

# **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 for Sustaining The Himalayan Ecosystem

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# Mission Document of National Mission for Sustaining The Himalayan Ecosystem

## EXECUTIVE SUMMARY

The Himalayan ecosystem is fragile and diverse. It includes over 51 million people who practice hill agriculture and remains vulnerable. 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 ecosystem 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 house 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. Recession of Himalayan glaciers will pose a major danger to the country. Currently available data gathered by multiples of institutions without a coordinated effort do not indicate systematic trends of recession of Himalayan glaciers.

The National Action Plan on Climate Change (NAPCC) has enunciated the launch of a National Mission for Sustaining the Himalayan Ecosystem. The Mission needs to deliver better understanding of the coupling between the Himalayan ecosystem and the climate factors and provide inputs for Himalayan Sustainable development while addressing also the protection of a fragile ecosystem. 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 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.

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 of coordinating this mission. However, the mission requires valuable cooperation of Indian Himalayan States, the planning commission and the Ministry of Environment and Forests to achieve its goals.

Sustainability of an ecosystem demands a balance and equilibrium among various forms of 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 a coordinated effort in identification and strengthening of 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.

Primary objective of the mission is to develop in a time bound manner a sustainable National capacity to continuously assess the health status of the Himalayan Ecosystem and enable policy bodies in their policy-formulation functions and assist States in the Indian Himalayan Region with their implementation of actions selected for sustainable development. This would call for suitable 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 State 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 12<sup>th</sup> 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.

Primary objective of the mission calls for a series of Secondary objectives which include

- 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.

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 ecosystem

- 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. The mission demands also regional cooperation and policy implications. A close coordination with Ministry of External Affairs (MEA) and Ministry of Environment and Forests (MoEF) will be essential.

## CHAPTER-1

### Introduction

#### 1.1 Background

Sustainability of the Himalayan ecosystem is crucial for the livelihood of about 1.3 billion people in Asia. Natural geological wealth, forestry, wild life, flora, fauna and biodiversity, snow, ice and water bodies, traditional knowledge and mountain agriculture which characterize the region are special. It is now widely recognized that the rich and diverse Himalayan ecosystem is fragile. Un-sustainable changes in the ecosystem should be carefully avoided. The perennial rivers of north India depend heavily upon the sustainability of glaciers and the ecosystem of the Himalayan region.

With the growth and development of India, China and other countries sharing the Himalayan ecosystem, people living in these areas would seek access to developmental choices. Developmental paths of the states in the Indian Himalayan Region should be consistent with the sustainability of the prevailing ecosystem. The region is also characterized by its geological phenomena and hazards of natural disasters like landslides and earthquakes. The episodic events releasing large amounts of energy pose a challenge to the planners and to the development objectives of the states in the region.

The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) has concluded that there is an unequivocal evidence of current trends of global warming of earth's atmosphere caused by anthropogenic emissions. . The IPCC also estimates that global average surface temperatures would increase in the range of 1-6.3°C over the next 100 years. It is widely acknowledged that climate change is not just about averages, but also of extremes.

Increasing temperatures and changing precipitation patterns in the Indian Himalayan Region can be expected to influence even more profoundly the regional mountain 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.

In the above context, the 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.

### 1.1.1 Himalayan Eco-system

The Himalayan ranges are the youngest and loftiest among the mountain systems of the world. They represent a highly complex and diversified system both in terms of biological and physical attributes. The region has a discrete geographic and ecological entity. It produces a distinctive climate of its own and influences the climate of much of Asia. However, the variations in topographical features along three dimensional frame work (i.e., latitudinal: South-North; longitudinal: East-West; altitudinal: Low-High) cause diversity in climate and habitat conditions within the region.

The Himalayan landscape systems are unique. These systems, with their steep slopes and sharp gradients, are heterogeneous and exhibit sharp and most often systemic changes in climatic variables over very short distances. These features consequently result into enhanced changes in hydrological processes, with accelerated direct runoff and erosion. Major rivers of the region have their origin from these mountains and are the source of water for a large proportion 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. All this has contributed to a whole range of diversity in indigenous human habitations, cultures and knowledge systems.

The region is largely inhabited by indigenous societies. Living in biodiversity rich areas of the country, the mountain people are dependent upon biodiversity for

meeting with their livelihood needs. Therefore, sustaining biodiversity in the region also means protecting the interests of the people. The region serves as a rich repository of plant and animal wealth in diverse ecological systems. These ecosystems reflect a mosaic of biotic communities at various spatial and organizational levels. Recognition of the Himalaya as one among 34 global biodiversity hotspots aptly reflects its wide ranging ecological significance.

The vulnerability of the biological and physical features of the Himalayan Ecosystem towards natural and human induced disturbances is well recognized. Immediate actions are required to ensure sustenance of the ecosystem. Among others, this ecosystem needs to be protected against both improperly conceived developmental activities and yet to be assessed consequences of climate change. Further, in view of the pressing need for conservation of biological diversity in totality, sustainability of Himalayan Ecosystems has gained paramount importance. Hence, the National Mission for Sustaining Himalayan Ecosystems (NMSHE) is one of India's eight missions under National Action Plan on Climate Change (NAPCC).

## **1.2 Indian Himalayan Region**

The Indian Himalayan Region (IHR) with geographical coverage of over 5.3 lakh Km<sup>2</sup> comprises of the vast mountain range extending over 2500 km in length between the Indus and the Brahmaputra river systems and 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 Himalayan ecosystem is vital to the ecological security of the Indian landmass and occupies the strategic position of entire northern boundary (North-West to North-East) of the country. Apart from national security standpoint, IHR is also important for its high forest cover. More than 41.5% of its geographical area is under forests representing one-third of the total forest cover in India and nearly half (47%) of the very good+ forest cover category of the country. These forests generate a plethora of goods and services. However, a complex interplay of climatic and geological processes, destructive patterns of resource use and economic marginalization have led to the situation of heavy resource degradation and associated environmental consequences on the highly diverse and fragile Himalayan eco-system.

### ***1.2.1. Effect of Climate Change on the Himalayan Ecosystem***

Ecologically sensitive mountainous areas, like the Himalaya, 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 in the region. Himalayan Ecosystem resources are critical on the face of natural disturbances, anthropogenic activities

and climate change. It has important implications for formulation of management strategies and sustenance of dependent human societies. 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. Any changes in the Himalayan glacier dynamics and melting are expected to severely affect about 1.3 billions of people.

The Indian Himalayan Region (IHR) harbours about 8000 species of flowering plants, i.e., nearly 50% of the total flowering plants of India. Of this, nearly 30% are endemic to the region. There are over 816 tree species, 675 edibles and nearly 1740 species of medicinal value in the IHR. The Himalaya with its vast green cover acts as a 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 service needs to be therefore further strengthened and exploited for global good. Further, vast area under permanent snow cover and glaciers (about 17% of IHR), and about 30-40% under seasonal snow cover, form a unique water reservoir. This feeds several important perennial rivers that provide water for drinking, irrigation, and hydropower. IHR is home to nearly 4% of the country's population, and is provider for their livelihoods.

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

The task force on Mountain Ecosystem for Environment and Forest Sector constituted by the Planning Commission, Government of India, has prepared an account of State of Art in knowledge and institutional capacities associated with the Himalayan ecosystem. The committee constituted by the Expert group of Ministry of Environment and Forests under the Chair of Dr Patwardhan has submitted its report on the status of knowledge on Himalayan glaciers.

### **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 Eco-system**

Eco-systems have an inherent capacity to withstand incremental changes in climate and landscape, leading to a natural carrying capacity of eco-system. When this capacity is exceeded, the eco-system features get changed in ways that become socially and environmentally unacceptable. Among others, this could well lead to loss of rare or endangered species, migration of species, and shifting of habitats. All these changes have implications for sustenance of life, including human beings.

The National Mission for Sustaining Himalayan Eco-system (NMSHE) aims to a) understand scientifically the complex processes affecting this eco-system, b) evolve suitable management and policy measures for sustaining and safeguarding the Himalayan eco-system including Himalayan glaciers and c) work with the states in the Indian Himalayan region in the implementation of scientifically derived policy measures. Objectives of the mission call for coordinated inputs and actions of several stake holders. For instance, inputs from the Ministries of Science and Technology and Environment and Forests as well as planning commission and actions of the states in IHR are required. The mission, therefore plans to position a sound coordination mechanism for ensuring cooperative and cohesive actions by the states in the Indian Himalayan Region (IHR).

Recognizing the scientific and technological inputs required for sustaining the fragile Himalayan Eco-system, the Ministry of Science and Technology has been charged with the responsibility of implementing this mission. However, active coordination with Ministry of Environment and Forests and Planning commission and concerned state governments is essential for successful implementation of the mission.

The mission would attempt to evolve management measures for sustaining and safeguarding the Himalayan glaciers and mountain ecosystem by:

- **Enhancing monitoring of Himalayan ecosystem** with a focus on recession of Himalayan glaciers and its impact on river system and other downstream socio-ecological processes.
- **Establishing observational and monitoring network** to assess ecosystem health including freshwater systems.
- **Promoting community-based management** through developing mechanisms for incentives for protection and enhancement of forested lands.
- **Strengthening regional cooperation** through established mechanisms for exchanging information with countries sharing the Himalayan ecology.

The mission, towards achieving the above, will involve various institutions already engaged in investigation, conservation and management of natural resources in IHR. The mission would 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, active in the area, 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.

While designing and implementing strategies and plans for achieving the goals of the mission, focus will be to follow the following cardinal principles enshrined in NAPCC:

- **Protecting of vulnerable sections of society** – this includes participatory resource management strategies and development of livelihood options.
- **Developing human resource** – there has to be heavy emphasis on skill development, at all levels, across various sectors to enable communities become sufficiently empowered with know-how and mountain specific required skills, necessary for adaptation to climate change.
- **Enhancing ecological sustainability** . by investigating causes and consequences of disturbance regimes, promoting conservation of native and endemic elements, and understanding glacier and river system dynamics.

- **Deploying technologies** . for hazard mitigation & disaster management, development of ideal human habitats, and agriculture and forest sector innovations.

The task force set up by the Planning Commission of India on Mountain Ecosystems (Environment & Forest Sector) had observed and highlighted an apparent need of coordination, networking and cohesiveness among the institutions working for conservation and development in the mountains. Requirements of adequate manpower and funds, infrastructure, communication and incentives for enhancing the delivery systems and connecting the laboratory findings to the real field requirements have been identified. To some extent, the essentiality of a mission mode programme with effective coordination and management was brought out by this task force by suggesting that a mission is required for filling the knowledge gaps and helping in evolving sustainable developmental strategies while sustaining Himalayan Eco-system.

The National Mission on Sustaining Himalayan Eco-system will undertake:

- a) Collation and documentation of all relevant knowledge existing within the formal and non formal sectors,
- b) Building of institutional and human capacities to observe and assess changes in ecosystem along with correlations of likely causes for the changes for providing inputs for formulation of policies and strategies for management
- c) Establishment of a State of the Art National Center for Himalayan Glaciology complete with provisions for promoting research in the area
- d) Assistance to the Ministry of Environment and Forests in the formulation of policies and management strategies and
- e) Assistance to states in the Indian Himalayan Region for implementation of sustainable actions through coordination functions

### **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<sup>2</sup> and Himalayan glaciers are estimated to provide around 8.6X10<sup>6</sup> m<sup>3</sup> of water annually. Himalayan glaciers feed Asia's seven great rivers: the Ganga, Indus, Brahmaputra, Salween, Mekong, Yangtze and Huang Ho.

Concerns have been expressed that glaciers might be receding at faster rates on account of global warming. Absence of systematic trends in glacier melt behavior

is also reported. Reliable and scientific assessment of health of Himalayan Glaciers is essential at this stage. An initiative is also 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. 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 scientific data residing in the knowledge institutions across various administrative departments has now been documented.

A recent discussion paper (published by the Ministry of Environment & Forests, GOI) entitled "Himalayan Glaciers: a state of art review of glacial studies, glacial retreat and climate change" is also available.

Understanding Glacier dynamics and the alterations on the associated ecosystems require the use of modern tools of advanced science and technology. 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. There is now an opportunity for the Indian science sector to contribute to an important National mission.

Observational and monitoring network on Himalayan glaciers and Himalayan ecosystem will be established with a 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**

Inter-connection of a large number of sub systems within the Himalayan ecosystem is well known. Interconnectivity poses additional challenge, which can be met only if all the knowledge institutions in the region are networked through a common objective. Increasing intensity of threats to all levels of biological diversity in the sub-systems of Himalayan Ecosystem has been feared. The threat perception has raised concerns and called for long term and integrated management of these sub-systems and their bioresources. There is now a growing realization that conservation and rational use of biodiversity in the Himalayan region could bring enormous economic benefits to the inhabitants and contribute to the sustainable development of region.

Traditionally, indigenous communities in the region have been dependent on bioresources to meet basic sustenance needs, notably food, fodder, fuel, fertilizer, fiber, shelter, health care, etc. More than 80% of the population in the region is involved in agriculture, animal husbandry, forestry and other biodiversity dependent vocations. Among other bioresources with direct economic value, the Himalayan region is well recognized for diversity of medicinal plants, wild edibles and other non timber forest produce (NTFPs). However, as elsewhere in the world, there is a need to bring in a paradigm shift in realizing the economic contribution of Himalayan eco-system. The attention needs to be focused on the value of ecosystem services. For example, the forest biomass value in some oak forest stands of Central Himalaya,  $545.782 \text{ t ha}^{-1} \text{ yr}^{-1}$ , is typical for the region. 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 forest eco-systems. 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 uniqueness and attractiveness of eco-system emanates also from biological systems inclusive of: critical habitats and species; ecosystem structure derived from diversity and resilience ecosystem functions, including carbon and water relations; indigenous mountain farming systems with economically and ecologically important crops susceptible to climate change; nomadic pastoralism; agriculture-horticulture-animal husbandry and traditions of organic agriculture, etc.

### Ongoing Research on Himalayan Ecology

DST has mounted in 1990s, 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 states of Uttarakhand and Himachal Pradesh.

Among others, realizing the importance of Himalayan eco-system, the Ministry of Environment and Forests has established G.B. Pant Institute of Himalayan Environment & Development (GBPIHED) long back in 1988, with a mandate of achieving sustainable development and environmental conservation in the Indian Himalayan Region (IHR). Over the years, the Institute has taken significant strides in identifying problems, developing region specific approaches, demonstrating their efficacy in the field and disseminating the information to various stakeholders. Diverse problems thus addressed related to ecology, resource conservation, traditional practices, livelihood opportunities, land restoration, propagation protocol development, biotechnological interventions, etc. As a result large quantum of data has been generated, analyzed and synthesized.

The report of the task force on Mountain Ecosystems has enumerated lucidly the ongoing research activities in various other 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.

## CHAPTER-2

### **Main Objectives of the Mission**

The most crucial and primary objective of the mission is to develop a sustainable National capacity to continuously assess the health status of the Himalayan Ecosystem and enable policy bodies in their policy-formulation functions and assist States in the Indian Himalayan Region with their implementation of actions selected for sustainable development. This integrated objective would demand a) scientific assessment of 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, b) research for framing evidence-based policy measures to protect the fragile ecosystem and c) time bound action programmes at state level in the Indian Himalayan Region in order to sustain the ecological resilience and ensure the continued provision of key ecosystem services.

Secondary objectives of the National Mission for Sustaining Himalayan Ecosystem identified within the overall primary objective are

- Networking of knowledge institutions engaged in studies on Himalayan Ecosystem and development of a coherent data base on the geological, hydrological, biological and socio cultural dimensions including traditional knowledge systems on preservation and conservation of the ecosystem
- Detection and decoupling of natural and anthropogenic induced signals of global environmental changes in mountain ecosystems and prediction of future trends on potential impacts of climate change on the Himalayan ecosystem with a sound S&T backup.
- Assessment of the socio-economic and ecological consequences of global environmental change and design of appropriate strategies for growth in the economy of the mountain regions and the lowland systems dependent on mountain resources in the region.
- Studying of traditional knowledge systems for community participation in adaptation, mitigation and coping mechanisms inclusive of farming and traditional health care systems
- Evaluation of policy alternatives for regional development plans towards sustainable tourism development, water and other natural resource management for mountain ecosystems in the region.
- Creation of awareness amongst stakeholders in the region for including them in the design and implementation of the programme.

- Assisting the states in the Indian Himalayan Region with informed actions required for sustaining the Himalayan ecosystem,
- Development of regional cooperation with neighboring countries, to generate a strong data base through monitoring and analysis, to eventually create a knowledge base for policy interventions.

Long term objective of the mission is to position a viable and self-learning knowledge system assisting the policy bodies and state authorities. This would require

- a) Building human and institutional capacities in the different existing / new Institutions in the Himalayan region.
- b) Identification of national knowledge institutions and development of a self sustaining knowledge network.
- c) Development and adoption of new methods for assessing the health of the Himalayan eco system including those of glaciers and create a data base of the same.
- d) Assessment and quantification of 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) Assessment and exploration of means of augmentation of the carbon sink potentials of the Himalayan eco system
- f) Exploration of 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) Identification of most-desirable Adaptation Policies to Improve Regional Sustainability.

## CHAPTER-3

### Proposed Actions to address Objectives and Goals of the Mission

#### 3.1 Continuous Monitoring of the Eco-system and Data Generation.

One of the most crucial needs and gap areas is the availability of reliable and authentic data on the Himalayan Ecosystem. Data needs for the mission include a) information on ecosystem integrity and stability, b) delineation of areas of different land cover / land use, soil erosions, weather variability, c) assessment of availability and demand of water and other natural resources, d) average yields, e) growth rate of population relying on the Ecosystem, e) tourist information and f) other regional data. The data collected should include also spatial and temporal dimensions. A sound data collection system should include also exchange and continuous updating on the one hand and ability to analyze and model the likely future changes in the ecosystem. In other words, 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) and datasets from mountain farming systems including nomadic pastoralism 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. Generation of multi-location meteorological data, using modern technologies, will be stressed in the Mission. Data generation will need to be multi-centric and involve time series. Inter-operability and standardization of format for data collection would be essential. The mission will address the major issue of standardization and inter-operability of data generated.

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 organizations as possible. This exercise should involve a national effort calling for cooperation and collaboration from a large number of institutions and agencies.

### **3.2 Glaciology Research**

Himalayan glaciers form an important part of Himalayan eco systems. Creation of research capacity in knowledge institutions for glaciology in the country has become crucial in recent years. 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), Dehradun. 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.

### **3.3 Generation of Bio-Geo Database & Ecological Modeling For Himalayas**

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 which will be strengthened appropriately.

### **3.4 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.

### **3.5 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.

### **3.6 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. GIS based decision support system complete with integrated approaches for determining the path alternatives for development will be developed to suit the region. In order to select desirable measures among alternatives, multi-stakeholder consultation will be deployed to relate evidence-based policy 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 involve community participation. 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.

It is recognized that impacts of climate change would fall disproportionately on those that are least able to face the same. For example the indigenous tribal communities of the region, could be more vulnerable than others and ill equipped to adapt to vagaries of climate change. Therefore, mission will attempt to closely examine the intricate relationship between the natural environment and indigenous cultural systems in the target region. Attempt will be made to explore how indigenous knowledge can become part of a shared learning effort to address climate change impacts, mitigation and adaptation, and link with the sustainability.

### **3.6.1 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. Aquatic diversity and
5. Soil microbial diversity.

Several awareness campaigns for farmers on agro-biodiversity conservation, food security, legal rights and bio resources are 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.

While investigating and analyzing indigenous knowledge and practices to cope with climate change, the mission will promote relevant organizations/agencies to undertake awareness campaigns, especially in tribal areas, and establish knowledge network with indigenous groups to enable communities to share and assimilate knowledge on the subject. Establishment of field demonstrations and imparting training on improved/alternate livelihoods under change scenario and design future interventions to enable communities to adapt to climate change will form a strong component of Mission.

### **3.6.2. Plantation Systems in the Himalaya**

The Himalayan eco-system supports diversity of native/endemic species having multipurpose values. The mission will establish mechanisms for promoting plantations of such species so as to maintain integrity of the system. Encouragements to participation of indigenous communities in such efforts will be ensured by devising appropriate incentive mechanisms and acknowledging their contributions.

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.

### **3.7.1 Sustainable forestry**

Sustainable forestry in the region calls for a combination of both standard sylvi cultural knowledge and involvement of communities with TEK available in the realm of forest management. It is known that introduction of socially valued species with 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 of the ecosystem. Further extension of such traditional practices of forest management to larger parts of the Himalaya will be explored.

Sustaining Himalayan Ecosystem demands an in situ conservation of all forms of life along with their life-support system. An underlying referral system for monitoring and evaluating changes in natural ecosystems and indigenous communities needs to be strengthened in the region. The mission, through the nodal ministry for Indian Biosphere Reserves (i.e., Ministry of Environment &

Forests) will make provisions for promoting participatory mechanisms for long term management and sustainable use of Himalayan Biosphere reserves resources. The involved lead Biosphere Centers of the ministry will be further strengthened to find-out ways and means for developing such mechanisms.

### **3.8 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. 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 collaborative 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.

### **3.9 Enhanced implementation of guidelines for Priority Action in the National Mission on Sustaining the Himalayan Ecosystem**

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.

#### **3.9.1 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:

3.9.1.1 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 laws 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.

#### 3.9.1.2 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 biodegradable household waste and recycling and re-use of other types of waste. This may be accomplished through public-private partnerships, 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 focused 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.

### 3.9.1.3 Promotion of Sustainable Pilgrimage:

Measures for promoting the healthy and sustainable development of religious pilgrimage to the many sacred and holy sites scattered all over the Himalayas, are also necessary. Some of these actions are:

- (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.

#### 3.9.1.4

##### 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 will 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.

#### 3.9.1.5 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.

#### 3.9.1.6 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.

3.9.1.7 Building environmental awareness:

Building environmental awareness among the people in the region is key measure in the development of sustainable measures for the fragile Himalayan ecosystem.

- (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.

## CHAPTER-4

### **Approach, Strategies and Methodologies to Address Gap Areas**

- 4.1 The National Mission for Sustaining Himalayan Eco-system (NMSHE) desires to provide an integrating platform for several knowledge institutions engaged in the study of glaciers and of the other eco-system components. It will strive to provide inputs for evolving policy strategies and recommending action programmes for sustaining the eco system based sound S&T datasets. 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.
- 4.2 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:
  - 4.2.1 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. To achieve this, socio-cultural implications and potentials for integration of indigenous knowledge systems would be evaluated and integrated into the mission actions.
  - 4.2.2. Community based management systems will be studied for their potential to create 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.
  - 4.2.3 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.
  - 4.2.4 Study of ecological service potentials emanating from the Himalayan eco-system will be integrated into the mission through research in both natural

and social science areas. For this enrollment of both natural and social science research groups into the mission will be accomplished.

- 4.2.5 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.
- 4.2.6 Considering the need for maintaining compatibility, through uniform approaches, with global datasets, the mission will promote/strengthen initiatives to establish State-of-Art observation, monitoring and prediction system. This may include provisions for collaborative ventures at landscape level with neighbouring countries which share Himalayan ecology.
- 4.2.7 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
- 4.2.8 Finally the mission will evolve a framework to integrate sensitivity analysis, vulnerability indicator setting, vulnerability assessment, and adaptation option evaluation.

## CHAPTER-5

### Work Elements and Timelines

- 5.1 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 among the existing knowledge institutions 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 will 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. 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.
- 5.1.1 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**

	<b>Task force 1</b> Natural and geological wealth	<b>Task force 2</b> Water, ice, snow resources including glaciers	<b>Task force 3</b> Forest resources and plant biodiversity	<b>Task force 4</b> Micro flora and fauna and wild life & animal population	<b>Task force 5</b> Traditional Knowledge Systems	<b>Task force 6</b> Himalayan Agriculture
	Nodal organization enrolled <b>WIHG (DST)</b>	Nodal organization enrolled <b>NIH (MWR)</b>	Nodal organization enrolled <b>GBPIHED (MoEF)</b>	Nodal organization enrolled <b>WII (MoEF)</b>	Nodal organization Enrolled <b>JNU/DST</b>	Nodal organization Enrolled <b>(ICAR/Min of Agri.)</b>
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

5.1.2 A cross cultural research group with defined roles and functional responsibilities and coordinating mechanism is envisaged for tackling the diverse needs of the mission. The mission would require an effective coordination among Planning Commission, 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.

- 5.1.3 Actions planned under the National Mission on Sustaining Himalayan Eco system 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.
- 5.2 Promotion of Eco tourism and policy research would form important knowledge domains under the National Mission on Sustaining Himalayan Eco-system. This will include developing policy guidelines for Pilgrimage Tourism in sensitive areas as well as framework for promoting Ecotourism and Regulated Commercial tourism in the region. Mission will make adequate budget provisions to strengthen this sector. This will, however, require effective involvement of State Governments.
- 5.2.1 A beginning towards achieving this was made through Shimla Declaration on Sustainable Himalayan Development during Himalayan Chief Ministers' Conclave (Shimla, October 30, 2009).

The Conclave made several recommendations under four categories viz.,

- i. Knowledge Gaps and Research Needs;
- ii. Social and Economic Implications of Climate Variability;
- iii. Local Actions: Global Impacts;
- iv. Role of Academia, Civil Society and Industry.

The conclave recommended inclusion of these recommendations as part of the action plan for the National Mission for Sustaining Himalayan Ecosystem. The Conclave agreed on the following actions:

- (a) To foster cooperation on sustainable development by establishing the Himalayan Sustainable Development (HSD) Forum which will meet annually and would be hosted by partner states on a rotational basis.
- (b) To set up State Level Council for Climate Change in every state which will be located in CM's office and would function as the convener for the HSD Forum. The Councils will play a catalytic role in tracking research being conducted by different departments and institutions. The Council will work as an information and knowledge pool to foster exchange of data related to climate change, good practices and policy initiatives across the Himalayan states.
- (c) To pursue the common agenda to protect, conserve and enhance forests and other natural resources of the state. They will work to ensure that financial incentives are provided for natural resources, which capture the cost of ecosystem services, carbon sequestration as well as land and livelihood opportunities.
- (d) The Conclave noted that the Himalayas are the nation's watershed. They noted that hydroelectric power provides renewable sources of power. But equally this energy development is faced with new challenges, and noted the importance of maintaining ecological flows in rivers. They also voiced concern about the impact of climate change on glaciers, which could lead to changes in hydrology of the critical and perennial rivers of the States and the need for evolving methods for comprehensive impacts of projects at a basin-level. They agreed to set up a joint working group to look into these urgent issues and to recommend actions.
- (e) Himalayan states need to look for alternative models for urban growth, keeping in mind the specific conditions and constraints of the region.
- (f) To support technologies, which would provide methods of building green roads and to discuss these with central and states agencies for

urgent implementation. They agreed to explore alternative forms of mass transit, which is eco-friendly like railways and ropeways.

- (g) The Conclave voiced concern of the possible impacts of climate change on agriculture and horticulture in the states, which is critical for livelihoods and economic security of people. They agreed to undertake research in these areas and to evolve best practices to adapt to these coming changes. They agreed that traditional knowledge, built on diversity and innovation of local communities, needs to be supported to build resilience and coping strategies.
- (h) Energy security being a basic human need, the conclave noted that new and renewable energy sources could provide important leapfrog solutions in the many remote and grid-unconnected villages of the states and felt the need for the central government to provide adequate incentives for the promotion of these technologies.
- (i) The Conclave noted that tourism and pilgrimage is an important economic and social activity for the region. However, the growth of unregulated tourism or unmanaged pilgrimage could destroy the very spiritual character and pristine ecology, which attracts visitors in the first place. It is therefore, imperative that the region explores alternative models for this sector.
- (j) It agreed that encouraging green industry and clean technology is important for the region. They noted that industry must take up the challenge of building sustainable businesses, which reduce and minimise pollution and waste and ensure there is no damage to local ecology and people's livelihoods.
- (k) The Conclave noted that employment for young people is a development imperative for every state. They noted that green jobs in the emerging areas of adaptive agriculture, horticulture, green buildings, water conservation, green energy and others will provide a huge opportunity for the youth of the states. They agreed to propose to the Central government to incorporate these emerging areas in their ongoing skill development programmes and to provide resources to the states for new green job creation.

### 5.3 PROPOSED TIMELINES FOR ACTIONS

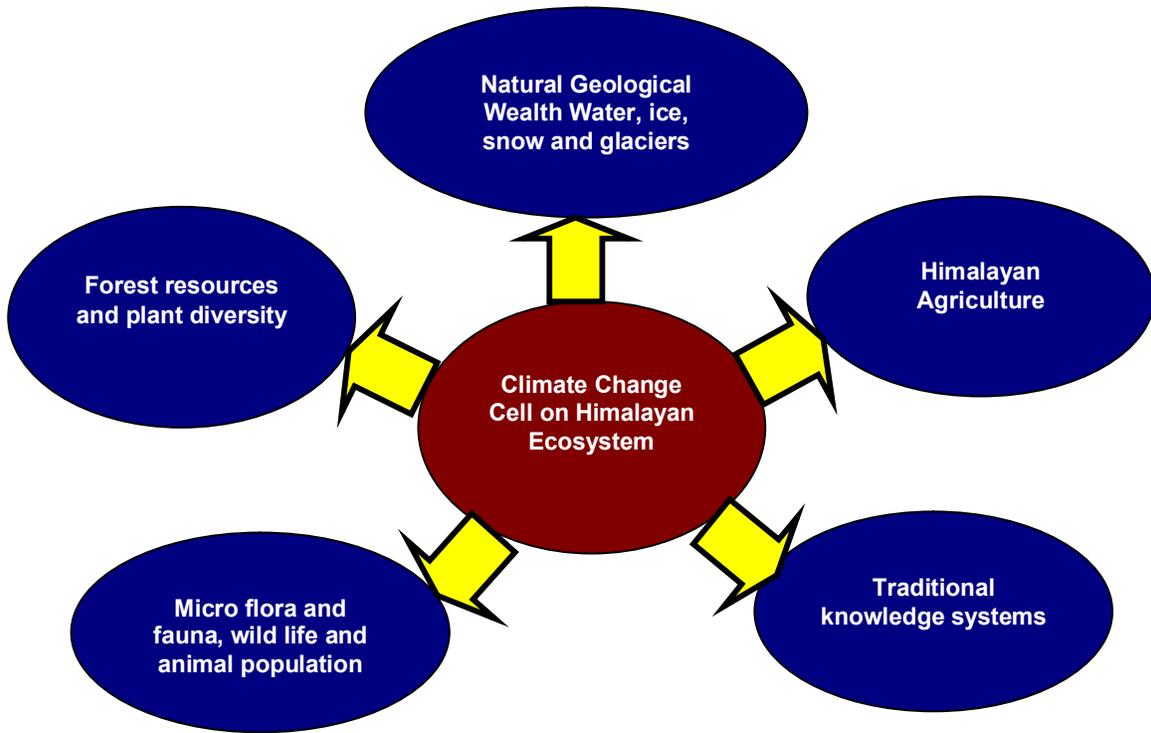
Action identified	Expected date of commencement	Expected date of completion
Enrollment of partnering institutions- Meeting of Stakeholders/ partnering agencies	July 2010	September 2010
Grouping of knowledge domains and formation of knowledge networks including theme leaders and nodal institutions for knowledge grid and development of an integrated mission plan document with multi- stake holder participation	September 2010	December 2010
Detailed project documents	October 2010	January 2011
Funding of research programmes and projects	September 2010	On going
Building new institutional and human capacities <ul style="list-style-type: none"> <li>• Nucleus center for glaciology at Wadia Institute on Himalayan Geology</li> <li>• National center on Himalayan Glaciology</li> <li>• Building Human capacities through fellowships and training</li> </ul>	December 2008 (Already established)  January 2011 (Already established) July 2010	Ongoing  Ongoing Ongoing
Development of regional cooperation	October 2010	Ongoing
Steering and monitoring of mission	September 2010	Ongoing
Reporting to PMs council	-----	Periodical on quarterly basis

## CHAPTER-6

### **Institutional Arrangements for Implementation of the Mission**

- 6.1 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. The coordinating mechanism would involve also setting up of mirror coordination sites in Planning Commission and The Ministry of Environment and Forests. A specific fund would be earmarked within the budget of the Department of Science and Technology for supporting the work elements under the Mission.
- 6.2 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.
- 6.3 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.
- 6.4 The data related to Glaciological Research generated through DST funding will be processed and analyzed at the National Centre for Himalayan 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:



- 6.5 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, Ministry of Mines (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.

- 6.6 Sustaining Himalayan eco-system is a challenging task. It involves six different sets of actions namely
- a) Generation and sharing of reliable data as inputs for formulation of policies,
  - b) Identification and selection of good practices and actions for protecting the Himalayan ecosystem based on both modern and traditional knowledge systems
  - c) Supporting of the selected actions with suitable regulatory framework,
  - d) Ground-level implementation of selected actions and plans at the levels of Indian Himalayan States and
  - e) Development of regional cooperation among the neighboring countries and
  - f) Continuous monitoring and oversight for ensuring the implementation of selected paths.

Stipulation of clear guidelines for sustainable management and governance of Himalayan eco-system is a critical need. Involvement and commitment of Himalayan states is a fundamental requirement. In this context, Ministry of Environment & Forests has already made a beginning by bringing out a publication 'Governance for Sustaining Himalayan Ecosystem . guidelines and best practices'+to provide basis on which new approaches and practices can be adopted. Also, as a follow-up of Shimla Declaration in Himalayan Chief Minister's Conclave (October 30, 2009), the ministry has established a technical secretariat at GBPIHED for Himalayan Sustainable Development Forum. The mission will make special provisions, including manpower and budget, to strengthen such initiatives to bring in all Himalayan states at one forum to address issues of environmental degradation and sustainable development in the region.

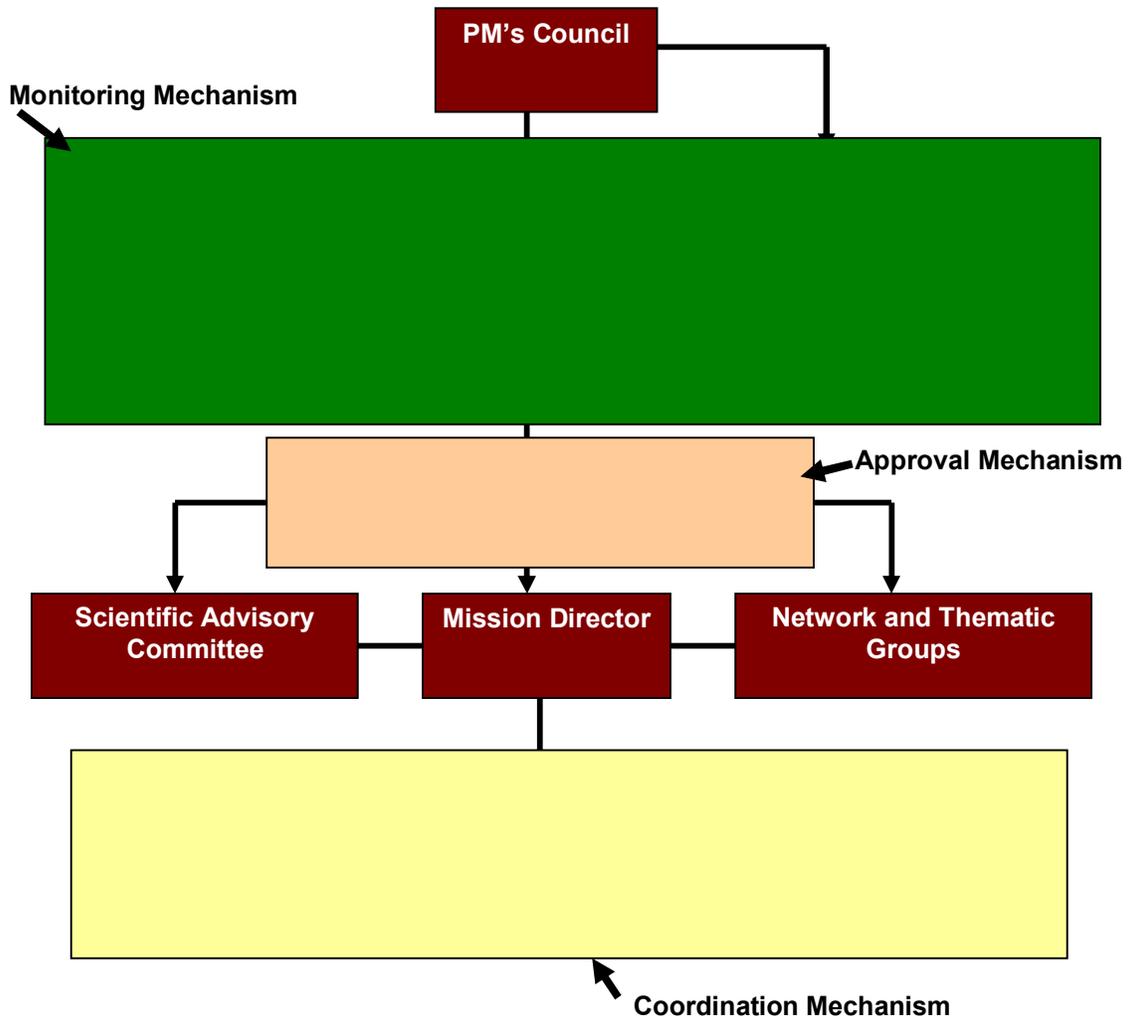
## CHAPTER-7

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

- 7.1 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 its autonomous knowledge institutions; Ministry of Environment and Forests (MoEF) and its autonomous knowledge institutions; Ministry of Water Resources (MoWR) and its autonomous knowledge institutions; Department of Space (DOS) and its 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), Ministry of Agriculture (MoA) as well as Ministry of Defence (MoD) would be enrolled into the mission taking into account the needs for regional cooperation and work within the areas of national boundary.
- 7.1.1 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 form crucial components for ecosystem studies in the Himalayan region.
- 7.1.2 The National Mission on Sustaining Himalayan Eco-system calls for significant level of interactions and collaboration with Non-Governmental Organizations (NGOs) and participation of civil society. Therefore, collaboration with Indian Council for Social Studies and other social sciences research organizations are planned during the second phase of the mission.
- 7.2 Monitoring and Evaluation**
- 7.2.1 The National Mission on Sustaining Himalayan Ecosystem would be monitored periodically, at least twice in a calendar year, by a High Powered Committee (HPC) under the Chairmanship of the Honorable Minister for Science and Technology and Earth Sciences. An oversight function will be carried out by the HPC for monitoring and making policy decisions including mid course corrections, if required any.
- 7.2.2 The National Advisory Council for National Mission on Sustaining Himalayan Eco-system would form the think tank and give inputs to the Monitoring committee and evaluate the progress of work. A mechanism for

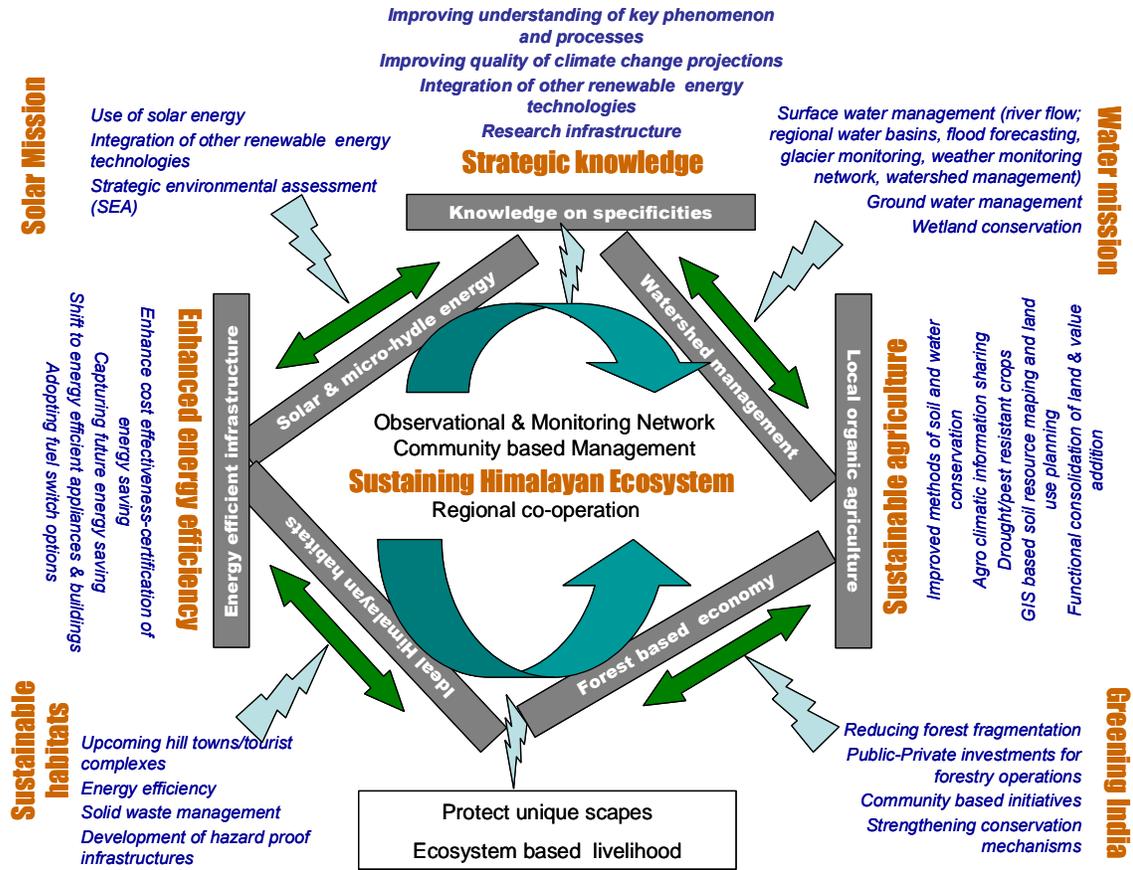
- the PM's council for periodical and scheduled reporting of progress to the PMO would be developed and implemented.
- 7.2.3 An Advisory Council drawn from a committee of experts from different areas will provide think tank functions on technical areas and various work elements. The mechanism for input 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.
- 7.2.4 A dedicated Mission Cell on Himalayan Ecosystem will be constituted for the purpose of coordination and reporting to the various committees and oversight groups. Taking into account of the diverse needs of the mission, it is proposed that the coordination arrangement will house three mirror site namely in the Ministry of Science and Technology, Ministry of Environment and Forests and Planning Commission. Such a 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.
- 7.2.5 The mission also includes 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



7.3 The National Mission for Sustaining Himalayan Ecosystem is location specific and demands formulation of actions derived from regional perspective. The mission could draw valuable lessons from other missions under National Action Plan for Climate Change. Therefore the mission coordination mechanism would include also the development of a strong synergistic mechanism with other National Missions of NAPCC. Following is a schematic presentation of envisaged synergy with other missions.

Fig 3: Envisaged Synergy of NMSHE with other Missions of NAPCC



## CHAPTER-8

### Mission Deliverables

- 8.1 NMSHE is a unique mission. It 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:
- 8.1.1 Creation of a fund (of say Rs 1650 crores) for developing capacities for Sustaining Himalayan Ecosystem to serve the activities during the 11<sup>th</sup> and 12<sup>th</sup> plan periods
  - 8.1.2 Establishment of a State of the Art National Center for Himalayan Glaciology complete with a provision for supporting Extra Mural Research in the glaciology
  - 8.1.3 Identification and networking of all knowledge institutions in the region which possess the institutional capacity for studies on Himalayan eco systems
  - 8.1.4 Derivation of codes of practices for knowledge coalition among networked knowledge institutions under various ministries as well as state Governments and community based organizations in thematic areas relating to the sustainability of Himalayan ecosystem
  - 8.1.5 Further Strengthening of selected (say 12) knowledge institutions with resources, manpower, governance and communication facilities for promoting deeper engagement of these institutions
  - 8.1.6 Establishment of about 10 new centers in existing 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
  - 8.1.7 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

- 8.1.8 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
- 8.1.9 Positioning of a multi-centric 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
- 8.1.10 Annual Status reports on the health of various sub components of Himalayan Ecosystems
- 8.1.11 Training of at least 100 technical experts for carrying out environmental impact assessment on Himalayan ecosystem for various human activities in the region
- 8.1.12 Conduct of 25 programmes on capacity building for linking innovations from Traditional and modern Knowledge systems
- 8.1.13 Establishment of an observational network for monitoring and forewarning of changes in ecosystem in the Himalayan region.
- 8.1.14 Positioning of a framework for regional cooperation with neighboring countries in the area of Himalayan glaciology.
- 8.1.15 Bi-annual Advisories to Himalayan Sustainable Development Forum through State Councils for Climate change in Indian Himalayan States for actions for implementation
- 8.1.16 Establishment of a synergistic mechanism with other National Missions under NAPCC.

## Chapter-9

### Financial Resources Required

- 9.1 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 XI<sup>th</sup> plan budget of various interacting ministries.
- 9.2 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 remainder part of the XI<sup>th</sup> 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 XI<sup>th</sup> 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 XII<sup>th</sup> 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.

SNo	Activity	Proposed Budget		
		11 <sup>th</sup> Plan	12 <sup>th</sup> Plan	2012-17
		2010-11	2011-12	
1	Glaciology Institute	25	20	350
2	Networking of Knowledge Institutions	8	16	180
3	Training of Glaciologists/ Ecosystem Specialists	5	8	25
4	Institutional Strengthening including Virtual Centres	32	46	600
5	Ecosystem Observations/ Monitoring	-	4	120
6	Public Outreach/ awareness programmes (PPP Model)	3	7	25
7	Support to G-SHE	6	15	200
8	Total	79	116	1500

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