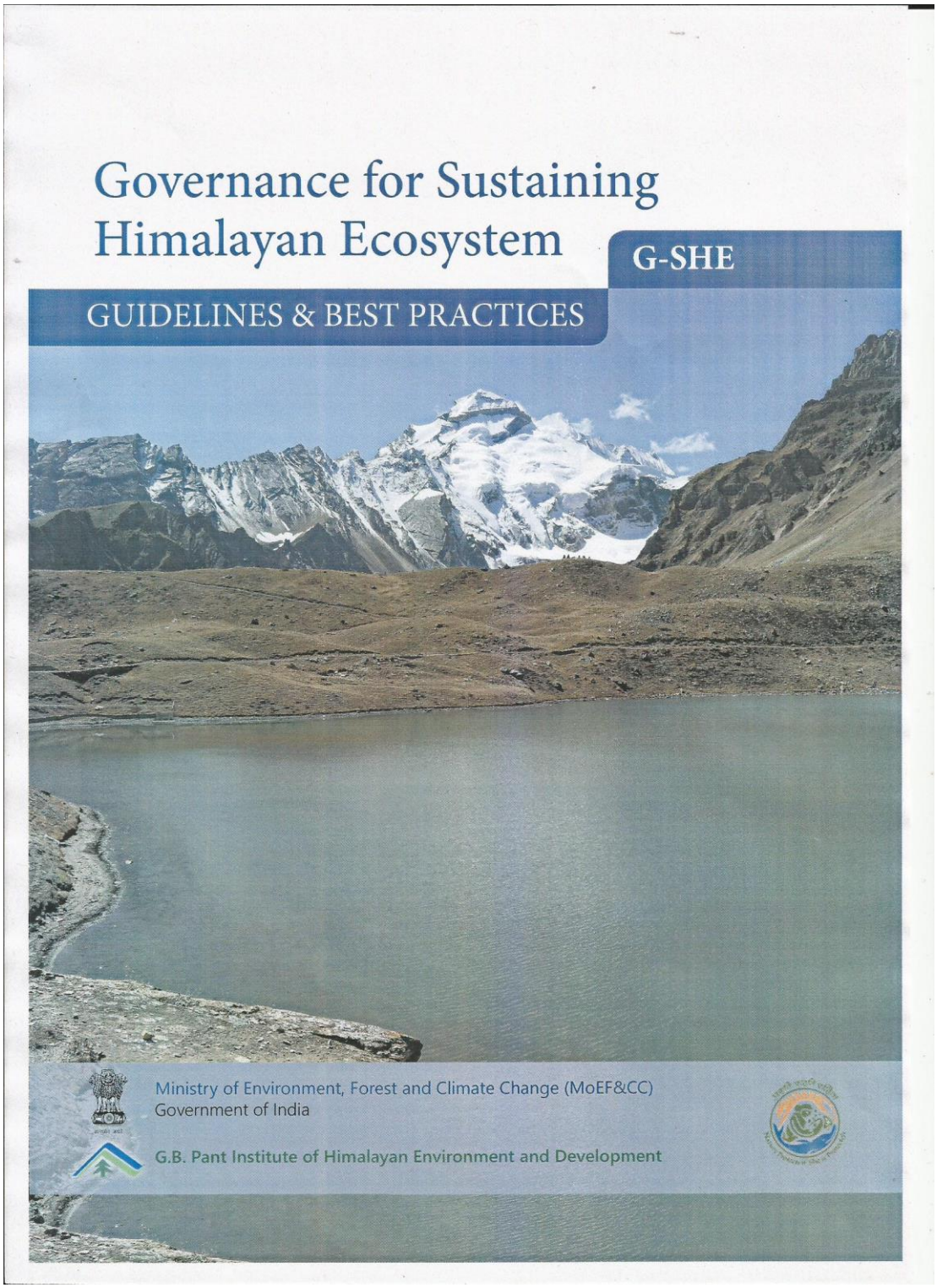
Please provide your comments to hsdf.gbpihed@gmail.com by Feb 26, 2016



Governance for Sustaining Himalayan Ecosystem (G-SHE)

(Guidelines & Best Practices)

A. 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, Tibet autonomous region of China covers an area more 3.44 million km^2 spread over Afganistan, Bangladesh, Bhutan, China, India, Mayanmar, Nepal and Pakistan. It stretches across a length of over 3000 km, from low laying valleys to an altitude of around 8848 m asl[1]. The Himalaya is characterized by 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 the diversity of human races, religions and cultures.

The Himalaya carries a strategic significance as a natural boundary between the countries and the Himalayan ecosystems contribute significantly towards the ecological and economic security of the countries it passes through. The Himalaya has a regional relevance as a climate regulator[2] and water tower of Asia; the interaction of orography of Himalayan landmass with Indian summer monsoon and East Asian monsoon generates huge amount of precipitation. It is also the largest depository and storehouse of snow and ice outside the two poles; the ten major rivers of the world originate and drain through the Himalayas, and the basin of these rivers are home of about 1.35 billion people[3] and more than 3 billion people benefit water supplies and food and energy produced with the water from these river basins[4]. The Himalayan ecosystems are rich repository of biodiversity which are characterized by richness, representativeness and uniqueness of its biodiversity elements from gene level to ecosystem levels[5]. A part of the region is also recognized as a global biodiversity hotspots and the biodiversity has contributed to development of a whole range of cultures, traditions, and the 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/ sediments and energy contributing to agricultural productivity of downstream lands, and opportunities for hydropower development.

Indian Himalayan Region - The Indian Himalayan Region (IHR) spans over 5.37 lakh km^2 (0.537 million km^2) between $21^o57'–37^o5'$N and $72^o40'–97^o25'$E and covers

[1] Bandhopadhyay J. Pandit Govind Ballabh Pant Memorial Lecture, GBPIHED (2013)
[2] Bioscience, 47: 735–745 (1997).
[3] Lamadrid and MacClune, (2010)
[4] http://www.icimod.org/?q=3487
[5] 2nd Pandit Govind Ballabh Pant Memorial Lecture, GBPIHED (1992)

nearly 16.2% of the total geographical area of the country (Figure 1). Administratively, the 10 states i.e. Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura, Meghalaya are fully covered in IHR, while West Bengal and Assam are partially covered including only the hill districts. The major statistics of IHR is depicted in Table 1.

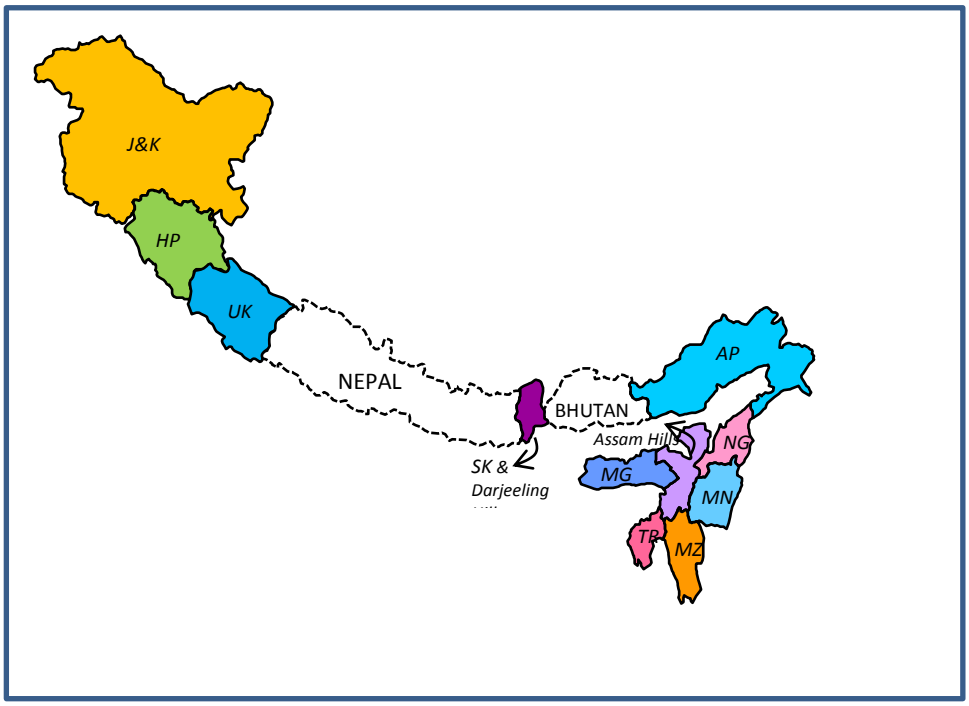


Figure 1. Map showing IHR States

[Including 10 states fully: AP- Arunachal Pradesh, HP-Himachal Pradesh, J&K - Jammu & Kashmir, MN- Manipur, MG- Meghalaya, MZ- Mizoram, NG- Nagaland, SK- Sikkim, TR- Tripura and UK- Uttarakhand, and 2 states partially i.e., hill districts of Assam and West Bengal]

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 uses to inhabitant and downstream populations and economies. Every year around 1,200,000 million m^3 /yr water flows through the Himalayan Rivers[6].

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

Table 1: Important features of States falling within IHR

Sl. No	States /Regions	Geographical area-GA (km^2) (year 2013)	Decennial Population (year 2011)	Sex ratio (2011)	Literacy rate (%)	Forest cover km^2 (% of GA) (year 2011)	Forest cover km^2 (% of GA) (year 2013)*	Decadal growth rate (2001-2011)
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; NIPFP; * India State of Forest Report, 2013)

The IHR has a rich forest cover and more than 41.5% of the geographical area of IHR is under forest representing one-third of the total forest cover in India and nearly half (47%) of the "very good quality" forest cover category 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 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 oils yielding medicinal plants, 279 species of fodder, and 155 sacred plants. The IHR harbours many Hindu shrines and places of tourism interest. It is 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, bio-diversity that flow from IHR are not only important to the people living in this region but also for those living downstream within and outside the country.

The sensitive and fragile Himalayan Ecosystems are now facing the threats of unscientific development and the 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 the development. In recent years, the incidences of recurring floods, landslides and forest fires causing huge loss to life, property and natural resources have become a regular phenomenon which poses 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. It has a great significance for livelihood and subsistence of the local population and survival and growth of the downstream civilizations and economies. In addition, the sustenance also has a trans-boundary relevance and link across the limits of national boundaries for supplemental service flows and climate risk mitigation.

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

The governance for sustenance, therefore, needs a holistic assessment of all the perspectives. At national level the sustenance efforts need recognition of relevance of Himalayan ecosystem for downstream economies, prevalent poverty in IHR, the outmigration, the susceptibility to disasters, climate risks & 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.

Box 1
NEP – Measures for the conservation of Mountains

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

Understanding the importance of Himalayan Ecosystem, the measures for the conservation of mountains and Himalayas have 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 envisages, among other things, a National Mission for Sustaining the Himalayan Ecosystem (Box 2a)[9].

[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

Recently, the Government of India has initiated a new Mission on Himalayan Studies (NMHS) to conduct focused studies in IHR (Box 2b).

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

Box 2a
The NAPCC & National Mission for Sustaining the Himalayan Ecosystem (NMSHE)

The NAPCC, which includes a comprehensive set of mitigation & adaptation measures, aims to promote nation's development objectives by integrating climate change perspective 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 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 organizations and panchayats for protection of forested lands.

Box 2b
National Mission on Himalayan Studies

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

B. Guidelines & Best Practices

1
Sustainable Urbanization in the Indian Himalaya

1.1 Sustainable Development of Hill Towns

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

Box 3

Smart City Mission

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 tourism point of view. With combine 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 livable 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

To resolve these crucial problems, amendments in building regulations combining different missions enacted by GoI for sustainable town planning, and advance location planning are necessary to protect the environment and achieve required economic development at the same time. Existing building regulations enforced in hill towns are mostly inspired from National Building Code, Delhi Master Plan/s and other Indian Standard (IS)[10], which are not appropriate in the context of hill towns. Therefore, holistic approach, which includes geo-environmental, developmental and technological aspects, is required to change existing in force building regulations and make them appropriate to the peculiar context of Indian hill towns (Box 3).

[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 year 2001 to 468 lakh in year 2011, the expansion of economic activities, influx of tourists, and intensive urbanization process in the IHR, have led to concomitant indiscriminate solid waste dumping and other waste such as e-waste. E-waste generation in the IHR states is around 10% of total e-waste of India, according to survey conducted by the CPCB in year 2005[11].

Due to an unregulated accumulation and recycling, problem of solid waste has become an instantaneous and long term apprehension which can lead to major environmental harms endangering human health.

BOX 4

Swachh Bharat Mission (SBM)

- 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 & Liquid Waste Management systems for overall cleanliness in the rural areas.
- Two IHR states Manipur and Meghalaya have been successful in managing more than 50% of total Municipal Solid Waste in the states under SBM.

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

To resolve the ill-effects of solid waste, GoI has launched an ambitious "Swatch Bharat Mission" 2nd October 2014, 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 focusing on the scientific management and disposal of municipal solid waste (Box 4). This mission has been implemented in the whole country including the IHR states. The most of Himalayan states lack any effective scientific solid-waste management plans, which is extremely threatening for the local environment and ecology.

[11]WEEE assessment study by the International Resource Group Systems South Asia Pvt. Ltd (IRGSSA), (m/s IRG Systems South Asia Pvt. Ltd), 2005.

For effective management of solid waste, many attempts have been taken so far under GoI enacted rule 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 Handing) Rules, 2011; E-Waste (Management and Handing) Rules, 2011; JNNURM SWM Toolkit 2012 as well as state/local legislations such as solid waste management in Shimla (HP), banning the use of plastic in few states (i.e. HP, UK, Sikkim, Tripura), the Door to Door Garbage Collection Bye-laws (MC Shimla)-2006 (Box 5); the Uttarakhand Plastic and other Non-Biodegradable Garbage (Regulation of Use and Disposal) Act, 2013.

BOX 5

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

Some of the salient feature covered under the Bye-law includes

- Prohibition to throw degradable garbage in public drains and sewage.
- Restriction or 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 of local authority or competent authority for removal of non-biodegradable garbage or non-biodegradable material from private properties.
- Studies, research and support programme.

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

BOX 6

Ban on Plastic in Himachal Pradesh (HP) and Uttarakhand

- The HP state government has taken a cabinet decision to ban plastic altogether in entire state from 15th August, 2009[1] with thickness less than 75 microns consequent to the HP Non-Biodegradable Garbage (Control) Act, 1995 and latest Notification on Plastic Waste (Management & Handling) Rules, 2011.
- Uttarakhand enacted the Uttarakhand Plastic and other Non-Biodegradable Garbage (Regulation of Use and Disposal) Act, 2013 in order to regulate the use and disposal of plastic and other non-biodegradable garbage in the state.
- The Uttarakhand high court has banned the use of polythene bags in Nainital district and ordered that Rs 500 fine be imposed on anyone found using it from 15th July 2014.
- The MC Shimla through Himachal Pradesh Non- Biodegradable Garbage (Control) Act, 1995 has also made a provision of fine ranging from Rs. 500 to Rs. 5000 for creating nuisance by littering of garbage.

Source: http://himachal.nic.in/environment/notifications.htm; http://timesofindia.indiatimes.com/city/Dehradun/Nainital-to-be-polythene-free-by-July-15-HC

For the sustainable management of solid waste, some important local practices have been also taken in hill state: (i) Door to Door (D2D) garbage collection schemes in few cities (i.e. Shimla, Dehradun & Agartala) (Box 5). This demonstrates the zero tolerance attitudes to pollution caused by plastic in the Hill States (Box 6). Realizing the growing

concern over e-waste, the GoI also supported several initiatives. The guidelines for e-waste collection, transportation, recycling and disposal have brought out in March 2008[12] by the MoEF&CC and the CPCB, which has become effective from 1st May, 2012. Waste to energy is actively promoted by the Ministry of New and Renewable Energy (MNRE). There is a potential of about 1700 MW from urban waste (1500 from MSW and 225 MW from sewage) and about 1300 MW from industrial waste. Waste to Energy (WtE) provides a solution towards complying with government regulations, and achieving integrated solid waste management.

[12] 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)

2
Tourism and Ecotourism

2.1 Tourism and Pilgrimage in Sensitive Areas

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

Many other tourist places are also located in the Himalaya for commercial tourism. These are thickly forested areas with rich biodiversity and scenic beauty for the nature tourist. But, unfortunately, most of these places lack adequate facilities of transport, accommodation, waste disposal and other amenities for 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 concept of the carrying capacity, for growth of sustainable pilgrimage and commercial tourism in the region. In this context, draft tourism policy-2015 and state level policies and guidelines have been formulated.

2.2 Ecotourism and Regulated 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[13].

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

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 fragile ecosystem of Himalaya. In year 2011, the Ministry of Environment and Forest (MoEF)[1] 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 prioritized several ecotourism projects in the various parts of their states. The community based ecotourism have been recommended as the most viable sustainable alternatives to the presently practiced commercial tourism; further, a variety of activities that encourage and support a wide range of objectives for socio-economic development and conservation are also described (Box 7). Local communities are encouraged to participate in the ecotourism activities. In addition, the whole mountain range of the northern India along with the snow-clad slopes, forests and rivers have also become important attractions for eco-tourists. Apart from this, some of the most prominent forms of ecotourism include wildlife tourism, agro tourism, and village tourism and so on. In this respect, there are many activities at various levels that assure the future of ecotourism in the IHR states. The approach to

Box 7
Major initiatives for community based ecotourism

- The major initiatives taken Uttarakhand state to promote community based eco-tourism include Home Stay at Bhakrakat, Tolma, Agora, Lata, Chotti-Haldwani; Village Camp Kyari- Kyari Village; Chipko Trail at Reni Village, Jim Corbett Heriatge Trail, Boar Canal Trail and Brahm Booboo Trial; Folk Music, Cultural Exchange, Village, Bird Watching at Rampur Mandi, etc.
- Assam Govt. has initiated Home Stay with Missing Tribe-Majuli Island - La Maison De Ananda, Manas National Park and Potasali Nameri Eco-Cam.
- Similarly other NE states like Arunachal Pradesh has started Home Stay with Monpa Tribe, Meghalaya has initiated Tree house and Tribe home Stay with Khasi Tribe at Mawlynnong, and Nagaland has built Tourist Cottages with Angame Tribe.

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

Box 8
Ecotourism Activities in IHR States

- Development of 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 TAAS, local orgs, and communities for biodiversity, conservation and income generation).
- Submitted a proposal for inclusion of Khangchendzonga Biosphere Reserve with area 2619.92 km^2 in the World Network of Biosphere Reserve under UNESCO-Man and Biosphere Program to the MoEF on 17th August 2011.

*Source: E*nvironment & wildlife Management Department, Govt. of Sikkim.

promote ecotourism in Sikkim and Assam is a good example in IHR state (Box 8). Further, immense opportunities for adventure cum ecotourism in the Himalayan region could be harnessed through community involvement. Linking of tourism with initiatives like Rural Business Hubs (RBH), as introduced in North East region, which envisages promotion of quality rural products like handloom, handicrafts, agro products, herbal products, bio-fuel, etc., may be considered as yet another aspect of promoting eco-tourism in the IHR.

2.2.2 Regulation of Commercial Tourism

The mass tourism, commercial type or pilgrimage related, is going to be 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. One of the sustainable ways is to deal with mass tourism in a regulated way (Box 9). 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 curtailing the vehicular influx, related traffic jams, and noise & air pollution in tourist areas. A few successful initiatives from the region (e.g. Ladakh initiative) have exhibited the potential of implementing the concept of 'Himalayan Homestays', which links cultural and natural heritage conservation through a commitment to reliability, protection and sensitive interpretation of local culture and nature heritage values. Such initiatives need to be promoted across the IHR.

Box 9
Regulation of tourism in Rohtang Pass

The Hon'ble National Green Tribunal (NGT) has imposed a complete ban on commercial activities including paragliding, snow scooter ride and horse-riding at Rohtang Pass and its adjoining areas. It has limited the commercial activities, passing of vehicles on the Rohtang Pass, located 52 km from Manali in Kullu district and much frequented by tourists, to check environmental degradation. Initially, the tribunal had banned all types of tourist vehicles. Later, it relaxed its order till November 30, limiting the entry of diesel and petrol tourist vehicles to the Rohtang Pass to 1,000 per day.

Source: http://www.greentribunal.gov.in/Writereaddata/Downloads/237-2013THC(PB-I)OA5-5-2015.pdf

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

3
Water security through rejuvenation of springs and river basins

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

Box 10
Springhed Development (Dhara Vikas) Program of Government of Sikkim

In the year 2008, Government of Sikkim has started a program under the name 'Dhara Vikas' for rejuvenation/ revival of the drying springs, streams, and lakes in state.

- This program was implemented through Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), where local expertise and experience was developed, and used to identify of the recharge area of springs based on the structure, weathering and fracture patterns of the rocks.
- The program also included the rainwater harvesting in their technology set from year 2010; within 5 years from inception the 400 area 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, CHIRAG-Nainital who were technically trained as para geohydrologists and helped to bridge the knowledge gap regarding geo-hydrology and revival of springs at the village level.

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

3.1 Springshed Development

Now several ministries and developmental agencies have accepted the concept of watershed for wasteland restorations, recharging of water sources, creating and empowering of decentralized 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 revival of springs by building on this concept and using several catchment treatment techniques (Box 10 & 11).

3.2 Rejuvenation of rivers basins

Indian Himalayan states have been identified as India's future power house and hundreds of power projects have been constructed/ are being constructed, on the many mountain rivers to generate hydropower. These projects often alter natural flow patterns, which adversely affect ecological functions and the social, economic, cultural and religious significance of these rivers. River rejuvenation 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 period, and maintain appropriate e-flows. Recently, rejuvenation of the Ganga has been prioritized as restoration of the wholesomeness by ensuring maintenance of minimum quantity and desirable quality of flows. These conditions are necessary to maintain ecological integrity and biodiversity of the river, and for non-disruptive biota movement and sediment transportation. 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 12).

Box 11
Spring Recharge Initiatives in IHR

- **Spring recharge through Village Environmental Action Plan (VEAP)** - The Village Environmental Action Plan developed by GBPIHED, was implemented under Swajal initiative in Uttarakhand. The plan combines participatory planning with integrated resource assessment, utilization and conservation. It also provides guidelines for spring recharge & rainwater harvesting (Annexure V a-b), technologies for wasteland rehabilitation (e.g., Sloping Watershed Environmental Engineering Technology-SWEET of GBPIHED), 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 springs 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 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 12
Minimum flow policy for Hydropower sector

- The HP Government has made mandated 15% of lean season water discharge as a pre-condition for upcoming HEPs in own 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 organizations and NGOs from the region can play important role in this context. A list of major institutions and their area(s) of operation is given in Appendix-1.

Some of the major initiatives implemented across IHR by the central and the state governments are presented here (Box 13 & 14). The focus of the programme needs to be broadened, also 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 military & paramilitary forces, etc. The Institutions mandated for research & development in Himalaya need to be strengthened to design and implement such courses in collaboration with Institutions of higher learning and administrative training centers.

Box 13
National Initiatives

- *Environmental Education, Awareness and Training (EEAT)* – This is a flagship scheme of MoEF&CC (GoI) 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 on the rich forest and bio-diverse 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 & 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

BOX 14
Sikkim Government toward Environmental Awareness

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

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

5.
Green Energy Solutions

Majority of the household in IHR states still use traditional fuel such as fuel wood, and agro & animal residues for meeting the energy requirements for domestic cooking and space heating purposes. Per household fuel consumption in IHR varies with regions and seasons. The percentage of households using firewood, crop residue, cow dung cake varies from 44.49 to 80.47%, 0.28 to 2.53%, and 0.05 to 4.19% respectively. Nowadays, increasing number of household 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 distant areas and for economic reasons, a large population of rural households still depends upon fuel wood (biomass energy) for their daily requirements. The fuel wood demands are mainly catered from the forests and its collection involves opportunity cost in terms of the time elapsed and the effort put, and also causes nibbling of forests, removal of tree growth and forest degradation. Further, biomass burning also contributes to carbon emission and health problems. Poor economic capacity also restricts energy use adversely affecting the energy security. Therefore, the substitution of energy requirements thru affordable green (renewable) resources, therefore, becomes the imminent need of the region. This provides an alternative way to address issue of meeting energy needs from perennial green energy sources such as solar, wind, biomass, hydro, and geothermal energy. Use of these sources will minimize the traditional fuel dependency to a great extent and help mitigating the environmental pollution, forest degradation, and maintaining minimum forest cover as per the goals of National Forest Policy and counteracting climate change impacts.

Box 15

Supportive Measures by States for Energy Generation and Conservation

- In Himachal Pradesh, the HIMURJA (Himachal Pradesh Energy Development Agency) 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, Tripura government has taken some initiatives like LED bulbs installation, implement biogas plants for the rural households, promotion of natural gas in transportation sector etc. toward the sustainable energy generation and conservation.

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

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 future are described in Box 15-16. Production of bioenergy from pine needle at village level has also been demonstrated successfully by a nongovernment organization (NGO) in Uttarakhand (Box 17).

Box 16
Measures for energy conservation in Uttarakhand

- The Uttarakhand Green Energy Cess Act, 2014 has been passed by the Uttarakhand Legislative Assembly to promote the electricity production from renewal power sources with the help of private developer and community co-operation. It has a provision of Green Energy Cess to be levied at the rate of 10 paisa per unit in case of electricity generated in the state by those generators who 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 mandatory the use of Compact Fluorescent Lamp (CFL), Energy efficient tube light and solar water heating systems in notified buildings (Govt., schools, colleges, hostels, housing complex, hospitals, hotels etc.), and following energy efficient systems.

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

Box 17
Initiative on Biomass Energy Generation from Pine Needle

To supplement the energy requirements of rural people and mitigate the threats of forest fire, the AVANI Bio Energy, Pithoragrah (Uttarakhand) have taken an initiative for harnessing the destructive energy of pine needles to generate electricity that can be sold to the power companies through the existing grid. The other associated environmental advantages of the initiative are described below. It generates electricity through 9 KW gasifier which is comparatively cheaper, easily accessible, and durable technology. Its byproduct (charcoal) can be used for cooking purposes; it provides a smoke-free environment to the villagers and also reduces GHG emissions. Removal of pine needles from forest floor will benefit the biodiversity of the region. The surplus generated through sale of electricity will also help in employing more local youth for collection of pine needles; the increasing demand would create a sustainable livelihood opportunities for the villagers.

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

6
Conservation areas and forest zone management

6.1 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 Forestry Policy for hill states that is 66% of the geographical area needs to be brought under forest cover. Therefore, there is need to conserve, manage and enhance forest resource, because, it provide a variety of ecosystem goods and services to people not only to the inhabitants of the region but also to the people residing in the lowlands.

Box 18
Initiatives to promote conservation efforts

- In recognition of forests as national wealth, the 13th Finance Commission has recommended an incremental grant of Rs 5000 crore for year 2010-15 towards the maintenance of forests amongst the states based on their 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, for pollinating orchards, from the Department of Horticulture and private bee keepers. Rate of renting a colony was up to US $ 20 (Rs 950) for a season in 2004. This highlights the need for strengthening the tradition of organic farming in the IHR.

In this context, various measures have been taken up by the Govt. of India, which includes Green India Mission under the ambit of National Action Plan for Climate Change (NAPCC). The mission holds promise and scaling up of planting activities especially in degraded area 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 decentralized way by the State Forest Development Agency (SFDA) at State level, Forest Development Agency (FDA) at Forest Division level, and Joint Forest Management Committees (JFMCs) at village level. In the past few decades traditional, religious and spiritual motivations have also been used to mobilize efforts for forest conservation (Box 18).

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, NGO's and rural people involved in conservation areas. This is now being seen as critical to the long-term success of any conservation programme.

The three major of 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 ii) Traditional System of north-eastern Himalaya. In Uttarakhand, after 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 also includes provisions for reservation for women and weaker sections of the society i.e. Scheduled Castes and the Scheduled Tribes as per the Uttarakhand Panchayati Forest Rules (UPFR), 2001. Though the forests are protected and managed by VPMCs and come under the jurisdiction of State Revenue Department, State Forest Department provides technical and financial assistance through Forest Development Agency (FDA) for the management of a sizable number of VPs after 2001. Other approach being followed in Arunachal Pradesh is 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

Box 19
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 Govt 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 IHRs 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 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 Himalayan Biodiversity Hotspot and a designated globally important endemic bird area, is inhabited by large populations of tribal communities, who traditionally own and depend for their livelihood & cultural sustenance on forests governed by the customary laws. The CCA reconciles conservational concerns with the community interests, as it aims to institutionalize 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 & sustainable use of forest resources, also yielding long term ecological benefits to the state.

and local communities through customary laws or other effective means for their significant biodiversity, ecological and related cultural values (Box 19).

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

Box 20
Payments for Ecosystem Services (PES), 2013 in Himachal Pradesh

The Himachal Pradesh government has notified 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 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 PES program in the State by identifying the necessary elements.
- To adopt an ecosystems approach in decision making
- To enable experimentation and pilots that informs and refines ES approaches.

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

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 forest for fuel, food, timber, and subsistence & 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 ecosystem service flows for development of economy and civilizations in downstream areas outside the IHR. Today, the sustenance of these flows, to meet 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. The Payments for Ecosystem Services (PES) 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 20). The PES is used to promote community-based eco-systems 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 land mass. Therefore, it requires careful monitoring to develop scientific basis for ascertaining their evolution, and the changes occurring over time. The key areas for monitoring are presented in Box 21. Among the identified areas under physical systems, the Himalayan glaciers, on account of their proven sensitivity to climatic perturbations and value of their downstream ecosystem services deserve priority attention (Box 22).

Box 21
Key Areas for Monitoring Himalayan Ecosystems

a. Physical systems

- Snow & Glaciers (glacial & seasonal snow covers)
- Snowmelt dynamics and its contribution to river water flows
- Water issues (regional water basins to location specific recharge issues)
- Weather and climate trends – relevant datasets (establishment of 'weather towers')
- Land degradation, land use, 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, and economically valuable, etc.)
- Ecosystem structure, diversity, and resilience
- Ecosystem functions (including carbon sequestration and water relations)

Box 22
Monitoring Snow and Glaciers of the Himalaya

- In IHR, a number of glacier studies have conducted by various organizations and national institutions under the guidance of Program 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 GBPIHED and other Institutes. It was a joint project of the Ministry of Environment, Forest & Climate Change and Department of Space.
- Under NMSHE, DST is establishing a Centre for Glaciology to initiate coordinated research on Himalayan glaciers.

In the IPCC Fourth Assessment (2007)[14] the entire Himalayan region, in terms of climate monitoring, has been described as data deficient area. To address above issues, long term weather monitoring is needed across the Himalayan region (Box 23). Government of India has also initiated weather and glacier monitoring programs such as the Himalayan Glaciology Programme (HGP) under DST since 1986 and Integrated Himalayan Meteorology Programme (IHMP) of the IMD since 2012 (Box 24).

Box 23
Monitoring using Weather Profilers

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

Box 24
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, Indian Himalayan Meteorological 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 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 neighboring 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 leading to cloud bursts, 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

[14] 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.

8
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 25). The Government of Himachal Pradesh has setup HP State Knowledge Cell on Climate Change (HPKCCC) under NMSHE for various climate change related functions including ideal Himalayan habitats. Smart City Mission has been launched by GoI 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 26).

Box 25 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 & 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 & control, renewable energy, health infrastructure, building codes, parks & 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 regions' cultural diversity and prevailing

Box 26
Applications of Smart Solutions

Total number of 100 smart cities has been distributed among the States and UTs on the basis of equitable criteria. All IHR states will have at least one city identified under Mission for development as Smart City. Sikkim state has received Rs 2.00 Crore as advance for preparation Smart City proposal under SCM guidelines in respect of Namchi Municipality.

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

8.2 Ecologically Safer Roads- Green Roads

Road is the only viable means of transportation and an important infrastructure for the economic development in mountain region. But, the construction and maintenance of road in IHR are often challenged by its topography, fragile geology, and the adverse climatic conditions. The development of conventional roads often causes landslides and deforestation, and increases slope instability, air pollution, deterioration of ecosystems. The Concept of "*Green Road'* provides an appropriate eco-friendly solution of the environmental problems. This

technology is based on the philosophy of promoting energy-efficiency, and minimum disruption to existing vegetative cover and re-utilization 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.

Box 27
New Initiatives

- GoI has taken 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 includes
  - 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 natural sink for air pollutant and noise absorbent.
  - Employment generation for local people through their involvement in planning and their maintenance.
  - Soil erosion control along embankment and slopes.

- The green road-building norms have been included in the Himachal Pradesh and Sikkim-SAPCC. Recently, on 10 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

Recognizing the importance of green road in the IHR states, few attempts have been made (Box 27). The mission aims to achieve sustainable development and harnessing the socio-economic and environmental benefits of cold-mix technology for rural roads and state roads, and help the country benefit from 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, enforce fuel quality standards and clean filters, especially for diesel vehicles. The ropeways are useful alternatives to roads in steep short stretches.

9
Disaster Risk Reduction

The geologically fragile Himalaya is vulnerable to hazards and disasters; the 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 the climate change has further aggravated the hazard and disaster risks in the IHR. The events in the 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 cloud bursts are tell-tale examples of the area's active tectonics, inherent fragility and the likely scales & dimensions of risk to life & property involved under climate change enhanced events. The impact of these disasters is further exaggerated 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 every year incurs heavy damage to the precious forest wealth, flora and fauna of the region. Of-late the trends of hazards across IHR have changed; now-a-days floods/ flash floods have emerged as the most dominant hazard type occurring in the region. The institutional framework to deal with (combat/ mitigate) disaster (Box 28) 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.

Box 28
DRR - Governance Issues, breakthroughs, and Developments

- Creation of Institutional structure 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 & information systems.
- Enforcement of developmental codes and prohibiting development in eco-sensitive zones.
- Prioritization of areas/ regions/state/ districts in terms of hazard vulnerability and development of mitigation and risk reduction strategies / actions.
- Rescue, relief and post disaster management.
- Awareness & 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 & policy formulation/uptake).
- Negotiating trans-boundary links of hazards/ disasters thru conventions and agreements (Regional Conventions).
- Development of database requirements, institutional coordination, & roles.
- Using the DRR experiences of other mountain areas / countries for IHR.

The climate change (CC) has increased the susceptibility of IHR to hazards. The impacts climate plus change are becoming manifest in terms of a) rapid hazards such as flash floods, and b) slow onset hazards such as melting of glaciers, drying of wetlands and springs, loss of bio-diversity /agri-biodiversity and associated knowledge base etc. For proper addressing of this vulnerability and prioritization of mitigation / adaptation action a suitable framework for vulnerability assessment / analysis is required (Box 29). The frameworks that are tried in 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 DSS type. The deficiency of data is another problem that plagues the process/ adversely affecting the projections.

Box 29
Vulnerability Frameworks in use

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

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

Box 30
State initiatives

- In Sikkim, the building standards/ regulations for this purpose are derived from various laws pertaining to planning and development of various states. The 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 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, landslide, and 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.

The disaster management has been institutionalized at State level (Box 30) thru creation of district, and state level institutions defining of roles and responsibilities of state line departments, creation of disaster response and mitigation fund, and handling of disaster management with a proactive prevention, mitigation and preparedness driven approach. In IHR states, various capacity building and awareness are being conducted are 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 mock-drills, e) awareness is spread through rallies, mass-meetings, programmes at school/ college levels and distribution of IEC material through Government sponsored and UNDP funded programs.

C. Conclusion and the way forward

The ecosystems are important for their goods and services flows and therefore, contribute towards economic development; the Himalayan ecosystems are vital for their forests, biodiversity, water resources and hydropower potential, and aesthetic and cultural relevance which not only contributes towards subsistence of inhabitant societies and growth of local economy, but also support the sustenance and growth of down-stream civilizations and economies. Its mountains and forests also provide a service climate moderation in the sub-continent, and absorption of atmospheric Carbon Dioxide to mitigate the global warming. These systems 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 sustenance of Himalayan Ecosystems relate to institutional issues, unscientific development & exploitation of resources, poor enforcement, non-acknowledgement of IHR's ecosystem values, lack of incentive mechanisms for of ecosystem conservation, void in trans-boundary effects & agreements, lack of climate and hazard proof developmental planning, conservation/ management guidelines, and awareness building and promotion of good practices. Therefore, the governance for Himalayan ecosystems is complex and needs a holistic and multipronged approach, with due considerations 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-scale. This revised edition of GSHE 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/ 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, Swatch 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 VII).

The MoEF&CC jointly with GBPIHED aims to revise the contents and scope of GSHE from time to time to make it more broad based and updated. We expect that the best

practices and the guidelines of the GSHE be replicated/ implemented with the support of state governments across the IHR for better sustenance of the Himalayan ecosystems.

Annexure I

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 be able to identify the sources in terms of the factory make as well as type of individuals.
- 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 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, expedition members in promoting the suggested management plan in a particular geographic region would help a lot in managing the waste in the Himalaya.

Annexure II

Hill Town planning and Architectural Norms

- Fragmentation of habitat in hill areas should be prevented. The habitats in hill/mountain areas should be consolidated in order to avoid demands for creation of additional infrastructure.
- Specific areas for rural/urban development should be designated beyond which construction may not be permitted.
- No construction should be undertaken in areas having slope above 30^0 on areas which fall in hazard zones or areas falling on the spring lines and first order streams identified by the State Governments on the basis of available scientific evidence.
- Construction should be permitted in areas with slope between 10^0 to 30^0 or spring recharge areas or old landslide zones with such restrictions as competent local authority may decide.
- Architectural and aesthetic norms for construction of buildings in mountain/hill areas should be enforced.
- Tourist resorts, commercial complexes and institutional buildings should be located in areas with surplus water and electricity so as not to affect the rights of existing users without their prior consultation;
- Where cutting in an area causes ecological damage and slope instability in adjacent areas, such cuttings shall not be undertaken unless appropriate measures are taken to avoid such damages.
- An integrated development plan may be prepared taking into consideration environmental and other relevant factors including ecologically sensitive areas, hazard zones, drainage channels, steep slopes and fertile lands. Areas rich in ground water may not be diverted for construction activities.
- In highly seismic areas like Himalaya, all construction should incorporate earthquake resistant features as prescribed in building codes, guidelines, manuals and other bye-laws.
- Location-specific technologies should be deployed for construction of buildings (including use of hollow blocks for better insulation of buildings, and making use of passive solar heating, e.g., in extreme cold areas like Leh in Laddakh).
- Regulation of sale/purchase of land and residential/commercial buildings may be considered in order to prevent violation of land use planning norms.
- "Green roads" having channels for collection of water for irrigation purposes should be made a part of the construction norm.

Annexure III

Regulating Tourists and Pilgrimage to Sensitive Areas

- Pilgrimage tourism in the Himalaya requires both development and regulation so as to reduce congestion and resultant pollution.
- The accommodation and road transport infrastructure needs to be developed in pilgrimage sites. Existing 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 Himalaya with a provision for the villagers for some earnings from the visitors.
- An inventory of historical, sensitive and sacred sites including sacred groves should be prepared and their vulnerability should be assessed.
- The number of tourists to vulnerable sites should be regulated and limited e.g. Gangotri glacier.
- The pilgrimage tourism is a kind of "economy class" tourism in the Indian Himalayan Region since most pilgrims generally belong to middle income group and prefer to stay in Dharamshalas and moderately priced accommodation. Suitable accommodation and other facilities need to be made available accordingly. This will also help in identifying carrying capacity of the area in accommodating the inflow of tourists.
- The access to such (and other) sites of incomparable value through vehicles needs to be restricted beyond a certain zone.

Annexure IV

Promoting Ecotourism and Regulation of Commercial Tourism

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

Annexure Va

Rejuvenation of Springs and Degraded sites

- Special attention should be paid to recharge of ground water and improvement of hydrology and quality of mountain lakes/wetlands through restoration of forests.
- Detailed geological mapping should be conducted to identify the spring recharge zone and locate structures such as, joints, faults, shear zone fractures and cleavage etc.
- Nuclear water prospecting technologies available with 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 recharge zone from biotic interferences such as, grazing, felling of trees and cutting of grasses and other vegetation, mining, wildfire etc. in 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 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.

Annexure Vb

Rain Water Harvesting

- All buildings to be constructed in future in urban areas should have provision for roof-top rain water harvesting commensurate with its plinth area with minimum capacity of 5 KL for plinth area above 200 sq. m., 2 KL for plinth area of 200 sq. m. or below in case of residential buildings and minimum capacity of 0.01 cum per sq. m. of plinth area in case of commercial and institutional buildings such as tourist complexes, hotels, shopping complexes and Government buildings:
  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 rain water 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;
- Ground water aquifer recharge structures should be constructed wherever such structures do not lead to slope instabilities.

Annexure VI

Ecologically Safer Roads

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

Annexure VII

Community Based Disaster Risk Management

- Undertaking groundwork within government agencies working at village, block and district levels and to explore possibilities for CBDRM to occur and florish, this includes the analyses 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 CDBRM programme within a selected community/ communities
- Community based participatory monitoring and evaluation (usually community devised) to measure progress with risk reduction to take actions to improve the actions.
- Ensuring of establishment, strengthening, and sustenance of community level organization mechanism for implementation of CDBRM by involving the local residents in the community.

Annexure VII

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 meeting of 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	DST/ MoEF&CC/	Facilitation of technical support to

		technical secretariat for implementing G-SHE at GBPIHED	GBPIHED	states for G-SHE implementation
		Stage 2: Making the Technical Secretariat functional and updating of G-SHE	GBPIHED/ 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	GBPIHED/ Mountain Division	Network of agencies for transfer of information and feedback and monitoring
		Stage 4; Feedback to DST/ MoEF&CC on progress	GBPIHED/ 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	Organizations 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 Selected Institutions in the IHR

Sl No.	Institute
1.	Botanical Survey of India, (BSI), Kolkata
2.	Central Potato Research Institute (CPRI), Shimla
3.	Central Institute of Temperate Horticulture (CITH), Srinagar
4.	Central Soil & Water Conservation Research & Training Institute (CSWCRTI), Dehradun
5.	Central University Himachal Pradesh, Jammu & Kashmir
6.	Defense Research Development Organization (DRDO)
7.	Forest Research Institute (FRI), Dehradun
8.	Forest Survey of India (FSI), Dehradun
9.	G.B. Pant Institute of Himalayan Environment & Development, (GBPIHED), Almora
10.	Geological Survey of India (GSI), Kolkata
11.	High Altitude Plant Physiology Research Centre, (HAPPRC), Srinagar (Garhwal)
12.	Himalaya Institute of Engineering and Technology (HIET), Sirmour, Himachal Pradesh
13.	Hemvati Nandan Bahuguna Garhwal University, Srinagar
14.	Indian Institute of Technology, Roorkee, Guwahati, Mandi (HP)
15.	Institute of Bioresources & Sustainable Development, Imphal
16.	Institute of Himalayan Bioresources and Technology (IHBT), Palampur
17.	Indian Institute of Remote Sensing (IIRS), Dehradun
18.	Jawaharlal Nehru University, New Delhi
19.	National Bureau of Plant & Genetic Resources (NBPGR), Delhi
20.	National Botanical Research Institute (NBRI), Lucknow
21.	North East Region Institute for Water & Land Management (NERIWALM), Tezpur
22.	North Eastern Region Community Resource Management Society (NERCRMS), Shillong
23.	National Institute of Technology, Jammu & Kashmir, Himachal Pradesh,

	Uttarakhand, Assam, Sikkim, Arunachal Pradesh, Meghalaya, Mizoram, Nagaland.
24.	National Research Centre for Mithun (NRCM), Jharnapani
25.	National Research Centre for Yak (NRCY), Dirang
26.	National Research Centre for Orchids (NRCO), East Sikkim
27.	National Research Centre for Mushroom (NRCM), Solan
28.	National Research Centre on Coldwater Fisheries (NRCCWF), Bhimtal
29.	North Eastern Hill University, Shillong.
30.	Rain Forest Research Institute (RFRI), Jorhat
31.	Regional Research Laboratory, Jammu, Jorhat, Itanagar
32.	Snow and Avalanche Study Establishment (SASE), Manali
33.	State Forest Research Institute, Itanagar
34.	Vivekanand Parvatiya Krishi Anusandhan Sansthan (VPKAS), Almora
35.	Wildlife Institute of India (WII), Dehradun
36.	Wadia Institute of Himalayan Geology (WIHG), Dehradun
37.	World Wide Fund for Nature
38.	The Missing Link
39.	CHIRAG, Nainital
40.	MRDS, Shillong