Final Draft

NATIONAL MISSION FOR SUSTAINING THE HIMALAYAN ECO-SYSTEM

Under
National Action Plan on Climate Change

Mission Document

GOVERNMENT OF INDIA
DEPARTMENT OF SCIENCE & TECHNOLOGY
MINISTRY OF SCIENCE & TECHNOLOGY
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Mission Document of National Mission on Sustaining The Himalayan Ecosystem

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EXECUTIVE SUMMARY

The Himalayan ecosystem possesses over 51 million people who practice hill agriculture and whose vulnerability is expected to increase on account of climate change. The Himalayan ecosystem is vital to the ecological security of the Indian landmass, through providing forest cover, feeding perennial rivers that are the source of drinking water, irrigation, and hydropower, conserving biodiversity, providing a rich base for high value agriculture, and spectacular landscapes for sustainable tourism.

The Himalayan eco system is vulnerable and susceptible to the impacts and consequences of a) changes on account of natural causes, b) climate change resulting from anthropogenic emissions and c) developmental paradigms of the modern society.

The Himalayas have one of the largest resources of snow and ice and its glaciers which form a source of fresh water for the perennial rivers such as the Indus, the Ganga, and the Brahmaputra. Glacial melt may impact their long-term lean-season flows, with adverse impacts on the economy in terms of water availability and hydropower generation. The available monitoring data on Himalayan glaciers indicates that while recession of some glaciers has occurred in some Himalayan regions in recent years, the trend is not consistent across the entire mountain chain.

The National Action Plan on Climate Change (NAPCC) envisages launch of a Mission for sustaining the Himalayan Ecosystem to evolve management measures for sustaining and safeguarding the Himalayan glacier and mountain eco-system. The Mission is expected to seek to understand the coupling

between the Himalayan ecosystem and the climate factors and address the issue of glacier melt. This will require the joint effort of climatologists, glaciologists and other experts. Exchange of information with the South Asian countries and countries sharing the Himalayan ecology will also be required. There is a need to establish an observational and monitoring network for the Himalayan environment to assess freshwater resources and health of the ecosystem.

The National Mission for Sustaining Himalayan Ecosystem (NMSHE) aims to understand the complex processes affecting the Himalayan Eco system and evolve suitable management and policy measures for sustaining and safeguarding the Himalayan eco-system. Recognizing the importance of scientific and technological inputs required for sustaining the fragile Himalayan Ecosystem, the Ministry of Science and Technology has been charged with the nodal responsibility.

The mission attempts to address some important issues concerning

a) Himalayan Glaciers and the associated hydrological consequences,
b) Biodiversity conservation and protection,
c) Wild life conservation and protection,
d) Traditional knowledge societies and their livelihood and
e) Planning for sustaining of the Himalayan Ecosystem.

Sustainability of an ecosystem demands a balance and equilibrium among various forms life and their surroundings established over long periods of time. Therefore, the mission recognizes the need for creation and building of national capacities to observe and respond to changes in a sustainable manner. The mission proposes to build human and knowledge capacities and identify and strengthen institutions engaged already in the conservation and management of the natural resources in the Indian Himalayan Region (IHR). Mission plans to effectively network such institutions with common and shared objectives, co-

sharing of resources and co-generation of processes leading to ecologically sustainable development.

Sustaining the Himalayan eco system as a national mission, will focus on the rapid generation of four types of national capacities, They deal with

a) Human and knowledge capacities,
b) Institutional capacities,
c) Capacities for evidence based policy building and governance and
d) Continuous self learning for balancing between forces of Nature and actions of mankind.

National Mission on Sustaining the Himalayan Eco system is to create and build in the country in a time bound manner capacities in the four types namely knowledge, institutional, evidence-based policy implementation and learning systems for balancing changes in eco system with responsible human actions. National Mission for Sustaining the Himalayan Eco system will adopt different approaches for building various capacities.

a) Building Human and Knowledge Capacities:

Capacity to capture, store and apply knowledge relating to the vulnerability and changes in the Himalayan eco system over extended periods of time requires specially trained man power and expertise. The National Mission for Sustaining the Himalayan eco system will focus on the creation of human capacities in the areas relating to sustaining the Himalayan ecosystem, About 100 professionals and experts in the area will be trained. Minimum of 25 well trained glaciologists will become available for research and development and inputs for policy studies.

b) Building Institutional Capacities:

National Mission for Sustaining the Himalayan ecosystem will build institutional systems with long term memories and organizational structures for long term observations, studies, understanding and forewarning of changes in the

Himalayan eco system. Two pronged approaches are planned. There are a large number of knowledge institutions and community based organizations which are already engaged in various aspects relating to the sustenance of the Himalayan eco system. They are currently working in a non-coordinated manner with sub critical resources. The national Mission will achieve a) better coordination among such knowledge institutions and b) build new institutions in areas of knowledge gaps in a time bound manner. Both virtual knowledge networks and real knowledge institutions are planned. The National center for Himalayan Glaciology will undertake both intra mural research and support Extra Mural Research in other knowledge institutions. Similarly institutional capacities in the areas of traditional knowledge systems, Himalayan agriculture, eco tourism and biodiversity will be built.

c) Building Capacities for evidence based policy implementation:

The challenge of adapting to climate change requires a coordinated response from the Union Government and governments of the Himalayan States. This will require a regular and focused dialogue among these States as well as the Union Government. The National Mission for Sustaining the Himalayan Eco system will establish a platform for a periodical dialogue among the various stake holders. The dialogue will focus on the elaboration of a comprehensive and practical strategy appropriate to the current immediate and long-term challenge involved in sustaining a fragile eco system. These strategies may include management of the Himalayan river-basins, cooperation in water resources management to adapt to climate change, the promotion of sustainable agriculture and industrial development in the Himalayan region. Governance systems will need to select the most sustainable path of human development without endangering a fragile ecosystem. Coordinated responses are required between the Central and Sate Governments and this aspect will be covered directly by the Prime Minister's office.

d) Building capacities for continuous learning and pro-active designing of development strategies:

An apex knowledge body with capacity to study and evolve strategies for sustaining the Himalayan eco system will be developed and established during the 12th plan period. The apex knowledge institution will develop strong linkages with virtual knowledge networks, community based organizations and engage in regional cooperation, while undertaking research on developmental policy studies.

The primary objectives of the mission include:

- Building national strength in four domains namely
    a) Human and knowledge capacities,
    b) Institutional capacities,
    c) Capacities for evidence based policy building and governance and
    d) Continuous self learning for balancing between forces of Nature and actions of mankind.

- To network knowledge institutions engaged in research on Himalayan Ecosystem and develop a coherent data base on the geological, hydrological, biological and socio cultural dimensions including traditional knowledge systems on preservation and conservation of the ecosystem

- To detect & decouple natural and anthropogenic induced signals of global environmental changes in mountain ecosystems and predict future trends on potential impacts of climate change on the Himalayan ecosystem with a sound S&T backup.

- To assess the socio-economic and ecological consequences of global environmental change and design appropriate strategies for growth in the economy of the mountain regions and the lowland systems dependent on mountain resources in the region.

- To study traditional knowledge systems for community participation in adaptation, mitigation and coping mechanisms inclusive of farming and traditional health care systems

- To evaluate policy alternatives for regional development plans towards sustainable tourism development, water and other natural resource management for mountain ecosystems in the region.

- To create awareness amongst stakeholders in the region for including them in the design and implementation of the programme.

- To develop regional cooperation with neighboring countries, to generate a strong data base through monitoring and analysis, to eventually create a knowledge base for policy interventions.

There are also several secondary and long term objectives of the Mission.

Broad actions to achieve the objectives and goals of the mission are:

a) Enrollment of partners and partnering institutions,
b) Grouping of specialization areas and formation of knowledge networks for glaciology, ecology and biodiversity, livelihood mapping, vulnerability assessment and policy studies,
c) Preparation of detailed project sub-documents with deliverables and time lines,
d) Funding of research in existing institutions and establishment of national center for Himalayan Glaciology,
e) Building new institutional and human capacities and a new apex body with a capacity to study and evolve strategies for sustaining the Himalayan eco system

f) Development of regional cooperation with neighboring countries,
g) Steering and monitoring of the mission through empowered committees and
h) Evolve a periodical reporting system to the National Action Plan on Climate Change and PM's council.

The Mission would be monitored periodically, at least twice in a calendar year, by a High powered Committee under the Chairmanship of the Honorable Minister for Science and Technology and Earth Sciences. The High Powered Committee will include among others representatives of Ministry of Environment & Forests, Ministries of Agriculture and Water Resources and of the Governments of Himalayan States. The Prime Minister's Council on Climate Change would periodically review reports of this committee. The National Advisory Council for National Mission on Sustaining Himalayan Ecosystem would form the think tank and give inputs to the Monitoring committee and evaluate the progress of work. The mechanism for input approvals and funding decisions will involve a Committee of Secretaries of the participating departments. A dedicated Mission Cell on Himalayan Ecosystem will be constituted for the purpose of coordination and reporting to the various committees and oversight groups. This cell will be responsible for coordination with nodal institutions coordinating thematic work elements and report to the Committee of Secretaries as well as submit periodic reports to the PMO. Since the mission includes also regional cooperation and policy implications, a close coordination with Ministry of External Affairs (MEA) and Ministry of Environment and Forests (MoEF) will be ensured.

CHAPTER-1

Introduction

1.1 Background

The Fourth Assessment Report of the Inter Governmental Panel on Climate Change (IPCC) has concluded with high confidence the attribution of the warming of the Earth since the industrial era to anthropogenic emissions. The IPCC also estimates that over the next century, global average surface temperatures would increase in the range of 1-6.3^{o}C relative to pre-industrial times for various emission scenarios of the world. It is widely acknowledged that climate change is not just about averages, but also of extremes. Increases in the minimum and maximum seasonal temperatures could induce triggering of frequent storms and extreme climatic events viz. high precipitation or drought, thereby leading to irreversible changes in fragile ecosystems

Increasing temperatures and changing precipitation patterns in the Indian sub-continent can be expected to influence even more profoundly the regional ecosystems and some sections of human populations. The changes can be expected to be complex. Effects of climatic changes on the environment and people's livelihoods could impact health, agriculture, forests, water resources, coastal areas, species and natural areas. There is a compelling need for a concerted effort to understand the implications of climate change on vulnerable sections of people and develop special strategies for sustaining fragile ecosystems on which large number of people depend.

1.1.1 Himalayan Eco System

Himalayan landscape systems are unique. Himalayan Mountain systems, with their steep slopes and sharp gradients, are heterogeneous and exhibit sharp and systemic changes in climatic variables over very short distances and enhanced changes in hydrological processes, with accelerated direct runoff and erosion. Major rivers of the region have their origin from these mountains. They provide a source for water for a large sector of the human population within and outside the mountain region. Many of the world's crops originate in mountains, a crucial resource that should be conserved for sustaining modern agriculture. Natural wealth in the region including geological assets forms an important part of the Himalayan eco system.

Forest profile of the region supports a large and diverse wild life population. The region is inhabited by traditional societies and represents a sector of the society that remains marginalized. Living in biodiversity rich areas of the country, the mountain people are dependent upon biodiversity for meeting with their livelihood needs. Sustaining bio diversity in the region means also protecting the interests of the people, plant and animal biodiversity. Himalayan eco system includes in its biodiversity - the forest cover, plant diversity, micro flora and fauna, wild life and animal populations, in addition to its other natural mineral wealth, water, snow and glaciers and, the traditional and modern societies inhabiting the region.

Himalayan Eco system represents one of the most fragile systems of the world. It should be protected against improperly conceived developmental activities. In light of the need for conservation of biological diversity in full in the context of climate change, sustaining Himalayan Ecosystems has gained paramount importance. The National Mission for Sustaining Himalayan Ecosystems (NMSHE) is hence one of India's eight missions under National Action Plan on Climate Change.

1.2 Himalayan Region

Himalayan region, in India, comprises of the vast mountain range extending over 2500 km in length between the Indus and the Brahmaputra river systems. Raising from low-lying plains to over 8000 m above sea level, it is around 300 Km at its widest part with an average width of 80 Km. As the world's highest mountain chain, the Himalaya is characterized by a complex geologic structure, snowcapped peaks, large valley glaciers, deep river gorges and rich vegetation. The region possesses a distinctive climate of its own. The lofty mountain chain influences the climate of much of Asia. A complex interplay of climatic and geological processes, patterns of resource use and economic conditions have led to resource degradation and associated environmental consequences on the highly diverse and fragile Himalayan ecosystem.

1.2.1. Effect of Climate Change on the Himalayan Ecosystem

Ecologically sensitive mountainous areas like Himalayas are prone to adverse impacts of global climate changes on account of both natural causes and anthropogenic emissions in other parts of the world as well as those arising out of unplanned developmental activities of the region. Some of the significant consequences arising out of the global warming on the Himalayan region could relate to a) variability in the volumetric flow of water in the rivers, b) loss in biodiversity, c) unsustainable changes in ecology, d) glacier recession, e) deforestation and degradation, f) conditions for impending natural disasters and g) dislocation of traditional societies dependent vulnerably on the Himalayan ecosystem.

Ganges, Brahmaputra, Yamuna, and other major river systems originate in the Himalayas. Millions of mountain population of the Himalayan region and a total of 1.3 billion people living on the vast water basins downstream, amounting to about a fifth of the world's population depend on the Himalayan rivers for their water

supply. Any changes in the Himalayan glacier dynamics and melting are expected to severely affect these billions of people.

The Indian Himalayan Region (IHR) supports around 13,000 species of flowering plants, i.e. nearly 50% of the total flowering plants of India. Of this, nearly 30% of this flora is endemic to the region. There are over 816 tree species, 675 edibles and nearly 1743 species of medicinal value found in the IHR. The Himalaya with its vast green cover acts as 'sink' for carbon dioxide. Annual carbon sequestration by the forests of western and northeastern Himalaya is just one of the important ecosystem services being performed by the Himalayan forests. This needs to be therefore further strengthened and exploited for global good.

The task force on mountain ecosystem constituted by the Government of Uttrakhand has prepared an account of State of Art in knowledge and institutional capacities associated with the Himalayan ecosystem.

1.2.2 Implications of Climate Change on Human Health

Change in climate could also cause infectious diseases transmitted by insects, i.e., vector borne diseases like malaria, yellow fever etc. The distribution of vector-borne diseases is restricted by climatic tolerance and any climatic change is expected to alter the edges of current geographical distribution.

Mountain regions are predicted to encounter above-average climate changes caused by human activities; thus the implications for human health from the impacts of climate change need reviewing.

1.3 National Action Plan on Climate Change

The National Action Plan on Climate Change(NAPCC) is India's domestic plan for ecologically sustainable development to be implemented with her own

resources. It identifies measures that promote developmental objectives while also yielding benefits for addressing climate change efficiently and effectively.

1.3.1 National Missions

Eight national missions have been recommended for implementation, in the NAPCC. The document suggests a multi-pronged, integrated & long-term approach with well defined time-lines for achieving the goals envisioned.

1.3.2. National Mission for Sustaining the Himalayan Ecosystem

Ecosystems have an inherent capacity to withstand changes in climate and landscape, leading to a natural carrying capacity of ecology. When this capacity is exceeded, the ecosystem can change in ways that can be socially and environmentally unacceptable. This could well lead to loss of rare or endangered species and migration of species and shifting of habitats. Conservation of Biodiversity is intrinsic to human well-being as it can help reverse the negative impacts of climate change and limit the negative impacts on habitats and species, of extreme weather conditions.

The National Mission for Sustaining Himalayan Ecosystem (NMSHE) aims to understand the complex processes affecting the Himalayan Eco system and evolve suitable management and policy measures for sustaining and safeguarding the Himalayan eco-system including Himalayan glaciers. The mission plans to position a sound coordination mechanism for ensuring cooperative and cohesive actions by the states in the Indian Himalayan Region. Recognizing the scientific and technological inputs required for sustaining the fragile Himalayan Ecosystem, the Ministry of Science and Technology has been charged with the responsibility of implementing this mission in active coordination with other stakeholder ministries/agencies and State governments concerned..

The mission attempts to address some important issues concerning a) Himalayan Glaciers and the associated hydrological consequences, b) biodiversity conservation and protection, c) wild life conservation and protection, d) traditional knowledge societies and their livelihood and e) planning for sustaining of the Himalayan Ecosystem.

The mission dealing with the sustenance of a diverse Himalayan ecosystem should involve institutions engaged already in the conservation and management of the natural resources in the Indian Himalayan Region (IHR). Mission should effectively network such institutions with common and shared objectives, co-sharing of resources and Co-generation of processes leading to ecologically sustainable development Several Institutions are active in the area. They can be broadly grouped into following categories: (i) Government institutions dealing with research and development, (ii) Non-government Organizations (NGOs) with local, national and international mandate, and (iii) Community based organizations.

The task force set up by the Government of Uttrakhand had observed an apparent want of coordination, networking and cohesiveness among the institutions working for conservation and development in the mountains. Need for adequate manpower and funds, infrastructure, communication and incentives is considered necessary for enhancing the delivery systems and connecting the laboratory findings to the real field requirements. To some extent, the essentiality of a mission mode programme with effective coordination and management has been brought out by the task force set up by the Government of Uttrakhand., A mission is required for filling the knowledge gaps and helping in evolving sustainable developmental strategies while sustaining Himalayan Ecosystem.

The National mission will undertake

a) Collation and documentation of all relevant knowledge existing within the formal and non formal sectors,

b) Networking and strengthening of existing knowledge institutions and bridging recognized gaps,

c) Establish institutions and mechanisms for continuous observations and updating of information and knowledge,

d) Establish sound and sustaining mechanisms for field data collection and ground truthing with research data outputs and

e) Linking traditional knowledge and livelihood issues with planning processes.

1.3.2.1 Himalayan Glaciers

The Himalaya is referred to as the 'third pole' as it has a large area with perennial snow cover and perhaps the largest concentration of glaciers outside the polar caps. The glacier coverage is estimated at about 33,000 km^2 and Himalayan glaciers provide around $8.6X10^6$ $m^3$of water annually. Himalayan glaciers feed Asia's seven great rivers: the Ganga, Indus, Brahmaputra, Salween, Mekong, Yangtze and Huang Ho. There have been global concerns that glaciers might be receding at faster rates on account of climate change and global warming. An initiative is needed to develop a regional cooperation to quantify effects, assess vulnerability and tackle climate change impacts on the glacial ecosystem to evolve mitigation and adaptation measures.

Ongoing Research on Himalayan Glaciology

Geological Survey of India, Snow and Avalanche Study Establishment (SASE), of Defence Research and Development Organization (DRDO), Space Application Centre (SAC) of Department of Space (DOS) and many other national organizations including the Survey of India (SOI) have been engaged in monitoring the changes in glaciers of Himalaya. The Department of Science and Technology had been supporting research on glaciers on project mode for more than 15 years under its 'Himalayan Glaciology Programme'. G.B. Pant Institute of Himalayan Environment & Development (GBHED) has been active in the area of research on glaciology. Several knowledge institutions have been actively engaged in research on Himalayan Glaciers. An attempt has been made to document the scientific data residing in the knowledge institutions across various administrative departments as a result of a decision taken by the expert committee on climate change. A sound and reliable mechanism for data exchange and sharing on Himalayan Glaciers is necessary. A Study Group was constituted by the Principal Scientific Advisor (PSA) to Government of India, Chair of the Expert Committee on Climate Change, under the Chairmanship of Prof Anand Patwardhan to prepare a National white paper on knowledge institutions and available data on Himalayan glaciers. **The draft version of the report of the Study Group is given as Annex-I.**

Understanding Glacier dynamics and the alterations on the associated eco systems require the use of modern tools of advanced science and technology. It is an opportunity for the science sector to contribute to an important National mission that requires regional cooperation and actions. Long term data sets are required on recession of Himalayan glaciers and its impact on river, impacts on downstream hydrological regimes and associated changes in biological diversity and socio-cultural systems. Short term project mode approaches would not be sufficient. Recognizing the importance of long term observations, DST had supported Extra Mural Research on glaciers on long term basis over 15 year periods.

Establishment of observational and monitoring network on Himalayan glaciers will be required with mandate to study:

- Physical systems concerning glacial & seasonal snow covers;
- Snow melt dynamics and its contribution to river water flows;
- Water issues *(regional water basins to location specific recharge issues);*
- Weather and climate trends - relevant datasets (*establishment of weather towers)*
- Land degradation, land use land cover change *(representative protected and non protected sites),*
- Changes in ecosystems and biogeochemical fluxes and
- Energy systems *(alternate energy and energy efficiency)*

1.3.2.2 Himalayan Eco-system: Observations, ground truthing and Follow-up actions

Himalayan eco system is closely inter-connected with a large number of sub systems. In view of growing threat to biological diversity, conservation and rational use of biodiversity in the Himalayan region could bring enormous economic benefits to the local population and can indeed contribute to sustainable development.

The forest biomass value in some oak forest stands of Central Himalaya, 545–782 t ha–1 yr–1, is typical for the region. The Himalaya with its vast green cover acts as 'sink' for carbon dioxide. Estimates of annual carbon sequestration by the forests of western and northeastern Himalaya are computed to 6.49 mt, that values to 843 million US$. Carbon sequestration is one of the important ecosystem services being performed by the Himalayan forests. In addition, the beautiful landscapes, numerous rivers and streams cascading down the mountain slopes, diversity of cultures and religions, and colorful festivals of indigenous/ethnic communities present strong attractions for people from all over

the globe. The attractiveness of eco system emanates also from biological Systems inclusive of Critical habitats and species, ecosystem structure derived form diversity and resilience ecosystem functions including carbon and water relations, mountain farming systems complete with Drought resistant and economically important crops susceptible to CC Nomadic pastoralism; agriculture-horticulture-animal husbandry and Traditions of organic agriculture.

Ongoing Research on Himalayan Ecology

In the late 1990's DST launched a programme on 'Bio-Geo Database & Ecological Modeling for Himalayas' with an aim to assess the potentiality of various sectors of natural resources for selected micro-watersheds in project mode and thereafter building up of application oriented scenarios for the decision makers. A data base has been generated for the state of Uttarakhand and Himachal Pradesh. The report of the task force on Uttrakhand has enumerated lucidly the ongoing research activities in various institutions on Himalayan Ecology. There are some good starting points.

Planned Actions in Protecting Himalayan Ecology

The Prime Minister's Office has already initiated a coordination mechanism for ensuring planned implementation actions involving the Chief Ministers of the Indian Himalayan States. **A mechanism for implementing policy derived actions is already in position. This is captured in Annex- II**.

CHAPTER-2

Main Objectives of the Mission

The objective of the mission is to assess scientifically the vulnerability of the Himalayan eco system to short and long term variability in the weather and climate in all its dimensions of physical, biological and socio-cultural aspects with a view to assist in framing appropriate policy measures and time bound action programmes to sustain its ecological resilience and ensure the continued provision of key ecosystem services. The primary objectives are given as follows:

- To network knowledge institutions engaged in research on Himalayan Ecosystem and develop a coherent data base on the geological, hydrological, biological and socio cultural dimensions including traditional knowledge systems on preservation and conservation of the ecosystem

- To detect & decouple natural and anthropogenic induced signals of global environmental changes in mountain ecosystems and predict future trends on potential impacts of climate change on the Himalayan ecosystem with a sound S&T backup.

- To assess the socio-economic and ecological consequences of global environmental change and design appropriate strategies for growth in the economy of the mountain regions and the lowland systems dependent on mountain resources in the region.

- To study traditional knowledge systems for community participation in adaptation, mitigation and coping mechanisms inclusive of farming and traditional health care systems

- To evaluate policy alternatives for regional development plans towards sustainable tourism development, water and other natural resource management for mountain ecosystems in the region.

- To create awareness amongst stakeholders in the region for including them in the design and implementation of the programme.

- To develop regional cooperation with neighboring countries, to generate a strong data base through monitoring and analysis, to eventually create a knowledge base for policy interventions.

Secondary and long term objective of the mission are:

a) Building human and institutional capacities in the different existing / new Institutions in the Himalayan region.

b) Identify national knowledge institutions and develop a self sustaining knowledge network.

c) Develop and adopt new scientific and technological methods for assessing the health of the Himalayan eco system including those of glaciers and create a data base of the same.

d) Assess and quantify the changes in the Himalayan eco system attributable to the climate change as a result of global emissions and human activities in the region and model for future projections

e) Assess and explore means of augmentation of the carbon sink potentials of the Himalayan eco system

f) To explore linking of traditional and formal knowledge systems through strategic mechanism of formalization for mutual benefit and value for the sustainability of the Himalayan ecosystem

g) Identify Desirable Adaptation Policies to Improve Regional Sustainability.

CHAPTER-3

Approach, Strategies and Methodologies to Address Gap Areas

National mission for Sustaining Himalayan Ecosystem will provide an integrating platform for several knowledge institutions engaged in the study of glaciers and the ecosystem. It will strive to provide inputs for evolving policy strategies and recommending action programmes for sustaining the eco system based sound S&T data. The main strategy of the national mission would therefore be based on strengthening of ongoing activities in the knowledge domain by enrolling knowledge institutions in the area and develop new institutional mechanisms needed for a long term coordinated action programme through appropriate steering and monitoring mechanisms.

NMSHE will design an integrated approach for identifying vulnerabilities of the resource system to climate and socio-economic changes, and for evaluating adaptation options. In particular, the mission will address the following gaps in ecosystem vulnerability and adaptation science:

- Measurement of vulnerabilities of existing ecosystems including the adaptive capacity of current institutional and physical structures to deal with climate variations and other socioeconomic changes. Critical thresholds of vulnerabilities and barriers to adaptation in the resource systems will also be examined. For this socio-cultural implications and potentials for integration of indigenous knowledge systems would be evaluated and integrated into the mission actions.

- Community based management systems will be examined for creating an environment for effective collaboration with society and development of

participatory approaches for improved outreach will be studied and evaluated through requisite number of pilot trials.

- New mechanisms for promoting access to knowledge and sharing of benefits will be examined through special policy research groups and community based organizations with local presence and respect.

- Study of ecological service potentials emanating from the Himalayan ecosystem will be integrated into the mission though research in both natural and social sciences areas. For this enrollment of social science research groups into the mission will be accomplished.

- Strategies and approaches selected for a Mission involving both scientific and socio-economic priorities of a fragile ecosystem demands an inclusive and participative model rather than command control systems. A separate study group to learn from the lessons of green and white revolutions in the country where participation of farmers was obtained will be constituted.

- An integrated assessment (IA) framework will be developed to enhance adaptive capacity of resource planning and management to the impacts of climate change and other socio-economic changes; and

- Finally evolve a framework to integrate sensitivity analysis, vulnerability indicator setting, vulnerability assessment, and adaptation option evaluation.

CHAPTER-4

Proposed Actions to address Objectives and Goals of the Mission

4.1 Continuous Monitoring of the Ecosystem and Data Generation.

Data needs for the mission include ecosystem stability, delineation of areas of different land cover / land use, soil erosions, assessment of availability and demand of water and other natural resources, average yields, population growth rate, tourist information and other regional data. The data collected should include also spatial and temporal dimensions. The model variables and parameters differ among sub-regions, and vary between the present and the future (changed economic and ecological condition). Thus, the database should consist of information for each land unit under both current and future conditions.

Data required for the identification of vulnerabilities to climate and economic changes will come mainly from several sources: field work, survey (including the use of modern techniques), expert judgment, existing data derived from previous studies on various research, government documents, statistics and reports, and scientific literature.

Monitoring and analyses of indicators of environmental change in the region would form a major activity for the proposed Mission. The research component will focus on ecological indicators of environmental and economic changes. This indicator system includes sub-groups such as cryospheric indicators related to snow conditions, glaciers, and permafrost. Historical and current data on terrestrial ecosystems, freshwater ecosystems (streams and lakes) will be collected and analyzed. The research will also study the watershed hydrology and water balance in the region. The Ministry of water resources has carried out

a large volume of work in this area already. NMSHE will further strengthen the data collections activities through S&T inputs

Data collection and compilation would be based on a cooperative and coordinated programme involving as many as knowledge institutions from both formal and community based organization as possible. This exercise should involve a national effort calling for cooperation and collaboration from a large number of institutions and agencies

4.2 Glaciology Research

Himalayan glaciers form an important part of Himalayan eco systems. There is a need for creating research capacity in knowledge institutions for glaciology in the country. A national center which will support also Extra Mural Research on a sustained basis for long term observations on Himalayan Glaciers is being developed as a part of a National Initiative. A preliminary effort to network knowledge institutions working in the area of Himalayan glaciology has already been made and database development on the ongoing work is being initiated. Multi institutional cooperation and networked R&D programmes in the areas of observational science and technologies for 10 representative Glaciers in the Himalaya have been initiated.

A National Centre for Himalayan Glaciology is being established by DST and a nodal center has already been initiated as a part of the Wadia Institute of Himalayan Geology (WIHG), Dehradhun. R&D efforts to understand the glacier dynamics in the Himalayan region which is vulnerable to both natural and man made changes are proposed to be undertaken through a nationally coordinated programme. Special drive and mechanisms for developing human capacity in the area of glaciology are being initiated.

4.3 Generation of Bio-Geo Database & Ecological Modeling For Himalayas

The strategic importance of the fragile Himalayan eco-system demands spatial methodologies for the conservation of its natural environment. Nationally coordinated initiatives on "Bio-Geo Database & Ecological Modeling for Himalayas" from different agencies with local presence in the Himalayan region are required. Department of Science & Technology has initiated some measures. The programme needs to be scaled and sized to meet the requirements of the region. There are other initiatives on this subject from other agencies.

4.4 Prediction of Socio-Economic and Climate Change Scenarios

The present-day ecological and economic impacts of economic and tourism development will be studied in detail. This will provide a baseline set of measurements that can be used to assess societal vulnerabilities to future climate and socio-economic changes. In this Mission three types of scenarios will be specified: climate change, future socio-economic conditions, and adaptation options. In developing climate scenarios, the study will identify a set of scenarios representing current climate variation and future change. The vulnerability assessment needs information on specific frequency and/or magnitude of climate events. An analysis of how land use has been changing for the past 30 years over selected areas in the Himalayan region with respect to policy, population and economic increase and ecosystem condition change with some reasonable projections into the future would provide insights to the impact assessment to socio-economic and climate changes. To handle a variety of data sources containing both spatial and non-spatial data, a geographic information system will be used to serve as a spatially-referenced database for integrated analysis. Various methods will be used to project future tourism development, population increase and economic growth.

Any integrated assessment should include studies on economic sectors (tourism, water resources, and agriculture), as well as sensitivities of fragile ecological systems to climate and economic changes in the region. The mission requires an integrative approach.

4.5 Vulnerability Assessment

Tools of both computer-based and non-model based methods will be used for measuring vulnerabilities to determine how vulnerable these sensitive systems are to climatic perturbations and socio-economic changes. Survey, empirical observations, and Nominal Group Techniques will be used to study the impacts and stresses of present-day conditions, and to evaluate existing adaptive capacities of various key sectors sensitive to climate variations and socio-economic changes. Ecological and economic impacts of current economic growth and climate variation will provide a baseline set of measurements and observations that can be used to measure progress toward reducing vulnerability to future economic and climate changes.

Analyses of the social, economic, and ecological impacts (negative and positive) of alternative economic and climate change scenarios for different economic sectors will be undertaken to fill impact data gaps for key sectors that are sensitive to climate and socioeconomic changes. To improve impact information, expert judgment, and various ecological simulation or statistical models, GIS, will be employed to identify impacts of climate and socioeconomic change scenarios. These models will be modified based on regional conditions and will be tested before application for this Mission. The assessment study should a) identify the vulnerabilities of ecosystems, tourism sector, water resources, agriculture, and regional minority communities to climate and economic changes and b) develop an integrated system to understand the inter-sectoral linkages of the stakeholders employing multi-criteria based methods.

4.6 Identification of desirable Adaptation Policies to Improve Regional Sustainability

There is a need to integrate scientific information on impacts, vulnerability, and adaptation in decision making processes, risk management, and sustainable development initiatives. The focus should be on designing an Integrated Assessment (IA) approach assisted by analytic hierarchy process (AHP) and a multi-criteria decision making (MCDM) technique. There is a challenge in designing a suitable analytical system to relate at least semi-quantitatively sustainability and vulnerabilities of a complex mountain based ecosystem. Multi-criteria options evaluation (MCOE) of adaptation measures should be one of the major components of the proposed Mission. In order to select desirable measures among alternatives, multi-stakeholder consultation (MSC) and MCOE will be used to relate impact information to decision making requiring subjective judgment and interpretation.

Considerable knowledge base exists on mountain geology, soil science, hydrology, biodiversity, having relevance for sustainable management of the Himalayan region in the context of 'global change' and 'globalization'. However, there is an increasing realization now than ever before that conservation linked sustainable management of natural resources of the very traditional mountain societies has to be community participatory. Such an approach will be necessary ensure that the chosen developmental pathway is based on a value system that they understand and appreciate and thereby enabling their voluntary participation. NMSHE will make efforts to integrate traditional ecological knowledge (TEK) with modern understanding to evolve 'hybrid technologies / techniques' for better conservation and maintenance of ecology, economy and sustainable management of natural resources.

4.6.1 Sustainable agriculture and food security

Ensuring sustainable agriculture is critical not only for ensuring sustainable food security for the mountain people that is based on their own values systems, but also in the larger context of conserving human-managed biodiversity under varied land use systems, for the larger human wellbeing too. There is an urgent need to assess the different varieties of new hybrids of Wheat and other cereals which are resistant to temperature and diseases in the Himalayan region. An inventory of arable land and existing usable water resources is required. There is also a need to record and document the existing base in the Himalayan Ecosystem in terms of

1. Genetic diversity of crop plant
2. Genetic diversity of live stock
3. Genetic diversity of forest species.
4. Acuatic diversity and
5. Soil diversity.

In addition to the above an awareness campaign for farmers on agro-biodiversity conservation, food security, legal rights and bio resources has to be planned. Further local youth have to be trained to set up seed bank. Integrated pest management and nutrient supply techniques may be adopted by farmers to better achieve agriculture output.

4.6.2. Plantation Systems in the Himalaya

Tea plantations are widely prevalent in the Himalayan region. In order to remove the ill-effects of non-sustainable agricultural practices and ensure sustainable high production levels a *technology to create buffering mechanisms in the soil system* is to be developed through the minimal introduction of both TEK-based technologies with modern methods of agriculture.

4.7.1 Sustainable forestry

Text-book based sylvi cultural knowledge has so far been the exclusive basis for forestry practices. However, in recent times, involvement of communities through TEK available in the realm of forest management, through introduction of socially valued species that have ecological keystone value, along with socially valued ecosystems (eg., sacred groves) and socially valued cultural landscapes for implementation of 'joint forest management' (JFM) has facilitated biodiversity conservation linked sustainable forestry practices in certain parts and this should be further extended to larger parts of the Himalaya.

4.8 Strengthening of Regional Cooperation

Himalayan ecosystem is vulnerable to global emissions and impacts of climate changes. There are several trans-boundary and regional issues closely interwoven with the resilience of the Himalayan ecosystem Therefore, there is a requirement for improving trans-boundary exchange of information through mutually agreed mechanisms and processes. The lead participation of the Ministry of External Affairs and collaboration of Ministry of Environment and Forests as well as Ministry of Defense are essential. There is a need and scope for encouraging collaborating R&D projects with trans- boundary implications and collaboration. Aspects like collective surveillance and testing with enhanced communication for addressing issues of emergency following of an outbreak, resource sharing, and understanding of administrative and jurisdictional functions of each other may need to be considered. At this stage, the mission could recognize only the case of strengthening of international cooperation in the Mission on Himalayan eco system. Special strategies may need to be devised after consultations with the other ministries coordinated and led by the Ministry of External Affairs.

CHAPTER-5

Work Elements and Timelines

The Mission on sustaining Himalayan Ecosystem demands the development of a major national network. Several knowledge institutions under the administrative management of various ministries and Community based organizations and experts from the university sector are already engaged in some of the work elements associated with the mission. A strong and effective co-ordination is planned. These organizations will be networked and further strengthened. A Major work element under the mission should be enrolment of partners and partnering institutions. Thematic working groups and knowledge network for each theme area should be formed. Mapping of eco system, monitoring of glacier resources, database on traditional knowledge systems and livelihood management practices etc. call for a partnership between governmental and community based as well as non-governmental organizations. At the other end of the spectrum, a multi-parameteric and multi-variant system like Himalayan eco system calls for applications of rigorous principles of statistics and other related tools and techniques.

The technical work element will be structured into a matrix type organizational arrangement with some work elements connecting vertical thematic research groups. For instance, vulnerability assessment studies would require a multi-pronged approach.

Thematic Study groups for a) natural and geological wealth, b) water, snow and glaciers, c) forest cover and plant diversity, d) micro flora and fauna, e) wild life and animal population and f), traditional knowledge systems will be formed and for each thematic area one coordinating institution or organization needs to be identified and enrolled. The matrix structure proposed for the technical work elements of the mission is presented in Table 1.

Table 1: Proposed Matrix Structure to promote cross cultural interactions among various agencies and institutions engaged in work relating to Himalayan Ecosystem

	Task force 1 Natural and geological wealth	**Task force 2** Water, ice, snow resources including glaciers	**Task force 3** Forest resources and plant bio diversity	**Task force 4** Micro flora and fauna and wild life & animal population	**Task force 5** Traditional Knowledge Systems	**Task force 6** Himalayan Agriculture
	Nodal organization enrolled **WIHG (DST)**	Nodal organization enrolled **NIH (MWR)**	Nodal organization enrolled **GBPIHED (MoEF)**	Nodal organization enrolled **WII (MoEF)**	Nodal organization Enrolled **JNU/DST**	Nodal organization Enrolled **(ICAR/ Min of Agri.)**
Data bases						
Monitoring systems						
Modeling and simulation						
Vulnerability assessment						
Adaptation policy research						
Pilot studies for revalidation						
EMR Funding and Capacity building and long term forecasts						

Legends:

WIHG: Wadia Institute of Himalayan Geology

NIH: National Institute of Hydrology

GBPIHED: G.B. Pant Institute of Himalayan Environment & Development

WII: Wildlife Institute of India

JNU : Jawaharlal Nehru University

ICAR: Indian Council of Agricultural Research

A cross cultural research group with defined roles and functional responsibilities and coordinating mechanism is required for tackling the diverse needs of the mission. The mission envisages an effective coordination among Ministry of Environment & Forests (MoEF), Ministry of Water Resources (MoWR), Ministry of Science and Technology (MoST), Ministry of Earth Sciences (MoES), Department of Space (DOS), Defence Research & Development Organization (DRDO), Ministry of External Affairs (MEA), and Ministry of Home Affairs (MHA). Geological Survey of India (GSI), Survey of India (SOI), India Meteorological Department (IMD), University departments with strong research activities in the area will form the key knowledge bodies involved in the mission.

Actions planned under the national mission on Sustaining Himalayan Eco systems are grouped under seven heads. They are:

a) Enrollment of partners and partnering institutions,

b) Grouping of specialization areas and formation of knowledge networks for glaciology, ecology and biodiversity, livelihood mapping, vulnerability assessment and policy studies,

c) Preparation of detailed project sub-documents with deliverables and time lines,

d) Funding of research in existing institutions and establishment of national center for Himalayan Glaciology,

e) Building new institutional and human capacities,

f) Development of regional cooperation with neighboring countries, g) steering and monitoring of the mission through empowered committees and

g) Evolve a periodical reporting system to the National Action Plan on Climate Change and PM's council.

Eco tourism and policy research would form important knowledge domains under the national mission on sustaining Himalayan ecosystem.

Action identified	**Expected date of commencement**	**Expected date of completion**
Enrollment of partnering institutions	September 2009	December 2009
Grouping of knowledge domains and formation of knowledge networks including theme leaders and nodal institutions for knowledge grid and development of an integrated mission plan document with multi- stake holder participation	September 2009	December 2009
Detailed project documents	December 2009	February 2010
Funding of research programmes and projects	December 2009	On going
Building new institutional and human capacities • Nucleus center for glaciology at Wadia Institute on Himalayan Geology • National center on Himalayan Glaciology • Building Human capacities through fellowships and training	 December 2008 (Already established) January 2009 (Already established) December 2008	 Ongoing Ongoing Ongoing
Development of regional cooperation	October 2009	Ongoing
Steering and monitoring of mission	September 2009	Ongoing
Reporting to PMs council	------	Periodical on quarterly basis

CHAPTER-6

Institutional Arrangements for Implementation of the Mission

A dedicated professional group for coordinating and enabling national mission on Sustaining Himalayan eco system would be constituted under the Ministry of Science and Technology. A specific fund would be earmarked within the budget of the Department of Science and Technology for supporting the work elements under the Mission. Total of five task forces of experts in the five different knowledge domains (natural and geological wealth, water, ice, snow and glaciers, forest resources and plant diversity, micro flora, fauna and wild life & animal population and Traditional knowledge systems) would be formed to examine the various research proposals and projects received and make recommendations for funding. An input approval committee of secretaries would be constituted to allocate resources based on the recommendations of task forces.

An Advisory Council of technical experts will be constituted for the National mission on sustaining Himalayan Ecosystem. This council would play the think tank function and assist in the monitoring of the progress of the work under mission. The national mission proposes to work with the existing knowledge institutions within the structure and practices of Extra Mural Research support employed by the Ministry of Science and Technology as well as Intra Mural research programmes undertaken already in the domain areas institutions under various ministries. Establishment of the National Centre for Himalayan Glaciology and special programmes for human capacity building on Himalayan eco system would be supported by the Department of Science and Technology under existing provisions made.

The data related to Glaciological Research generated through DST funding will be processed and analyzed at the National Centre for Glaciology. Similarly bio – geo data related to Ecology, environment, fauna, flora etc generated will be processed and analyzed at National Centre for Bio-geo data base. All the above data will be modeled and processed at Himalayan Centre for Ecology in GIS environment and future Climatic Projections will be predicted. The information on climate change and Himalayan ecology will be discussed by the Advisory Council for suggesting necessary Policy Issues for adaptation which will be reported to the PM Council on Climate Change for implementation through State Governments. A coordinating arrangement of various sub tasks under different thematic groups will be as shown in Figure 1 below:

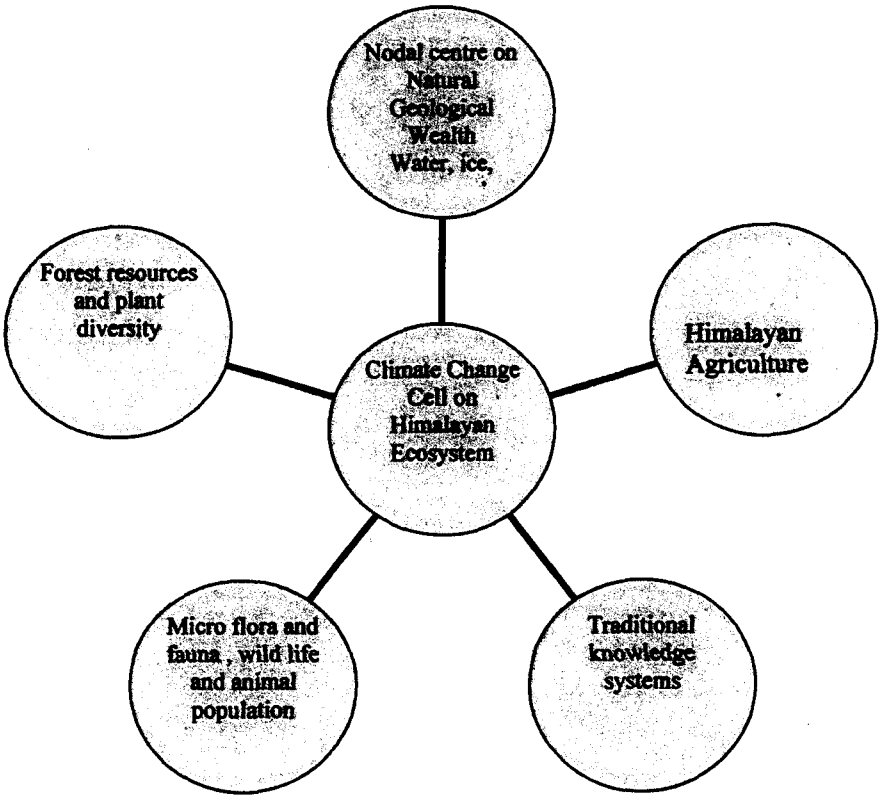

Fig-1: Flow Chart of Institutional Arrangements for Technical work functions

The nodal institution for each thematic area will be drawn from one of the five partnering departments or agencies in the national mission namely, Ministry of Environment and Forests, Geological Survey of India, Ministry of Science and Technology and including Council of Scientific and Industrial Research, Ministry of Water resources, Indian Council of Forestry Research and Education. In addition, a joint effort will be made between the Ministry of Human Resource Development and the Department of Science and Technology for developing a consortium of universities in the Himalayan Region. A special effort will be made to develop a network of Community based organizations and Non Governmental organizations to address the issues concerning Traditional Knowledge Systems.

CHAPTER-7

Coordination, Monitoring and Evaluation Mechanism and Organizational Structure for the Mission

All the three departments under the Ministry of Science and Technology viz., Department of Science & Technology (DST), Department of Scientific and Industrial Research (DSIR) and Department of Biotechnology (DBT) and their autonomous knowledge institutions; Ministry of Earth Sciences (MoES) and their autonomous knowledge institutions; Ministry of Environment and Forests (MoEF) and their autonomous knowledge institutions, Ministry of Water Resources (MoWR) and their autonomous knowledge institutions, Department of Space (DOS) and their autonomous knowledge institutions, Geological Survey of India (GSI), Survey of India (SOI), India Meteorological Department (IMD), University departments with strong research activities in the area, Ministry of External Affairs (MEA), Ministry of Home Affairs (MHA) as well as Ministry of Defence (MoD) would be enrolled into the mission taking into account of the needs for regional cooperation and work in the national boundary areas. Earth Science Organization (ESO)/ Ministry of Earth Sciences will be engaged formally as a part of the activities of the mission as it deals with the aspects related to atmosphere (weather and climate), cryosphere, hydrological cycle, etc which are crucial for ecosystem studies of Himalayan region.

The National Mission on Sustaining Himalayan Eco-systems would also call for significant amount of interactions and collaboration with Non-Governmental Organizations (NGOs) and participation of civil society. Collaboration with Indian Council for Social Studies and other social sciences research organizations are planned during the second phase of the mission.

Monitoring and Evaluation

The National Mission on Sustaining Himalayan Ecosystem would be monitored periodically, at least twice in a calendar year, by a High powered Committee under the Chairmanship of the Honorable Minister for Science and Technology and Earth Sciences. The National Advisory Council for National Mission on Sustaining Himalayan Ecosystem would form the think tank and give inputs to the Monitoring committee and evaluate the progress of work. A mechanism for the PM's council for periodical and scheduled reporting of progress to the PMO would be developed and implemented.

An Advisory Council drawn from a committee of experts from different areas will provide think tank functions on technical areas and various work elements. The mechanism for input approvals and funding decisions will involve a Committee of Secretaries of the participating departments with the Secretary of the administrative department of the nodal institution chairing the meeting.

An oversight function will be carried out by the High Power Committee under the Chairmanship of the Minister for Science and Technology and Earth Sciences for monitoring and making policy decisions including mid course corrections, if required any.

A dedicated Mission Cell on Himalayan Ecosystem will be constituted for the purpose of coordination and reporting to the various committees and oversight groups. This cell will be responsible for coordination with nodal institutions coordinating thematic work elements and report to the Committee of Secretaries as well as submit periodic reports to the PMO.

The mission includes also regional cooperation and policy implications. They need to be coordinated by MEA and MoEF. These aspects will be directly

handled by MEA and MoEF in consultation with the Minister of Science and Technology and Earth Sciences.

The overall structural arrangement of the mission is as presented in Figure 2

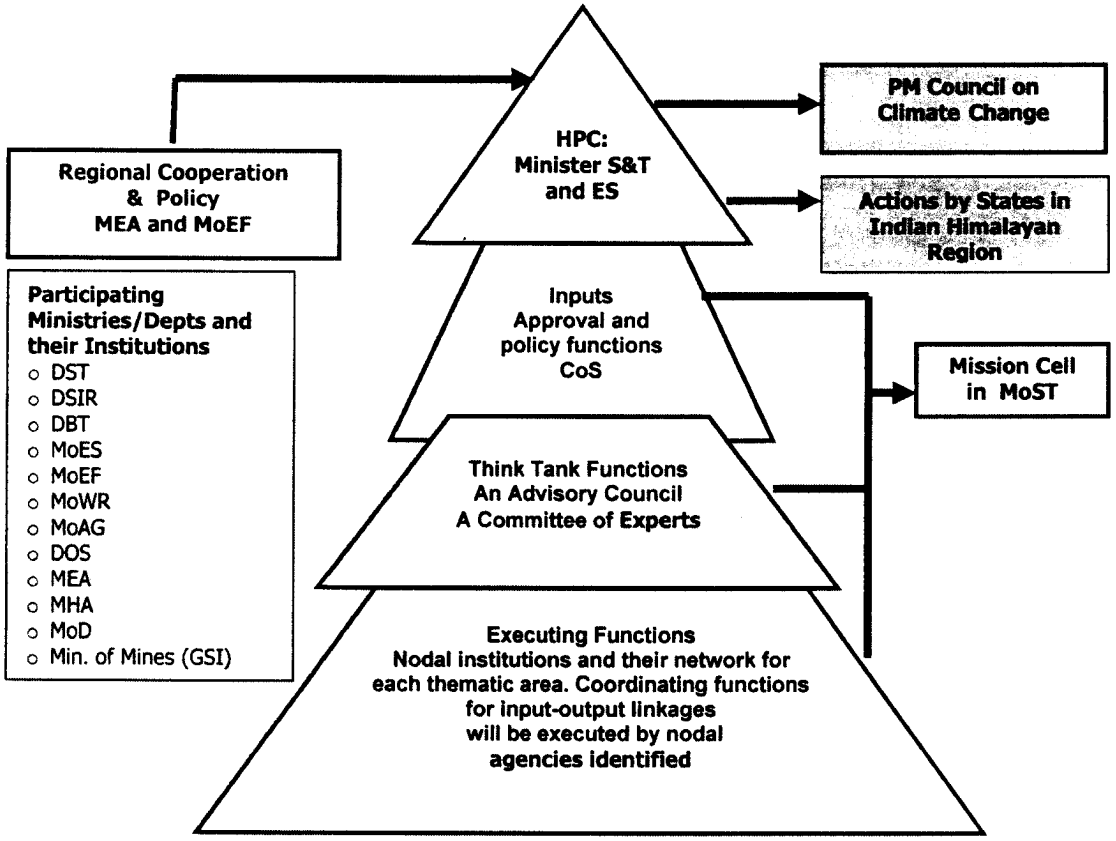

Fig 2: Organizational structure for coordination, monitoring and evaluation mechanism of the mission

CHAPTER-8

Mission Deliverables

NMSHE is a unique mission that should develop self sustaining knowledge networks which are capable of permanently contributing to the national efforts for sustaining a fragile Himalayan ecosystem. NMSHE needs to provide a time bound action program for a long term self sustaining national activity. Sustaining Himalayan ecosystem needs to emerge as a societal undertaking at the end of the mission period. Therefore, deliverables of NMSHE are special. They will include:

1. Creation of a fund (of say Rs 1650 crores) for developing capacities for Sustaining Himalayan Ecosystem to serve the activities during the 11^{th} and 12^{th} plan periods

2. Creation and building of capacities in the country in the domains of a) human and knowledge, b) institutional, c) policy design and implementation and d) continuous self-learning through an apex body approach

3. Identification of the knowledge institutions in the region which possess the institutional capacity for studies on Himalayan eco systems

4. The formation of self sustaining knowledge networks among identified knowledge institutions under various ministries as well as state Governments and community based organizations in thematic areas relating to the sustainability of Himalayan ecosystem

5. Further Strengthening of selected (say 12) knowledge institutions with resources, manpower, governance and communication facilities for promoting deeper engagement of these institutions

6. Establishment of new institutions in areas of knowledge gaps complete with special mechanisms and tools to create knowledge capacity for sustaining Himalayan ecosystem, particularly in the areas of Himalayan glaciology, ecology and biodiversity mapping, traditional knowledge systems, forestry for biological carbon capture, ecotourism services and policy research for developmental planning of a fragile ecosystem

7. Positioning of a viable national coordination mechanism for promoting of sharing of objectives and sharing of data and resources among the various participating institutions

8. Standardization of data collection systems for interoperability and mapping of natural resource wealth systems and positioning of a coherent data sharing and exchange framework among the participating knowledge institutions

9. Identification and training of about 100 experts and specialists in areas relevant to sustaining Himalayan ecosystem including about 25 glaciologists for research and development through and international training programmes

10. Positioning of a training system for community based organizations to relate laboratory findings to the real field conditions and provide feed back to the knowledge institutions on the likely changes in Himalayan ecosystem

11. Periodical Status reports on the health of various sub components of Himalayan Ecosystems

12. Creation of Human capacity and expertise for carrying out environmental impact assessment on Himalayan ecosystem for various human activities in the region

13. Capacity building programmes for linking innovations from Traditional and modern Knowledge systems

14. Establishment of a self sustaining observational network for monitoring and forewarning of changes in ecosystem in the Himalayan region.

15. Positioning of a framework for regional cooperation with neighbouring countries in the area of Himalayan glaciology

Chapter-9

Financial Resources Required

Fund requirements for the Mission would be met both through internal resources and a special fund created especially for NMSHE. Some of the ongoing activities of various knowledge institutions may be supported through internal resources. Coordination, research components and operational segments of Mission objectives and activities will be funded through a special fund. Autonomous institutions of Ministry of Science and Technology, Ministry of Environment and Forests, Ministry of Water Resources, Department of Space and some institutions of DRDO are already active in the area. Resources internal to these organizations will be further strengthened wherever necessary from the fund created under the mission, a coordinated effort among all the knowledge institutions regardless of administrative ministries under which they function needs to be accomplished. Certain components of mission work elements would therefore be absorbed within the budget provisions already made under the XIth plan budget of various interacting ministries.

The Mission plans to support also a number of new research, development and technology related initiatives and activities. It is estimated that a total fund of Rs 195 Crores will be required for the implementation of the Mission for the reminder part of the XIth Plan period which includes an amount of Rs 45 Crore allocated already through Standing Finance Committee (SFC) for establishment of a National Centre for Himalayan Glaciology at Wadia Institute of Himalayan Geology, Dehradun. Special provision will be made for additional fund of Rs 150 crores within the already allocated fund of Rs 11028 crores for the Department of Science and Technology for the XIth plan period for promotion of networked initiatives of the knowledge institutions in the region on observations, data collection and research and development connected to sustaining Himalayan

Ecosystems. A provision of Rs 1500 crores will be made in the XIIth plan period for establishing new institutes and institutional mechanisms for achieving the mission objective of a self sustained system for Sustaining Himalayan Ecosystem in the long run.

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ANNEX-II

Draft Guidelines for Priority Action in the National Mission on Sustaining the Himalayan Ecosystem

Himalayan ecosystem is vital to the ecological security of the Indian landmass. Immense altitudinal changes and associated climatic conditions within this region result in great variation in temperature, precipitation, soils, flora and fauna, supporting rich and diverse ecosystems. It provides the vital forest cover that generates a plethora of goods and services, feeds perennial rivers that provide water for drinking, irrigation, and hydropower. The Indian Himalayan Region (IHR) is home to nearly 4% of country's population, and a provider for their sustainable livelihoods through judicious use of biodiversity, practice of hill agriculture, and tourism, etc.

2. However, the Himalayan ecosystem is highly vulnerable both due to geological reasons and on account of the stress caused by increased pressure of population, exploitation of natural resources and other related challenges. These are likely to be exacerbated by the impact of climate change. Climate change may adversely impact the Himalayan ecosystem through increased temperature, altered precipitation patterns, episodes of drought, and biotic influences.

3. National Environment Policy 2006 envisages a few measures for conserving the mountain ecosystem. Specifically, the Policy proposes to:

- 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

Consider unique mountain scapes as entities with "Incomparable Values", in developing strategies for their protection.

4. India has also released its National Action Plan on Climate Change (NAPCC) which envisages, among other things, a National Mission for sustaining the Himalayan Ecosystem. The Mission is aimed at evolving management measures for sustaining and safeguarding the Himalayan glaciers and the mountain eco-system.

5. In achieving the objectives of the NEP 2006 and the National Mission for Sustaining the Himalayan Ecosystem, certain specific guidelines for development and regulation of the region need to be formulated and implemented at the National and State levels, as may be appropriate.

Issues that are relevant to the sustainable development of Himalayan ecosystem, such as pilgrimage, tourism, resource degradation, habitation and role of local communities in the development of IHR have been outlined as follows:

1. Sustainable Urbanization in the Himalaya

1. a. Solid Waste Management

The continued expansion in urban settlements, influx of visitors, trekkers and mountaineers in the Himalayan region has started to pose high biotic pressure and concomitant indiscriminate solid waste dumping. As a result, these areas are getting adversely affected. In the absence of proper management practices and inadequate infrastructural facilities, the human induced pollution such as solid waste, untreated sewage, and local air pollution due to vehicles has been continuously increasing in these areas. A few attempts, like solid waste management in Shimla (HP), banning the use of plastics in certain States (e.g. Sikkim), do's and don'ts in the form of guidelines by the Indian Mountaineering Foundation, can be evaluated for replication in other areas of IHR. In addition, the best international experiences as well as practices followed in regard to preservation of surroundings and prevention of littering in eco-sensitive places in India, e.g., Alaska, Gangotri/Leh region (for management of camp sites), Nepal and China (Tibet/Sichuan region) should be examined and appropriately adopted. There is an urgent need for developing and enforcing guidelines/prescriptions disallowing indiscriminate disposal of garbage, particularly the non-degradable waste, caused by accumulation of plastic bottles and polythene bags in hill towns in the Himalaya. The hill towns need to be planned particularly keeping in mind that tourists do not pay for municipal services. Many states have experimented – from banning

plastics, to taxing tourists – to better respond to these issues. However, they need support and new thinking on different aspects ranging from traditional architecture practices, local water management through protection of springs, ponds and lakes, and diverse systems of sewage and garbage management. Specific action areas for Solid Waste Management have been highlighted elsewhere. In addition, there is a need to motivate the residents to switch for a scientific waste disposal system in participatory manner and promote dissemination of such success stories (Box 1).

Box 1: Conservation of lake by residents of Nainital town

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

1. b. Town planning and Architectural norms

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

Large scale land instabilities, drying up of natural water sources, waste disposal problems and changing socio-cultural values are known impacts of unplanned construction activities. The "development" in the present context has become *unsustainable*. An integrated approach is, therefore, necessary to protect the environment and achieve required economic development at

the same time. Advance pl anning based on timely and reliable data has become crucial for sustainable growth of hill towns. Location planning of residential buildings, tourist resorts, and other commercial buildings, etc. has a significant role in advance town planning. As there are 12 Himalayan towns in the JNNURM and can serve as models in this regard, the finance provided under the Central Scheme can be used for this purpose to begin with.

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

Box 2: Ideal Himalayan Habitats

Considering the ecological fragility of the region, the concept of 'Ideal Himalayan Habitats' requires to be promoted for most human habitations. It would include formulation and implementation of holistic plans. Examples would include implementation of Environment Action Plan at the watershed level, to help transform identified human habitats by catalyzing the innate aspirations of local community towards greater sustainability and habitat conservation through participatory approaches. Such efforts would also include possibilities of functional consolidation of land for promotion of NR based employment generation in the region. It is felt that concept of 'Ideal Himalayan Habitats' should be implemented in such a way that it includes adequate representation of regions cultural diversity and prevailing Indigenous Knowledge.

2. Regulated tourism

2. a. Pilgrimage in sensitive areas

The Himalaya is known to be a home for saints, seekers of peace and enlightenment and a favoured destination of pilgrimage since time immemorial, and hosts a number of religious/sacred sites across the region. Each year, millions of pilgrims visit these sites. For example, Badrinath, Kedarnath, Gangotri- Yamunotri and Hemkund Sahib in Uttarakhand, Manimahesh, Jwala Devi, Chintpurni, Naina Devi in Himachal Pradesh, and Vaishnav Devi and Amarnath in Jammu & Kashmir are particularly important destinations. Unfortunately, most of these places lack adequate

facility of transport, accommodation, waste disposal and other amenities for ever growing number of pilgrims. Also, there is a gross lack of regulatory mechanism for infrastructure creation, management, and controlling the tourist inflow in such sites. As a result the sensitive ecosystems and cultural values of these areas are facing pressures far beyond the carrying capacity. Therefore, there is an urgent need to develop and implement guidelines for sustainable pilgrimage in the region encompassing the concept of carrying capacity of the area.

Box 3: Harnessing religious sentiments for conservation

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

2.b. Ecotourism and regulation of commercial tourism

The impacts of tourism on mountain ecosystems and biological resources are of great concern because of high biodiversity and environmental sensitivity of the Himalaya. Cultural identities and diversity in mountain regions are also under threat by the economic, social and environmental forces associated with mountain tourism. In this context, community based ecotourism emerges as one of the sustainable alternatives of presently practised commercial tourism in already over saturated hill towns like Nainital, Mussoorrie, Shimla, Kullu-Manali and Gantok, etc. In spite of efforts by some state governments, (e.g., Sikkim) the tourism has evolved as a mix of nature and commercial tourism, and the pace at which it is growing every year (nearly 15,000 tourist in 1980 to 3,50,000 tourist in 2007) does not augur well with the concept of ecotourism. Yet, the efforts

that have been made by the Sikkim state can serve as a basis of responsible tourism in other Himalayan states.

In the above context, diversion of tourists towards other potential sites including the Biosphere Reserves and other conservation areas is essentially required. A few successful initiatives from the region (e.g. Laddakh 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, and a good value for money both for the host and the visitor. Such initiatives need to be promoted across the IHR. Also, the approach of ecotourism in Sikkim (Box 4) is a good example for replication. Further, immense opportunities of adventure cum ecotourism in the Himalayan region (e.g., Annapurna Conservation Area project, Nepal; Nanda Devi Biosphere Reserve ecotourism approach, Uttarakhand) could also be harnessed through community involvement. Linking of the tourism with initiatives like Rural Business Hubs (RBH), as introduced in NE region, and which envisages promotion of quality rural products like handloom, hadicrafts, agro products, herbal products, bio-fuel, etc., in markets may be considered yet another aspect of promoting eco-tourism in the IHR.

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

Box 4: Ecotourism in Sikkim

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

3. Ecologically safer roads – green roads

Road density is directly related to other developmental activities in the region by providing much needed connectivity and accessibility. As such, road sector has been given high priority under the Prime Minister's Grameen Sarak Yojana (PMGSY) to ensure connectivity to each village having population of 250 or more in hills. On the other hand the present way of hill road construction is one of the most damaging activities for the sensitive Himalayan ecosystem (Box 4). Therefore, there is an urgent need for developing guidelines and bye laws to promote Green Road concept in IHR. The Rural Roads initiative in Nepal through peoples participation is a good example of successful implementation of the concept in the Himalaya. The Broad guidelines for Green Road sector in the IHR have been presented elsewhere.

Box 5: Impact of Road construction in IHR

- *The construction of 44000 km road in the Himalaya generates about 2640m^3 of debris (Valdiya, 1985).*
- *About 39% of the road bed is affected by rockfall and 38% by slumping, i.e., about 24 debris chutes/km^2 (Haigh et al., 1989).*
- *At the average rate of 550 m^3/km/year the total landslide debris on Himalayan roads would be of the order of 24 m.m^3 annually (Valdiya, 1987).*
- *Haigh (1984) reported 72 landslides larger than 10 m^3 and total landslides sediment yield of 1105 m^3/km along 66km reach of Mussoorie-Tehri road in 1978.*

4. Water security through rejuvenation of springs and catchments

Integration of conservation and development activities through stakeholder's participation and collaboration among different institutions and social actors is increasingly being recongnised as a promising approach of rejuvenation of natural springs and degraded sites and sustainable management of resources at the watershed scale. Policy response to such watershed or catchment based approaches is a welcome step in this direction (Box 5). Several ministries and developmental agencies have accepted the concept of watershed for wasteland restorations, recharging

the water sources, creating and empowering the decentralised village Institutions and strengthening the participatory processes.

Box 5: Watershed management in Uttarakhand

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

There is a need for promoting community participation in such policies and programmes using appropriate provisions already made in the Panchyati Raj Act. The village level developmental plans (e.g., Village Environment Action Plan), as being applied under Swajal initiative of Uttarakhand, using participatory planning process can be suggested as one of the options for integrating resource assessment, utilisation and conservation. Guidelines suggested for spring recharge, wasteland rehabilitation, and appropriate technologies may form the essential components of such plans.

5. Building environmental awareness

There is a strong need for promoting awareness both among local communities and the visitors about the issues pertaining to specificities and sensitivity of Himalayan environment. Effective use of media and imparting through informal conservation education is essentially required (Box 6). Various research organizations and NGOs from the region can play important role in this context. List of major Institutions and their area of operation is given (Annexure I).

Box 6: Promoting environmental awareness

a. Use of Media

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

b. Conservation Education

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

Apart from inculcating awareness amongst school children and college students, the programme subsequently needs to attract and motivate other stakeholder groups. Specifically there is a felt need for designing a special course on "Himalayan Ecology and People" and making it mandatory for those serving the region as administrators, natural resource planners, policy makers, etc. The Institutions mandated for Himalayan Research & Development need to be strengthened to design and implement such courses, if required in collaboration with higher education Institutions.

6. Energy Options

Biomass based energy is the main source of energy used at the households level for cooking and heating. An increasing number of households have

also started using LPG for cooking needs. Nearly 6.64 million households in the Indian Himalayan region use traditional (or modern) fuel for cooking purposes. A majority of households (4.31 million) use firewood as a primary source of cooking energy (64.8% of total Himalayan households). Among the modern fuels, LPG is widely used for cooking (23.8% households) followed by kerosene (4.6%), cow dung cake (3.6%) and crop residue (2.1%). In each Himalayan state firewood is used as a primary source of cooking energy, but the total number of households using firewood as a primary source may vary from 54.6% in Uttarakhand to 86.3% in Nagaland among the IHR states. Briquettes made up of charred pine needles are being introduced in the hill regions of Kumaon and Garhwal regions of Uttarakhand. NGOs, e.g., GRASS and private sector initiatives (e.g., through Green Energy Corporation) in Uttarakhand, produce charcoaled pine needle briquettes. In Himachal Pradesh, pine needles in combination with waste paper are used for making boards, file covers, etc. Use of pine needles as an alternative of fuel wood is a possibility and needs research on its economics and long term effects of its removal from the pine forests. Technologies for briquetting are available.

Box 7:

- *Uttarakhand has recently implemented a policy for harnessing renewable energy sources with the private sector / community participation which targets power generation as well as power conservation. Power generation can be done by individuals, Gram Panchayats, Registered Societies, and Private Companies. State Government has also launched a scheme for BPL families by providing assistance in procuring primary infrastructure such as stove and cylinder for use of LPG.*

- *Himachal Pradesh Government has a policy to allocate an additional quota of clean fuels (LPG, kerosene) to hilly areas in order to prevent deforestation. Biomass-to-energy and small hydropower plants need to be encouraged in the mountain areas to meet the energy needs. Provision of LPG as a clean cooking fuel in appropriately sized cylinders should also be considered to reduce pressure on forests.*

7. Conservation areas and forest zone management for community development

7. a. Conservation area management through community involvement

The conservation areas in the Indian Himalaya cover nearly 10% area of IHR, which is higher than the national average of about 7.3%. However, both the figures are below the current global average of 12% coverage under protected areas. In view of the biophysical values of the Himalayan region, there is a need to further strengthen conservation area network in the region by considering various proposals. Based on the biodiversity values and towards giving coverage to all representative ecosystems of biogeographic units, additional biosphere reserves and other protected areas need to be designated. While initiatives for strengthening of conservation areas is essentially required, there is a great need for reorienting existing norms and practices of management by harnessing the income generating potential of such areas for local communities (Box 8) so as and to promote their interest and participation in conservation.

Box 8.

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

In the context of above, among others, implementation of the concept of biosphere reserve; which promotes in situ conservation of all forms of life in its totality along with its support system, including the human dimensions, and underlying referral system for monitoring and evaluating changes in natural ecosystems and indigenous communities, needs to be strengthened

in the region. As the wilderness of Himalayan Biosphere Reserves is going to be the biggest asset in future and a means of earnings for its saviours, these landscapes (designated and proposed biosphere reserves) in the region require special attention. Some of these landscapes, based on their bio-physical and socio-cultural values have potential to also emerge as areas of 'incomparable value' (e.g., the proposed Cold Desert BR landscape in J&K and HP; Nanda Devi BR landscape in Uttarakhand, and Kanchendzonga BR in Sikkim).

Box 9:

- *In recognition of forests as a national wealth, 12th Finance Commission has recommended an incremental grant of Rs 1000 crore spread over the award period of 2005 – 10 for maintenance of forests. The amount has been distributed among the states based on their forest area for preservation of forest wealth.*
- *As the two thirds of the geographic area of IHR is targeted to be under the forest cover and the local communities play an important part in maintenance of these forests, payments for the ecosystem services of the standing forests of the region can be suggested as one of the possible measures to involve the local communities in conservation and adaptation efforts.*
- *Apple growers in Himachal Pradesh have started renting colonies of honey bees, for pollinating orchards, from the Department of Horticulture and private bee keepers. Rate of renting a colony were up to US $ 20 for a season in 2004.*

7. b. Conservation through integration of cultural values

Further, realizing the need for maintaining the valuable gene pool of traditional varieties/land races of domesticated biodiversity, and to promote the indigenous 'best management practices' in mountain farming as an adaptation and coping option under changing climate scenario, appropriate incentive mechanisms need to be framed and implemented to benefit the indigenous farming communities of the region. Also, to harness/improve community support to maintain/conserve uniqueness of biodiversity (both wild and domesticated), integration of cultural values and indigenous knowledge practices into management and putting in place an adequate reward system for communities is suggested (Box 10 a&b). Contribution of the Himalayan medicinal plant diversity in the traditional health care

systems and knowledge available with the traditional health practitioners also need to be rewarded considering the potential values (conservation and economic) of the Himalayan Medicinal Plants. Promotion of cultivation of medicinal plants in their respective altitudinal zones of occurrence would be one of the options towards conservation and sustainable utilization.

Box 10a: Community efforts – sustaining soil fertility by protecting forests

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

Box 10 b: Traditional wisdom – maintaining soil fertility

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

8. Monitoring Networks

The data of glaciers and snow-falls about snowbound areas should be developed in time-series in order to make an assessment of the impact of

climate and ascertain the changes. The data for monitoring of Himalayan ecosystem should be developed over long term and supported by ground trouthing. The key areas for monitoring are presented in Box 11.

Box 11:

a. Physical systems

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

b. ***Biological systems***

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

In the light of above facts, draft guidelines for the protection of the Himalayan ecosystem and its conservation in some specific areas have been attempted. The draft guidelines/codes of conduct may be suitably amended further in the light of discussion on various issues as described above or as may be considered relevant.

Recommendations on Key and Immediate Policy Decisions

Based on the above, a number of immediate policy measures could be considered.

The States which share the Himalayas are also its principal sentinels. Adaptation to Climate Change must become an integral part of their development strategies. The special vulnerabilities of this ecologically fragile region need to be recognised, as much as its rich natural resources in terms of forests, water wealth, biodiversity and tourism potential. While a number of long-term measures are under

consideration as part of the National Action Plan on Climate Change, several key and urgent interventions may be considered to prevent the further degradation of the Himalayan Ecology and to preserve their life-sustaining role for millions of our citizens. This not only includes those residing in this region, but also in the entire Indo-Gangetic Plain. These are listed below under separate categories, and could be included on the agenda of the proposed meeting to be convened by Prime Minister with the Hon'ble CMs of the States of Arunachal Pradesh, Himachal Pradesh Jammu & Kashmir, Sikkim, Uttarakhand and West Bengal.

1. **Sustainable Urbanization in Mountain Habitats:**

The cities in the Himalayan mountainous zones are increasing in size and in numbers. They are displaying the same degradation that plagues our cities in the plains – growing dumps of garbage and plastic, untreated sewerage, chronic water shortages, unplanned urban growth and heavy pollution from increasing vehicular traffic. This phenomenon will only exacerbate the impact from climate change. The following immediate interventions by all the concerned States, supported by the Union Government, could be considered:

(i) Town Planning and Adoption and Enforcement of Architectural Norms:

Given the ecological fragility of mountainous areas, it was agreed that rather than permit the unplanned growth of new settlements, there should be consolidation of existing urban settlements, which are governed through land-use planning incorporated in a municipal master plan. These designated settlements would be provided with all basic urban facilities, such as water supply, waste disposal and power, before further civilian growth is permitted. State authorities will prescribe regulations, taking into account the particularities of the local eco-system, including seismic vulnerability, the need to respect local aesthetics and harmony with Nature, and the optimum population load the settlement can sustain, given the availability of water and power. Consolidation of urban settlements, would also avoid the need to construct a larger number of road links to a

multiplicity of destinations, thereby causing further damage to the fragile ecology.

There are 12 Himalayan towns included in the JNNURM, which can serve as models in this regard.

Further action points may include:

(a) Municipal bye-laws will be amended, wherever required, to prohibit construction activity in areas falling in hazard zones or across alignments of natural springs, water sources and watersheds near urban settlements. There will be strict enforcement of these bye-laws, including through imposition of heavy penalties and compulsory demolition of illegal structures.

(b) The National Building Code will be revised by the Union Government, in consultation, with the concerned State Governments, to take into account the specific requirements of urban settlements in the Himalayan zone, including recommendations on the use of local materials and local architectural practices.

(c) The State Governments concerned will set up State-level Urban Arts Council, under relevant legislation, to oversee the implementation of the National Building Code for mountain areas and of respective Master Plans for designated urban settlements.

(d) The compulsory use of solar water heaters, rain water harvesting and appropriate sanitation facilities, will be incorporated in the National Building Code and Municipal bye lays in the concerned States.

(e) Construction activity will be prohibited in source-catchment areas of cities, including along mountain lakes and other water bodies. Their feeder channels will also be kept free of building activity.

In order to enable these decisions to be implemented urgently, it is necessary to draw up, as soon as possible, a comprehensive State-

wide inventory of such water resources and their channels, which could then be declared fully protected zones.

(ii) Solid Waste Management

In this regard, the following policy directives could be considered:

(a) The use of plastic bags would be banned in all hill towns and villages. This has been done with commendable success in the States of Himachal Pradesh and Sikkim.

(b) Potable local water, certified by a designated State authority, may be provided through all commercial outlets, such as local shops and restaurants, to discourage the use of bottled water, which adds to toxic plastic litter in hill towns and along trekking routes. This has been done successfully in Leh and promotes local employment.

(c) Each State will establish facilities for the composting of bio-degradable household waste and recycling and re-use of other types of waste. This maybe done through public-private partnership wherever feasible. This will be followed by the amendment to municipal bye-laws, making the segregation of household waste mandatory. This will be accompanied by a focussed awareness and public education campaign.

(d) An appropriate State tax or levy on all major commodities using plastic and/or non-biodegradable packaging, entering hill towns will be examined. This will create incentives to manufacturers of these goods to use/develop environmentally friendly packaging.

(iii) Promotion of Sustainable Pilgrimage:

The following measures to promote the healthy and sustainable development of religious pilgrimage to the many sacred and holy sites scattered all over the Himalayas, may be considered:

(a) A comprehensive inventory of key pilgrimage sites in each State would be drawn up, which would include analyses of the ecological capacity of each site, based on its location and fragility. Uttarakhand has recently issued guidelines restricting the numbers of pilgrims to the Gangotri glacier (Gaumukh) to 150 daily. The Union Government will assist in this exercise, which would be carried out by multi-disciplinary teams including engineers, scientists, ecologists, cultural anthropologists and respected NGOs.

(b) In advance of the results of the above exercise, develop a plan to harmonise the inflow of pilgrims with the capacity of the local environment to cater to the needs of pilgrims. These include the source of several Himalayan rivers, sacred lakes and forest groves. The selected sites would be arrived at through public consultation and consensus and will be publicly announced. There may also be restrictions on the months of the year when these sites would remain open, to allow recovery of the ecology during the off-season.

(c) The construction of roads should be prohibited beyond at least 10 kilometres from protected pilgrim sites, thereby creating a much-needed ecological and spiritual buffer zone around these sites. These areas, like national parks and sanctuaries, will be maintained as special areas, where there would be minimal human interference, respecting the pristine nature of these sites. Where there are existing roads beyond the 10-km buffer, vehicular traffic beyond this limit will be prohibited.

(d) Each designated pilgrimage site should have a declared buffer zone where development activity will be carefully regulated. Local communities residing in or around these pilgrimage sites should be given a role in the management of the buffer zone and to benefit from pilgrimage activities, through providing various services to pilgrims. This has been tried out with some success in the Periyar Tiger Reserve in Kerala.

(e) At all entry points to designated buffer zones, pilgrims will be advised to take back all waste, in particular, non-degradable

items. Provision may be made to sell them waste collection bags, which could be made by local communities, using local materials. Such waste may be collected and sorted out at special collection points outside the buffer zone, for disposal. A fee may be charged for the same.

(iv) Commercial and Adventure Tourism:

The measures listed for regulation of pilgrim traffic in the Himalayan zone would also apply, to a large extent, in promoting ecologically sustainable tourism in the region. The following interventions may also be considered:

(a) Homestead tourism would be promoted in this area and commercial hotel tourism of the 3 to 5 star-variety would be avoided. Local communities will be encouraged and enabled to provide homestead-based tourist facilities, through a package of incentives and through capacity building. The experience with homestead tourism in Ladakh is a good example.

(b) Each state will set up a Homestead Tourism Audit and Certification agency, to promote standardized and quality practices in designated tourism zones. These would include key environmental guidelines, such as the use of solar energy, use of organic produce, recycling of waste, cleanliness and hygiene, courtesy, knowledge of local culture and landscape, among others. This will also help educate tourists of the importance of safeguarding the Himalayan ecology.

(c) Recognising the adverse impact on Himalayan ecology due to unrestrained expansion in vehicular traffic, each state will consider the imposition of an entry tax for vehicles entering important hill towns. A similar tourism tax or trekking charge may be levied for all ecologically fragile zones, with the proceeds to be used for creating better facilities (for example clean toilets, tourist shelters) and for benefiting local communities.

(d) Parking fees for private vehicles in hill markets and hill towns will be raised substantially to discourage such traffic, thereby reducing both congestion and pollution. Each hill town will declare the central parts of the town, as walking areas, with access provided by pollution free electric or CNG buses.

v) "Green Road Construction"

Roads are the life-line of this remote and inaccessible region. However, the construction of roads must fully take into account the environmental fragility of the region. To this end, the concerned State Governments will consider promulgating, as soon as possible, the following guidelines for road construction in hill areas.

(a) Environmental Impact Assessment to be made mandatory for the construction of all state & national roads and expressways of more than 5 km length, including in the extension and widening of existing roads. This will not apply to inter-village roads.

(b) Road construction will provide for the treatment of hill slope instabilities resulting from road-cutting, cross drainage works and culverts, using bio-engineering and other appropriate technologies. Cost estimates for road construction in these areas will henceforth include estimates on this account.

(c) Plans for road construction must provide for disposal of debris from construction sites at suitable and identified locations, so as to avoid ecological damage and scarring of the landscape. Proposals for road construction must henceforth include cost estimates in this regard.

(d) Hot mix plants will only be set up at least 2 kms away from settlements. These sites should have a minimum open area of 200 sq. metres and should be already devoid of vegetation.

(e) All hill roads must provide adequate roadside drains and, wherever possible, be connected to the natural drainage system of the area.

(f) Alignment of proposed roads should avoid fault zones and historically landslide prone zones. Where this may not be possible, adequate measures will be taken to minimize associated risks, in consultation with experts.

(vi) Water security:

The importance of the Himalayas as a natural storehouse and source of water must be acknowledged fully. The region is already under water-stress, with the drying up or blockage of many water sources and natural springs. The following immediate actions, appear to be necessary:

(a) Initiate a state-wide programme for rejuvenation of Himalayan springs and protection of high-altitude lakes.

(b) Provide legislative protection for mountain lakes, natural springs and key water sources and prohibit construction activities along these water-bodies.

(c) Inventorise mountain springs (active and dormant) and also do detailed geological mapping to identify the spring recharge zone.

(vii) Building environmental awareness:

(a) Utilize local festivals and fairs for spreading environmental awareness and to link the protection of environment to local cultures and festivals.

(b) Central and State governments to together organise an annual festival of the Himalayas to celebrate local cultures, which demonstrate ways of sustainable living for resilient societies in harmony with the pristine nature of the Himalayas. This will also expose the rest of the country to the importance of the Himalayas in India's national life.

2. Safeguarding the Himalayas: A National Endeavour

The Prime Minister and the Chief Ministers of the Himalayan States are deeply concerned over the challenge the country faces from the

impact of Climate Change on the fragile and life-sustaining ecology of the Himalayas. This spectacular mountain chain is inextricably linked with India's civilizational ethos and the spiritual and cultural sensibility of our people. It is necessary for us to initiate and develop a truly national endeavour to safeguard the pristine ecology of the Himalayas. A coordinated approach between the Union and State Governments in the Himalayan States, is imperative if we are to successfully meet this challenge. It is in this spirit that the Prime Minister has convened the first ever meeting of the Chief Ministers of the Himalayan States. The deliberations at the meeting and the adoption of certain urgent and specific guidelines and decisions, is but the first step in formulating a comprehensive and ambitious National Mission for sustaining the Himalayan Eco-System. The Prime Minister and the Chief Ministers agreed to meet once in 3 months to exchange views, share experiences, review progress and evolve practical and effective measures to make the National Mission a success.