHR

S.N.	Institution
1	Ashoka Trust for Research in Ecology and the Environment (ATREE), Bengaluru, karnataka
2	Botanical Survey of India (BSI), Kolkata, West Bengal
3	Central Potato Research Institute (CPRI), Shimla, Himachal Pradesh
4	Central Institute of Temperate Horticulture (CITH), Srinagar, Jammu & Kashmir
5	Central Soil and Water Conservation Research & Training Institute (CSWCRTI), Dehradun, Uttarakhand
6	Central University, Himachal Pradesh / Jammu & Kashmir
7	Central Himalayan Rural Action Group (CHIRAG), Nainital, Uttarakhand
8	Defence Research and Development Organisation (DRDO), New Delhi
9	Forest Research Institute (FRI), Dehradun, Uttarakhand
10	Forest Survey of India (FSI), Dehradun, Uttarakhand
11	G.B. Pant National Institute of Himalayan Environment and Sustainable Development (GBPNIHESD), Almora, Uttarakhand
12	Geological Survey of India (GSI), Kolkata
13	High Altitude Plant Physiology Research Centre (HAPPRC), Srinagar, Uttarakhand
14	Hemwati Nandan Bahuguna Garhwal University, Srinagar, Uttarakhand
15	Indian Institute of Technology, Roorkee/Guwahati/Mandi
16	Institute of Bioresources & Sustainable Development, Imphal, Manipur
17	Institute of Himalayan Bioresource Technology (IHBT), Palampur, Himachal Pradesh
18	Indian Institute of Remote Sensing (IIRS), Dehradun, Uttarakhand
19	Jawaharlal Nehru University, New Delhi
20	National Bureau of Plant Genetic Resources (NBPGR), New Delhi
21	National Botanical Research Institute (NBRI), Lucknow
22	North Eastern Regional Institute of Water and Land Management (NERIWALM), Tezpur, Assam
23	North Eastern Region Community Resource Management Society (NERCRMS), Shillong, Meghalaya
24	National Institute of Technology, Jammu & Kashmir/Himachal Pradesh/Uttarakhand/Assam/Sikkim, Arunachal Pradesh/Meghalaya/Mizoram/Nagaland.
25	National Research Centre on Mithun (NRCM), Jharnapani, Nagaland
26	National Research Centre on Yak (NRCY), Dirang, Arunachal Pradesh
27	National Research Centre for Orchids (NRCO), Pakyong, Sikkim
28	National Research Centre for Mushroom (NRCM), Solan, Himachal Pradesh
29	National Research Centre on Coldwater Fisheries (NRCCWF), Bhimtal, Uttarakhand
30	North Eastern Hill University (NEHU), Shillong, Meghalaya
31	Rain Forest Research Institute (RFRI), Jorhat, Assam
32	Snow and Avalanche Study Establishment (SASE), Manali, Himachal Pradesh
33	State Forest Research Institute, Itanagar, Arunachal Pradesh
34	Vivekanand Parvatiya Krishi Anusandhan Sansthan (VPKAS), Almora, Uttarakhand
35	Wildlife Institute of India (WII), Dehradun, Uttarakhand
36	Wadia Institute of Himalayan Geology (WIHG), Dehradun, Uttarakhand
37	World Wide Fund for Nature (WWF) India, New Delhi
38	Meghalaya Rural Development Society (MRDS), Shillong

Focus	Geographical Coverage	Remarks
Ecology and Environment	All India & IHR	NGO
Forest Resources	All India Regional Offices in IHR	MoEF&CC
Agriculture	IHR	ICAR
Horticulture	IHR	ICAR
Soil and Water Conservation	IHR	ICAR
Natural Resource Conservation and Management	IHR	UGC
Community based Natural Resource Management	Uttarakhand	NGO
High Altitude Crop and Vegetables	IHR	MoD
Forest Resources	NW India	ICFRE (MoEF&CC)
Forest Resources	All India	MoEF&CC
Himalayan Environment and Development	5 Units in IHR	MoEF&CC
Geological Resources, Hazards, Natural Resource Assessment	All India, IHR	MoES
High altitute Plant Resources(MAPs & NTFPs)	IHR	HNB Garhwal University
Education and Research	Uttarakhand	Central University
Hydropower, Seismic-proof Housing, Mountain Water Resource and Hazards	All India and Mountain Focus	Autonomous
Biological Resources	NE Himalaya	CSIR
Biotechnological applications, Bioresources	IHR	CSIR
Remote Sensing (All resources)	All India & IHR	NRSA
Natural Resource Management	All India	Central University
Plant Resources	All India	ICAR
Biological resources	All India and Centres in IHR	CSIR
Land and Water Resources	NE India	MoWR
Resource Management and Poverty Alleviation in uplands	NE India	NGO
Natural Resource Management	IHR	MHRD
Mithun	NE India	ICAR
Yak	Eastern Himalaya	ICAR
Orchids	Eastern Himalaya	ICAR
Mushroom	All India	ICAR
Coldwater Fisheries	IHR	ICAR
Natural Resource Conservation and Management	NE India, IHR	Central University
Forest Resource	North Eastern Region	ICFRE (MoEF&CC)
Avalanche Control Measures	Western Himalaya	MoD
Forest Resources	J&K, Arunachal Pradesh	State of J&K, Arunachal Pradesh
Agriculture	IHR	ICAR
Wildlife/ PA Conservation & Management	Assam	MoEF&CC
Himalayan Geology	IHR, Unit in AP	CSIR
Nature Conservation, Threatened Species, Wetlands	All India, Centers in IHR	NGO
Rural Development	Meghalaya	State of Meghalaya

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

Notes

G.B. Pant National Institute of Himalayan Environment and Sustainable Development (GBPNIHESD)

G.B. Pant National Institute of Himalayan Environment and Sustainable Development (GBPNIHESD), previousely known as G.B. Pant Institute of Himalayan Environment and Development (GBPIHED), was established in 1988-89, 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, evolve integrated management strategies to demonstrate their efficacy for conservation of natural resources, and to ensure environmentally sound management in the entire Indian Himalayan Region. The Institute has headquarters at Kosi-Katarmal, Almora (Uttarakhand) and five units, namely, Himachal Unit at Mohal (Kullu, HP), Garhwal Unit at Srinagar (Garhwal, Uttarakhand), Sikkim Unit at Pangthang (Sikkim), North East Unit at Itanagar (Arunachal Pradesh), and Mountain Division at MoEF&CC, GoI (New Delhi).